Student Online Resources

for

Fundamentals of Pharmacology for Veterinary Technicians
CHAPTER 1

Introduction

The owner of a sick dog comes into a veterinary clinic seeking treatment for the animal. The owner is depending on the veterinarian to prescribe drugs that will effectively treat the dog’s illness, yet be safe for the dog and manufactured properly. How can this owner be sure that this is true? How can you convince this owner that it is true? Can you explain to the owner of that sick dog how drugs are manufactured and how their safe use in animals is monitored? What agencies regulate drugs? Are all drugs regulated in the same way?

The ability to assure clients that the medication they are giving their animals is safe is a fundamental skill needed in the veterinary profession. The Center for Veterinary Medicine at the Food and Drug Administration (FDA) ensures that approved veterinary drugs will not harm animals, or at least that the harm a drug produces is outweighed by its benefit.

Understanding the FDA approval process will help you to assure this client that the medication administered to his dog is safe. Key points in explaining the role of the FDA in the drug approval process will be covered in Chapter 2 and include the following:

• All companies that are attempting to get FDA approval for their drug must submit an Investigational New Drug (IND) application. Scientific support (experimental data, literature searches, etc.) is presented to support the IND application.
• Clinical trials are performed on drugs after the FDA approves the IND application.
• Once clinical data is collected, drug manufacturers can apply for a New Animal Drug Application (NADA) for consideration for marketing approval.
• New drugs are either approved or dismissed.
• Monitoring of FDA-approved drugs continues as long as the drug is on the market so that adverse reactions can be reported and documented for further investigation.

Remember, drugs are approved by a different government agency than biological agents. It is important to note that the FDA approves pharmaceutical compounds; the U.S. Department of Agriculture (USDA) approves biological agents (such as vaccines) for use; the Environmental Protection Agency (EPA) approves pesticides.

Additional information on the drug approval process can be found in Chapter 2 and at <http://www.fda.gov>.

Stay Connected

Helpful Web sites for Chapter 1 include:

<http://www.equitox.com> search in the research section, then go to the fast facts section. There is a section named drug approval under the fast facts section.
search in the existing sections such as The Green Book or Current Good Manufacturing Practices, or you can supply your own search terms such as FDA approval process or Animal Medicinal Drug Use Clarification Act of 1994 (AMDUCA)

Good information can be found by performing a google search under the terms on-line medical dictionary. These sites can provide you with clear and concise definitions on pharmacologic terms.

Critical Thinking Questions for Chapter 1

1. Why would a veterinary technician need or want a clear understanding of the historical development and current practices of drug development and usage?

2. Why are controlled substances an issue in veterinary practice? The controlled substance rating is based on the potential for human abuse, and the veterinary community is not treating humans.

Your instructor can access these answers at <http://www.agriculture.delmar.com/> in the Instructor Center.
CHAPTER 2

Introduction

A horse is diagnosed with a type of cancer that requires long-term treatment. The owner of this horse knows that drugs used to treat cancer have many side effects and may even be lethal. The owner wants to know how drugs like this can be approved and how the drug’s side effects are monitored. The owner is also concerned about the cost of this treatment. Can you explain why some drugs are expensive and what sources may be available to lower the costs for this owner? Can you explain the drug approval process to the client in clear and concise terms that he can understand? Why are some drugs more expensive than other drugs that are very similar in composition? How are drug side effects monitored?

Based on the information provided in Chapter 1, you should be able to explain the lengthy and expensive process of drug approval by the FDA. This process is not successful for every drug, and many companies take this into account when determining the price for their medications that do get FDA approval.

Many drugs have side effects; the decision to approve or reject a drug based on these side effects depends on the level of adversity that occurs. If the benefit of using that particular drug outweighs the adverse reaction, it may be acceptable. However, certain adverse reactions are so severe that they are contraindicated in certain animals or not approved at all. The classic example is the approval of antineoplastic agents (or anticancer drugs). The adverse effects of vomiting and diarrhea are acceptable in patients if it gives them the chance of survival. Severe vomiting and diarrhea may not be acceptable in a drug used to treat gastrointestinal disease.

Some drugs are more expensive than others due to patent protection, ingredients used, and cost of drug processing. Other drugs are less expensive to produce because of the same factors. Generic drugs are less expensive than the patent-protected drugs because the generic drug companies were not required to go through the expensive drug development stage required of the drug developer.

Stay Connected

Helpful Web sites for Chapter 2 include:

- [http://www.equinox.com](http://www.equinox.com) search in the research section, then go to the fast facts section. There is a section named drug approval under the fast facts section
- [http://www.fda.gov](http://www.fda.gov) supply search terms such as generic drug approval process or other terms related to drug approval
- [http://www.epa.gov](http://www.epa.gov) supply search terms such as pesticides for animals to view information on pesticide use and agriculturally based material
- [http://www.usda.gov](http://www.usda.gov) supply search terms such as animal vaccine approval process to view information on the role of the USDA in approving animal products
Critical Thinking Questions for Chapter 2

1. Is there a correlation between onset of drug action and duration of drug action?

2. What is the significance of a drug’s therapeutic index to a veterinary technician?

Your instructor can access these answers at <http://www.agriculture.delmar.com/> in the Instructor Center.
CHAPTER 3

Introduction

A cat presented to your clinic is having extreme difficulty breathing. The cat is breathing with its mouth open, and you notice that its gums and mucous membranes are not as pink as they should be. The veterinarian quickly begins a physical exam to assess the situation. The respiratory sounds are difficult to hear because of fluid in the cat’s chest. The veterinarian asks you to get a drug that will remove some fluid from the cat’s chest to make it breathe easier. You rush over to the drug cabinet and notice there are different forms of the drug the veterinarian asked you to get. Which one do you reach for, and why? Are you able to determine which route of drug administration the veterinarian would choose, and are you prepared to assist in the drug administration? In emergency situations, what are the most rapid routes of drug administration? What drug forms are available for these routes of administration?

The route of administration of a drug is important in determining how quickly a response to a drug occurs. In emergency situations, medications and fluids tend to be given intravenously. Intravenous injections give predictable concentrations of drug and usually give an immediate response because the drug is available to the tissues once it is in the circulation. Other routes of administration may be used, but drug absorption will be slower.

An example of a drug used to remove fluid from the chest cavity is furosemide. It is a diuretic (a chemical that increases fluid loss through increased urine production) that helps remove excess fluid from the body. If given IV, the diuretic effect of furosemide occurs within 5 minutes. If given orally, the diuretic effect of furosemide occurs within 1 hour. In emergency situations, an hour may be too long to wait for a drug effect to occur.

Stay Connected

Helpful Web sites for Chapter 3 include:

- [http://agriculture.about.com](http://agriculture.about.com) supply search terms such as therapeutic range to see topics like Veterinary and Animal Health Definitions and Terms
- [http://www.howstuffworks.com](http://www.howstuffworks.com) supply search terms such as drug action to see articles like Why Can Some Medicines Be Taken as Pills, While Other Medicines Have to Be Injected with a Needle

Critical Thinking Questions for Chapter 3

1. What is the significance of a drug’s therapeutic range to a veterinary technician?

2. What factors must be considered before determining the correct route of administration used to deliver any drug into an animal’s body?

Your instructor can access these answers at [http://www.agriculture.delmar.com/](http://www.agriculture.delmar.com/) in the Instructor Center.
CHAPTER 4

Introduction

A horse is experiencing front limb lameness from an injury that occurred during a race. The owner of this horse calls the veterinarian out to the ranch to have the horse examined. The vet determines that the horse needs an anti-inflammatory drug to decrease some of the front-limb joint swelling noted on the physical exam. The treatment includes an IM injection of an anti-inflammatory drug. The owner wonders why you are giving an injection in the horse’s muscle when the horse has pain in its joint. How does the medication get from a muscle to another location in the body? How do medications get to where they are needed?

The drug given in the muscle must diffuse from the injection site (the extracellular fluid of the muscle) into the blood. From the blood it is distributed to the front leg, where it can be effective. Drugs from the blood bind to receptors of certain tissues, thereby causing the desired reactions. Remember, once a drug gets into the blood it can travel to a variety of areas. When animals are given antibiotics, bacteria may be killed in many areas of the body, not just the area with the bacterial infection. Normal flora bacteria in the gastrointestinal tract are often affected by systemic antibiotics used to treat skin, urinary, or respiratory infections.

Stay Connected

Helpful Web sites for Chapter 4 include

<http://www.drugnet.com.hk/edu> search in the Virtual Department of Pharmacology to see Basic Principles of Drug Action and Internet Self-Assessment in Pharmacology

<http://www.forcon.ca/learning/pharmacology.html> supply search terms such as drug receptors and pharmacokinetics to find out information on a variety of pharmacology-based topics

Critical Thinking Questions for Chapter 4

1. How does the application of cold packs to an area affect the rate of absorption of subcutaneous fluids?

2. In human medicine some drugs (like nitroglycerin) are given sublingually (under the tongue). Why would these drugs not be given orally?

3. Think of ways that an understanding of pharmacokinetics can be applied to the daily practice of veterinary medicine. Give an example of the application of pharmacokinetics and explain your example.

Your instructor can access these answers at <http://www.agriculture.delmar.com/> in the Instructor Center.
CHAPTER 5

Introduction

A woman calls your veterinary clinic and states that she would like some antibiotics to treat her cat’s respiratory infection. She works at a discount store that has a pharmacy and she would like a prescription called in to that pharmacy for a human-labeled antibiotic that can be used in cats. Essentially, she is asking about the use of human-labeled products for veterinary purposes. Can drugs used for animals be dispensed at human pharmacies? What do you tell her?

Veterinarians can call prescriptions into human pharmacies (pharmacists cannot dispense drugs to animals without a veterinarian’s orders). Many drugs used in animals are the same as or similar to drugs used in people. Some differences between drugs manufactured for animals versus people include varying concentrations of drug per unit or drug formulation. The client still needs to bring the cat in for an examination by the veterinarian to establish a veterinarian/patient/client relationship. This client should be advised to provide follow up information once the prescription is given in its entirety to her animal.

Stay Connected

Helpful Web sites for Chapter 5 include:

- <http://www.fda.gov> supply search terms such as generic drugs to find out information about these drugs versus brand name drugs
- <http://www.druginfonet.com> search existing topics such as Drug Info to find information on Official Package Inserts and Patient Package Inserts or supply search terms such as generic versus brand name drugs
- <http://www.vetmed.wsu.edu/> search existing topics of the A-Z Index to see a variety of veterinary related topics such as Animal Health Handbook for Veterinarians

Critical Thinking Questions for Chapter 5

1. Since animals cannot open vials, why are veterinary drugs dispensed in childproof containers?

2. Why is it important to have a veterinary/patient/client relationship before prescribing or dispensing drugs?

Your instructor can access these answers at <http://www.agriculture.delmar.com/> in the Instructor Center.
CHAPTER 6

Introduction

On a bright sunny day, you decide to take a brisk walk on your break. As you walk you notice that you are sweating quite a bit and wonder if you drank enough water today to prevent you from becoming dehydrated. You know you should drink about eight (eight-ounce) glasses of water per day. You brought your liter bottle of water to work today and drank one bottle of water. Did you drink enough water today to replace normal water loss? Can you mathematically determine if you did or did not?

8 glasses of water x 8 oz/glass = 64 oz of water

(64 oz) (30 ml/oz) (L/1000 ml) = 1.92 L, or almost 2 L of water, are needed.

You have consumed only 1 L and need to drink another liter to meet your needs.

Stay Connected

Helpful Web sites for Chapter 6 include:

For excellent supplemental material perform a google search using search terms metric unit. There are many sites that compare the various systems of measurement as well as some that supply charts for quick reference.

<http://convert.french-property.co.uk/index.htm> search existing topics on conversion tables

Critical Thinking Questions for Chapter 6

1. In performing a dose calculation, you calculate a value of 6.0 cc of drug A to be given to an animal. Your calculation is double-checked by a co-worker, who finds that the value is actually 0.6 cc of drug A. You state that your calculation was close and you were only off by a decimal point. Is your statement a true reflection of the calculation error made?

2. When someone describes a 1-to-10 dilution, what exactly does this mean?

Your instructor can access these answers at <http://www.agriculture.delmar.com/> in the Instructor Center.
CHAPTER 7

Introduction

A 6-month-old F puppy is brought into the clinic for spaying. While the owner is filling out the paperwork, she asks what kind of anesthetic is used on puppies for routine surgeries. You tell her the name of the anesthetic used in your clinic and she asks you a series of questions: Is it the safest kind available? Does it provide pain relief, after surgery? What delivery method is the safest? What drugs provide pain relief, and can they be used with anesthetic agents? What about pain relief for the puppy after she goes home? Do all anesthetics provide post-surgical pain relief?

The safest kind of anesthetic tends to be that available in inhalant form, since the drug can be taken away quickly by disconnecting the anesthesia tubing. However, some inhalant anesthetics are safer than others (halothane causes more cardiovascular problems than isoflurane). Injectable anesthetics that have reversal agents may be considered safer than those that do not have reversal agents. Examples of injectable anesthetics with reversal agents include xylazine, whose reversal agents include yohimbine and tolazoline, and detomidine, whose reversal agent is atipamezole.

Some anesthetics provide some post-surgical analgesia; however, analgesics are administered to extend pain relief after surgical procedures. Some analgesics can cause respiratory depression. When given in addition to the anesthetic, these may cause problems in diseased or older animals. Examples of analgesics used post-surgically include butorphanol, fentanyl patches (usually used in clinical situations), phenylbutazone, and aspirin (see Chapter 16). The type of analgesic used depends on the procedure performed: oxymorphone is a more potent analgesic than xylazine for visceral pain, whereas a nonsteroidal anti-inflammatory drug like phenylbutazone may be sufficient for musculoskeletal pain and inflammation in minor musculoskeletal surgical procedures.

Stay Connected

Helpful Web sites for Chapter 7 include:

<http://www.vetinfo.com/> under existing topic of Dog Index to see a variety of drug information and disease conditions (including seizures and many nervous system drugs). There is also a Cat Index section on this site.

<http://info.med.yale.edu> search under anesthesia monitoring in which where there are many articles from their Veterinary Clinical Services including articles on anesthesia and analgesic guidelines for a variety of species (drug dosages included), physiologic effects of anesthetic and analgesic agents, and monitoring systems.

<http://cal.vet.upenn.edu> search under general medical/surgical projects to find an anesthesiology section. In this section there are descriptions of various anesthetic systems.

<http://www.howstuffworks.com> supply search terms such as how the nervous system works and how drugs affect the body
<http://www.discoveryhealth.co.uk/> search under Animal Planet or supply the search term animal to see such topics as Ask the Pet Vets, documentaries on a variety of animals, or supply specific search topics

<http://pharmacotherapy.medscape.com> supply search terms of nervous system drugs to find information on nervous system drugs used in humans (and perhaps extra-label in animals)

<http://www.fda.gov/cvm> supply search terms for specific information regarding drugs used for the nervous system

For excellent information on drug regulatory sites and species specific information on a variety of drugs used in animals perform a google search under the search terms animal drugs for the nervous system.

**Critical Thinking Questions for Chapter 7**

1. Why would animals prescribed phenobarbital for seizure control need to have blood collected to determine phenobarbital blood levels about 3–6 weeks after starting treatment?

2. What are some instances in which use of certain inhalant anesthetics would not be indicated?

Your instructor can access these answers at <http://www.agriculture.delmar.com/> in the Instructor Center.
CHAPTER 8

Introduction

A 14-year-old F/S Cocker Spaniel is brought into the clinic because her owner feels that the dog is not as energetic as usual. The Spaniel is up to date on her vaccinations and has been heartworm-tested annually. On physical exam, the vet notes that her mucous membrane color is not as pink as it has been in the past, hears a murmur on auscultation of her heart, and finds that some fluid appears to be present in the abdominal cavity. These signs indicate possible heart disease, so the appropriate diagnostic tests are performed on the dog. Chest radiographs show an enlarged heart. The dog’s ECG is normal and her blood values are normal. The dog is diagnosed with congestive heart failure and the vet prescribes a diuretic and a mixed vasodilator. The veterinarian also prescribes a sodium-restricted diet without any treats. The owner asks you how all these drugs are going to help her dog. Why can’t she keep her dog on the same dog food that she has been feeding for many years. What do you tell her? Can you explain the rationale behind low-sodium diets for animals with congestive heart failure? How can we assess the success or failure of cardiac treatment? Is there any way to determine if the drugs and diet restriction are working? When should the owner bring the dog in again for reexamination?

Diuretics decrease preload (volume of blood transported by the heart) and vasodilators decrease afterload (resistance to blood flow). If the heart has less fluid to move, it does not have to work so hard (theory behind diuretic use). If the heart does not have so much resistance to overcome to allow movement of blood, it does not have to work so hard (theory behind vasodilator use). The sodium-restricted diet also decreases preload. Remember that where sodium goes, water follows. By decreasing sodium in the diet, the volume of “water” in the blood decreases, reducing the volume of blood that the heart has to move (similar to the theory behind diuretic use).

Two ways to determine if the drugs and diet restrictions are working are by clinical assessment (decreased fluid in the abdomen, decreased coughing, increased energy levels, etc.) and by diagnostic tests (chest radiographs, blood tests, ECG, etc). It is wise to recheck animals that are diagnosed with cardiovascular disease. If there is no improvement, they should be rechecked right away; if there is some improvement, the time before recheck examination depends on the animal’s status. In nonemergency situations, this may be one week from the original diagnosis and treatment.

Stay Connected

Helpful Web sites for Chapter 8 include:

- [http://www.howstuffworks.com](http://www.howstuffworks.com) supply search terms such as how the heart works, what blood is, and other topics related to the cardiovascular system
- [http://pharmacotherapy.medscape.com](http://pharmacotherapy.medscape.com) supply search terms of cardiovascular drugs to find information on drugs used in humans (and perhaps extra-label in animals)
- [http://www.fda.gov/cvm](http://www.fda.gov/cvm) supply search terms for specific information regarding drugs used for the cardiovascular system
- [http://www.rxlist.com](http://www.rxlist.com) supply search term of drug name to find specific information on that drug
<http://www.ecglibrary.com/> search existing topics such as ECG history and a variety of ECG tracings

<http://www.studentbmj.com> search existing topics such as Topics Collection (to view a variety of health based topics) or Search/Archives (then supply terms such as history of the stethoscope or history of warfarin to learn interesting facts about these and other topics)

For excellent information on species specific information on a variety of drugs used in animals perform a google search under the search terms animal drugs for the cardiovascular system.

Critical Thinking Questions for Chapter 8

1. What clinical signs of possible cardiovascular disease can be observed by the client without medical training?

2. Think about the implications of giving an animal the diagnosis of cardiac disease. What major changes in care and lifestyle will follow for the animal and the owner?

Your instructor can access these answers at <http://www.agriculture.delmar.com/> in the Instructor Center.
CHAPTER 9

Introduction

A 4-year-old male (M) beagle is brought into the clinic with a two-day history of a harsh, honking cough. When questioned, the owner states that the dog was boarded last week while the family was on vacation. A physical exam shows that the dog’s TPR are normal, and he did not appear dehydrated. While in the clinic he coughed quite a bit, and the veterinarian determines that this dog probably has kennel cough, (a disease that can be caused by the bacterium Bordetella bronchiseptica and several viruses, including canine parainfluenza virus). Because this disease is usually self-limiting, no treatment is initiated. The owner, however, tells you that the dog is keeping the family awake all night with the incessant coughing. He wants to know if there is anything he can give the dog to control its cough. Is this a wise thing to do? Should all coughs be suppressed? The desire to suppress or not suppress a cough is based on the type of cough it is. Can you explain the difference to the owner of this beagle? Can you explain the rationale behind the treatment chosen for this dog? What drugs are available for this dog, and what are their potential side effects?

Coughs are categorized as productive and nonproductive. Productive coughs produce fluid that can be expelled through coughing. Non-productive coughs are harsh, do not produce fluid to be expelled through coughing, and tend to irritate the respiratory tract. Typically, nonproductive coughs are suppressed with antitussives to limit irritation and further injury to the respiratory tract. Antitussives are recommended for severe, continuous coughs and nonproductive coughs (usually associated with chronic bronchitis). Available antitussives include butorphanol, hydrocodone, codeine, dextromethorphan, and trimeprazine-prednisone (combination product). Side effects of most antitussives include respiratory depression.

In this case the veterinarian would choose to prescribe an antitussive for the patient.

Additional information on coughs can be found at <http://www.akc.org/pubs/gazette/health/0500health.cfm>

Stay Connected

Helpful Web sites for Chapter 9 include:

- [http://www.howstuffworks.com](http://www.howstuffworks.com) supply search terms such as how the respiratory system works and other topics related to the respiratory system
- [http://pharmacotherapy.medscape.com](http://pharmacotherapy.medscape.com) supply search terms of respiratory system drugs to find information on drugs used in humans (and perhaps extra-label in animals)
- [http://www.fda.gov/cvm](http://www.fda.gov/cvm) supply search terms for specific information regarding drugs used for the respiratory system
- [http://www.canismajor.com](http://www.canismajor.com) search under existing Topic section, then select Health and Veterinary Information. Choose topics such as Canine coughs and other diseases.
- [http://vetmedicine.about.com](http://vetmedicine.about.com) search under existing topics of Cat Diseases A-Z or Dog Diseases A-Z and choose information on a variety of topics such as respiratory diseases, anatomy, and chocolate toxicity in animals.
For excellent information on species specific information on a variety of drugs used in animals perform a google search under the search terms animal drugs for the respiratory system.

**Critical Thinking Questions for Chapter 9**

1. If an animal with a nonproductive cough is given fluids because it is dehydrated, what might happen to its cough?

2. Do animals with bronchitis or pneumonia have more severe coughs?

3. Why would epinephrine not be the first-choice bronchodilator for animals?

Your instructor can access these answers at <http://www.agriculture.delmar.com/> in the Instructor Center.
CHAPTER 10

Introduction

A 5-year-old M/N dachshund comes into the clinic for an examination. He has been lethargic lately and seems to be gaining weight. When you weigh him, you discover that he has not gained weight since his last appointment, but his abdomen hangs lower than it used to. He is still a bit overweight, but he has been for many years. The owner tells you that he has been drinking a lot and urinating a lot. On physical exam you find that TPR are normal, but note areas of alopecia (abnormal hair loss) are noted. The veterinarian orders some blood tests to determine what is going on with this dog. What tests do you think will be run on this dog’s blood? What are some examples of endocrine diseases that this dog might have? Are the treatments for these endocrine diseases safe? What do you tell the owner? Can you explain endocrine diseases to clients? Can you explain to the client with the dachshund the disease process occurring in this dog and how the proposed treatment can help this pet?

Polyuria and polydipsia (PU/PD) are seen in many diseases including kidney disease, pyometra (uterine infection), electrolyte imbalance (hypercalcemia, hypokalemia), liver disease, and endocrine disease. Endocrine diseases that cause PU/PD include diabetes mellitus, diabetes insipidus, hyperthyroidism, and hyperadrenocorticism.

Recommended diagnostic tests for animals with PU/PD include a complete blood count (CBC), serum biochemistry profile (assesses liver, kidney, and glucose status), and urinalysis. Endocrine tests include a thyroid test, which should be included in the serum biochemistry profile in cats, and suppression tests if hyperadrenocorticism is suspected.

The safety of treating endocrine diseases depends on the disease and the treatment selected. Side effects of insulin use for treating diabetes mellitus include hypoglycemia. Hypoglycemia can result if too much insulin is given, and that can cause in seizures, coma, and death. Side effects of treating hyperthyroidism with methimazole include vomiting, diarrhea, and lethargy. Side effects of mitotane for treatment of hyperadrenocorticism include neurologic signs, lethargy, vomiting, and diarrhea. The levels of side effects are related to the severity of the disease and how long the disease has been present in the animal.

Owners should be advised that endocrine diseases may take a long time to regulate and that diagnostic testing and physical examinations should be performed until the condition is regulated. Additional testing to monitor the disease is also warranted to keep the disease and treatment in check.

Stay Connected

Helpful Web sites for Chapter 10 include:

<http://www.howstuffworks.com> supply search terms such as what a hormone is and how the endocrine system works

<http://pharmacotherapy.medscape.com> supply search terms of endocrine drugs to find information on drugs used in humans (and perhaps extra-label in animals)
Critical Thinking Questions for Chapter 10

1. Consider the use of certain reproductive hormones in the practice of animal husbandry. Why would a breeder of herd animals such as dairy cattle be interested in all their breeding females experiencing “heat” at or near the same time (also known as “synchronization”)?

2. Why would a breeder of pack animals such as dogs be interested in discouraging synchronized heat in the breeding females?

4. What are “mismating” shots?

Your instructor can access these answers at <http://www.agriculture.delmar.com/> in the Instructor Center.
CHAPTER 11

Introduction

A teenager calls the clinic and says that she has been babysitting a child and his dog. The dog got into the cupboard and spilled cleaning supplies on the floor. When the babysitter found the dog, he was lapping up some of the chemicals from the floor. She wants to know what she can give the dog to make him vomit up the chemicals. What do you tell her? Is vomiting warranted in this case? What information do you need before making that decision? What home options does the babysitter have, or is it better to bring the dog into the clinic?

It is important to find out what chemicals the animal ingested to determine whether or not to induce vomiting in this animal. If in doubt, contact the ASPCA National Animal Poison Control Center to determine the best treatment for animal poisonings (there is a charge for each case). Vomiting is not recommended for ingestion of caustic substances such as ammonia, lye (drain cleaner), and bleach.

If vomiting is indicated, some home remedies include ipecac syrup (most parents and babysitters are familiar with this product), hydrogen peroxide, salt and water, mustard and water, and salt followed by food. Vomiting is not immediate and can continue for an extended period of time.

Stay Connected

Helpful Web sites for Chapter 11 include:

- [http://www.howstuffworks.com](http://www.howstuffworks.com) supply search terms such as how the intestinal tract works or how food is digested and other topics related to the gastrointestinal system
- [http://pharmacotherapy.medscape.com](http://pharmacotherapy.medscape.com) supply search terms of gastrointestinal drugs to find information on drugs used in humans (and perhaps extra-label in animals)
- [http://www.fda.gov/cvm](http://www.fda.gov/cvm) supply search terms for specific information regarding drugs used for the gastrointestinal system
- [http://www.canismajor.com](http://www.canismajor.com) search under existing Topic section, then select Health and Veterinary Information. Choose topics such as Puppy viruses, Intestinal upsets, and Bloat
- [http://vetmedicine.about.com](http://vetmedicine.about.com) search under existing topics of Cat Diseases A-Z or Dog Diseases A-Z and choose information on a variety of topics such as gastrointestinal diseases and anatomy
- [http://www.gastro.org](http://www.gastro.org) supply search term for a particular disease (human based)
- [http://www.botanical.com](http://www.botanical.com) supply search term such as castor oil to find out more about the use of botanicals in treating disease

For excellent information on species specific information on a variety of drugs used in animals perform a google search under the search terms animal drugs for the gastrointestinal system.

Critical Thinking Questions for Chapter 11

1. When you are called on to take a history of an animal presented to your clinic for vomiting and diarrhea, what are the most important questions for the owner/client?
2. Some animals may be on long-term corticosteroids for treatment of certain disease conditions. What are the gastrointestinal implications for a patient on long-term steroid use? What kinds of preventative measures can be taken to prevent gastrointestinal complications?

Your instructor can access these answers at <http://www.agriculture.delmar.com/> in the Instructor Center.
CHAPTER 12

Introduction

A client calls the clinic and says that her cat is spending a lot of time in his litterbox. When he is in the litterbox, he squats and occasionally starts crying. The client tells you that this has been going on since last night. What questions should you ask this client? What concerns do you have about the cat? Does the cat need immediate veterinary care, or can this problem wait until the cat’s next physical exam appointment?

You need to determine whether or not this cat can urinate. Since this cat is male, the risk of urinary obstruction is higher than in female cats. Male cats are especially prone to urethral obstruction due to the narrow diameter of their urethra. You need to determine how long this has been going on, and the owner must bring the cat into the clinic. Urinary obstruction is an emergency situation since the inability to urinate allows toxins to accumulate in the animal, which can lead to electrolyte imbalance and death. If this animal has a urinary tract infection rather than urinary obstruction, it is still best to treat promptly to avoid any long-term problems.

Stay Connected

Helpful Web sites for Chapter 12 include:

<http://www.howstuffworks.com> supply search terms such as how the urinary system works, how urine is formed, and other topics related to the urinary system

<http://pharmacotherapy.medscape.com> supply search terms of urinary drugs to find information on drugs used in humans (and perhaps extra-label in animals)

<http://www.fda.gov/cvm> supply search terms for specific information regarding drugs used for the urinary system

<http://www.canismajor.com> search under existing Topic section, then select Health and Veterinary Information. Choose topics such as Leptospirosis and other diseases.

<http://vetmedicine.about.com> search under existing topics of Cat Diseases A-Z or Dog Diseases A-Z and choose information on a variety of topics such as urinary system diseases and anatomy

<http://www.kidney.org> supply search term like glomerulonephritis for information on a variety of diseases (human)

<http://www.pslgroup.com> supply search term for urinary system disease for information on a variety of diseases (human)

<http://www.vetmed.wsu.edu/clientED> supply search term urinary incontinence, general information on urinalysis, or urinary tract disease

For excellent information on species specific information on a variety of drugs used in animals perform a google search under the search terms animal drugs for the urinary system or urine testing methods.
Critical Thinking Questions for Chapter 12

1. Urinalysis is one of the basic fundamental diagnostic tests used in the practice of medicine. Discuss the information that urinalysis provides about the health of an animal.

2. Why do loop diuretics cause electrolyte imbalances?

Your instructor can access these answers at <http://www.agriculture.delmar.com/> in the Instructor Center.
CHAPTER 13

Introduction

A client who loves to jog with his dog comes into the clinic to ask some advice. His dog is getting older but he wants the dog to continue to jog with him. He has already been giving the dog aspirin for pain from running, but he wants to know if he can also give something to ease any muscle pain the dog may be experiencing. He would like to give this medication daily so that the dog is not in pain. What options does he have for treating his dog? Could there be any complications from treating the dog as the owner would like to? What advice do you have for this jogger whose dog is having trouble keeping up with his owner’s daily exercise? Are all your recommendations based on drug use, or are there other options you could give the client?

There are a variety of treatment options here. Chapter 16 presents the anti-inflammatory options (nonsteroidal anti-inflammatories, such as carprofen and buffered aspirin; other drugs, such as flunixin meglumine that may not be indicated for long-term use; and steroidal anti-inflammatories). Sometimes animals with musculoskeletal injuries or degeneration are prescribed muscle relaxants, such as methocarbamol. Muscle relaxants are thought to work by decreasing muscle rigidity without affecting normal muscle tone. Conditions that can benefit from muscle relaxant use include intervertebral disk disease, muscle strain, and myositis. Side effects from methocarbamol use are rare but may include muscle weakness, ataxia, and vomiting. The greatest risk in medicating this dog is that the dog may overexert itself and cause more damage.

Some nonmedication options for this owner include physical therapy, chiropractic medicine, and nutraceuticals, such as polysulfated glycosaminoglycans. Polysulfated glycosaminoglycans are a mixture of glycosaminoglycans derived from bovine cartilage that are believed to work by increasing synovial fluid production from the synovial membrane and possibly reducing cartilage damage. Increased amounts of synovial fluid can help lubricate joints and ease joint movement.

Stay Connected

Helpful Web sites for Chapter 13 include:

- [http://www.howstuffworks.com](http://www.howstuffworks.com) supply search terms such as how muscles work and other topics related to the muscular system
- [http://pharmacotherapy.medscape.com](http://pharmacotherapy.medscape.com) supply search terms of muscular drugs to find information on drugs used in humans (and perhaps extra-label in animals)
- [http://www.fda.gov/cvm](http://www.fda.gov/cvm) supply search terms for specific information regarding drugs used for the muscular system
- [http://vetmedicine.about.com](http://vetmedicine.about.com) search under existing topics of Cat Diseases A-Z or Dog Diseases A-Z and choose information on a variety of topics such as muscle diseases and anatomy
- [http://www.onhealth.com](http://www.onhealth.com) supply search term muscle disease in animals to find articles on a variety of disease affecting the muscular system of animals
For excellent information on species specific information on a variety of drugs used in animals perform a google search under the search terms animal drugs for the muscular system or neuromuscular function.

Critical Thinking Questions for Chapter 13

1. The disease known as milk fever can strike lactating female animals under certain conditions. What are these conditions? How does milk fever affect muscle function?

2. Botulism and tetanus toxins both affect the neuromuscular junctions. Perform an Internet search to determine how each of these toxins affects the neuromuscular junctions.

Your instructor can access these answers at <http://www.agriculture.delmar.com/> in the Instructor Center.
CHAPTER 14

Introduction

A cat owner comes into your clinic requesting a refill of an antibiotic because her cat is sneezing again. The client explains that when the cat starts sneezing, she gives him antibiotics. The owner says she only needs about 14 pills because she only has to give her cat 2 to 3 days worth of pills before he stops sneezing. If you give her 14 pills that will give her enough antibiotic to treat the cat for a few “bouts” of sneezing. She would also like the “strongest” antibiotic you have. Can you help this client understand that her rationale of antibiotic use is flawed? What are some consequences of this kind of antibiotic use? Can you explain how antibiotics work, what side effects can be expected, and why “stronger” is not a good term to use in describing antibiotics?

Therefore, antibiotics should not be thought of as stronger or weaker than one another. Antibiotics are defined as narrow-spectrum (working only on gram-positive or gram-negative bacteria) or as broad-spectrum (working on both, but perhaps not all, gram-positive and gram-negative bacteria). The best way to treat bacterial infections is to know exactly what organism is present so that the proper antibiotic is used. Identifying bacteria is done through culture methods. Antibiotics are often dispensed to cover the most common organisms that cause the condition. The antibiotic that has the best chance of targeting a particular bacteria is the best one to use. It is unclear what the owner is referring to when she wants the strongest antibiotic for her cat. She may mean the broadest-spectrum antibiotic to make sure that the potential to inhibit the pathogen is maximized or she may be referring to the one that works without causing side effects.

Some consequences of indiscriminate antibiotic use include the development of antibiotic resistance. Antibiotics should always be prescribed and taken at the proper dose and for the proper time. Recheck examinations show the veterinary staff whether or not the infection is eliminated. If it is not, additional antibiotics can be prescribed at that time.

You should also remind this client that antibiotics do not “cure” sneezing.

Stay Connected

Helpful Web sites for Chapter 14 include:

- [http://www.howstuffworks.com](http://www.howstuffworks.com) supply search terms such as how antibiotics, antifungals, or antivirals work and other topics related to bacteria, fungi, and viruses
- [http://pharmacotherapy.medscape.com](http://pharmacotherapy.medscape.com) supply search terms of specific antimicrobials to find information on drugs used in humans (and perhaps extra-label in animals)
- [http://www.fda.gov/cvm](http://www.fda.gov/cvm) supply search terms for specific information regarding antimicrobial drugs
- [http://vetgate.ac.uk](http://vetgate.ac.uk) supply search term for specific antimicrobial
- [http://www.doctorfungus.org](http://www.doctorfungus.org) search under In Animals and supply specific search term
- [http://www.cleanlink.com](http://www.cleanlink.com) search Product Resources (guide), Information Resources (links, solutions, and articles), and Interactive Resources (forum) for information on a variety of disinfectants
For excellent information on species specific information on a variety of antimicrobials or disinfectants/antiseptics used in animals perform a google search under the search terms animal antimicrobials or types of disinfecting agents.

**Critical Thinking Questions for Chapter 14**

1. Antibiotic resistance has been in the news for the past few years. Think about the responsibilities that you have as a veterinary professional to prevent antibiotic resistance. What considerations are there in administering a course of antibiotic treatment for an animal? What protocols are appropriate for you in terms of follow-up protocols during antibiotic treatment?

2. Antibiotic use in food-producing animals is a source of concern for veterinary and human health professionals. Investigate research sources to explain why this is a concern and what veterinary professionals and the U.S. government is doing to address the issue.

Your instructor can access these answers at [http://www.agriculture.delmar.com/](http://www.agriculture.delmar.com/) in the Instructor Center.
CHAPTER 15

Introduction

A farmer has 200 calves that he would like to start on a deworming program. He is interested in giving his calves something that will cover many different parasites and is easy to administer. He would like to know what dewormers are available and whether they come in easy-to-administer forms. Are dewormers safe for cattle of all ages? What side effects does he need to watch for? Understanding the types of parasites that have to be controlled or treated, the rates of administration used in parasite control and treatment, and the side effects of these drugs is critical to your clients. Are you able to explain antiparasitic drugs to clients.

Dewormers used in livestock are typically chosen based on where the animals live (regionally and type of environment), age of the animal, and withdrawal times, which can differ based on whether animals produce meat or milk. Ivermectin-type products are often used topically. The product used in young animals may differ from the older animals because of withdrawal times. For example, doramectin may be used in calves because it has the longest-lasting effect on parasites, but it also has the longest slaughter hold, making it undesirable in some older animals. Doramectin cannot be used in lactating cows, so this group of animals will need a different deworming product. Dairy cows may be treated with an eprinomectin product because it is labeled for use in lactating animals.

Side effects to watch for in animals treated with topical dewormers include reaction at the application site and neurologic signs if given at extremely high doses. Neurologic signs include ataxia, listlessness, and occasionally death. The most common side effect observed is ataxia.

Stay Connected

Helpful Web sites for Chapter 15 include:

- [http://pharmacotherapy.medscape.com](http://pharmacotherapy.medscape.com) supply search terms of antiparasitic drugs to find information on drugs used in humans (and perhaps extra-label in animals)
- [http://www.fda.gov/cvm](http://www.fda.gov/cvm) supply search terms for specific information regarding drugs used to treat parasites
- [http://www.canismajor.com](http://www.canismajor.com) search under existing Topic section, then select Health and Veterinary Information. Choose topics such as Heartworm disease, Flea season for Fido, The critters on our critters, Canine worms, Mange, and Tiny Giardia can make Fido mighty sick.
- [http://vetmedicine.about.com](http://vetmedicine.about.com) search under existing topics of Cat Diseases A-Z or Dog Diseases A-Z and choose information on a variety of topics of parasitic disease
- [http://www.heartwormsociety.org](http://www.heartwormsociety.org) search What is Heartworm Disease and Veterinary Information
- [http://www.uaex.edu](http://www.uaex.edu) search Agriculture, then Pest Management, and select from a variety of topics such as Nematodes. There is also a Links section.
- [http://www.cdc.gov/](http://www.cdc.gov/) search topics such as Parasites and Parasitic Disease or DPDx for information on many different parasites
For excellent information on species specific information on a variety of drugs used in animals perform a google search under the search terms animal antiparasitic drugs or search for information on specific parasites and their life cycles.

**Critical Thinking Questions for Chapter 15**

1. What are the signs of organophosphate toxicity? Knowing these signs, what would you propose as an antidote?

2. Why is it important to do a fecal examination before dispensing a dewormer for a puppy or a kitten?

Your instructor can access these answers at [http://www.agriculture.delmar.com/](http://www.agriculture.delmar.com/) in the Instructor Center.
CHAPTER 16

Introduction

A horse owner calls the clinic requesting an exam on his five-year-old quarterhorse gelding, which has been showing signs of lameness for two days. On physical exam the veterinarian noted that the horse is pointing his left front foot (heel is off the ground). A nerve block is done to determine the location of the injury. Radiographs are also taken, and it is determined that the horse has degenerative changes in the navicular bone. The horse is put on phenylbutazone and referred to a farrier for proper shoeing. The owner asks you if the phenylbutazone will fix his horse’s lameness. Will it? Do analgesics and anti-inflammatory drugs cure disease? Can they cause additional problems for the animal?

Anti-inflammatory drugs like phenylbutazone work by inhibiting cyclooxygenase, an enzyme that promotes the formation of prostaglandin from arachidonic acid in the cell membrane. Some anti-inflammatory drugs are analgesics and antipyrexic drugs as well.

In this horse, degenerative changes are observed in the articular cartilage of the navicular bone. Anti-inflammatory drugs will not repair cartilage; they simply reduce inflammation, which affects swelling, pain, and decreased motion. Phenylbutazone will make the horse feel better but will do nothing to repair the injury. One danger in administering anti-inflammatory drugs to animals with injuries is that when they feel less pain, they may overexert themselves, further damaging the injured tissue. Masking the injury may make the animal feel better than it actually is.

Other dangers associated with anti-inflammatory drug use is the development of gastrointestinal problems (ulceration and bleeding), nephrotoxicity, bone marrow suppression, and bleeding tendencies (from decreased platelet aggregation).

Stay Connected

Helpful Web sites for Chapter 16 include:

<http://www.howstuffworks.com> supply search terms such as how inflammation occurs, how the immune system works, and how aspirin works

<http://pharmacotherapy.medscape.com> supply search terms of anti-inflammatory drugs to find information on drugs used in humans (and perhaps extra-label in animals)

<http://www.fda.gov/cvm> supply search terms for specific information regarding drugs used to treat inflammation

<http://www.canismajor.com> search under existing Topic section, then select Health and Veterinary Information. Choose topics such as Arthritis, PennHip information, and Over-the-counter drugs can poison pets.

<http://vetmedicine.about.com> search under existing topics of Cat Diseases A-Z or Dog Diseases A-Z and choose information on a variety of topics such as inflammatory conditions and arthritis

<http://www.arthritis.org> search for specific disease for pathophysiology of disease origin and progression (human)
search under Topics of Interest and choose from a list of diseases including intervertebral disk disease

For excellent information on species specific information on a variety of drugs used in animals perform a google search under the search terms animal anti-inflammatory drugs and side effects of anti-inflammatory regimens.

Critical Thinking Questions for Chapter 16

1. What considerations must be taken into account when deciding on the best approach to long-term use of anti-inflammatory agents?

2. What are some problems associated with glucocorticoid use?

Your instructor can access these answers at <http://www.agriculture.delmar.com/> in the Instructor Center.
CHAPTER 17

Introduction

A farmer tells you that one of his children’s fair calves has a skin infection and that he has been treating it with the ointment you once gave him for his other cattle. He says it looked exactly like the bacterial infection he saw in his cattle last year, so he thought this ointment would be an easy way to get rid of the infection. The fair is rapidly approaching, and he wants to clear this infection before the calf is judged. He does not want to treat the calf with oral antibiotics because there is a meat withdrawal time for these drugs. What can he give this calf? Are there additional tests you want to do or questions you want to ask this farmer?

It is not a good practice to hold onto medications used in other animals. It is difficult to know whether or not this infection is the same one his other cattle had last year without an examination. Since this is a calf that he is intending to take to the fair, he must make sure that he is treating the infection with the proper medication. One condition that should be tested for and examined in this calf is ringworm. Ringworm is usually diagnosed visually, but it is better to diagnose this disease with a Wood’s light or fungal assay, or both. Antibiotics would be ineffective against the organism that causes ringworm, which is a superficial fungal infection.

Another condition this calf may have is parasitic infestation, which can be diagnosed visually or with a skin scraping (for mites). Since parasitic infections are treated with different medications than bacterial infections and can be transmitted to other animals, it is important to give the farmer the proper medication for his animals.

Stay Connected

Helpful Web sites for Chapter 17 include:

<http://www.howstuffworks.com> supply search terms such as how the skin protects the body, and specific topics/diseases related to the skin

<http://pharmacotherapy.medscape.com> supply search terms of topical drugs to find information on drugs used in humans (and perhaps extra-label in animals)

<http://www.fda.gov/cvm> supply search terms for specific information regarding drugs used to treat skin conditions

<http://www.canismajor.com> search under existing Topic section, then select Health and Veterinary Information. Choose topics such as Hot spots, Canine fur, Canine allergies, and Canine skin.

<http://vetmedicine.about.com> search under existing topics of Cat Diseases A-Z or Dog Diseases A-Z and choose information on a variety of topics such as allergies and skin infections and infestations

For excellent information on species specific information on a variety of drugs used in animals perform a google search under the search terms animal drugs for the treatment of skin conditions or animal drugs available for topical use.
Critical Thinking Questions for Chapter 17

1. One action of corticosteroids is to suppress the immune system. Why would an animal benefit from corticosteroids if it has a bacterial infection?

2. What are some nonmedication therapies that can be used in an animal that has a skin condition?

Your instructor can access these answers at <http://www.agriculture.delmar.com/> in the Instructor Center.
CHAPTER 18

Introduction

A farmer comes into the clinic and says that some calves of his have developed pinkeye (a bacterial eye infection). He remembers that he has ointment at home that he used to treat his cat when the cat got a scratch on the cornea during a fight. He wonders if he can use the same ointment for his calves. Can he? Are there any questions you may want to ask him? Can antibiotics in ophthalmic ointments be absorbed systemically, thereby raising concerns about withdrawal times with these calves?

Antibiotics used in small animals may not be the same as those used in large animals. It is important to know which medication was used for the cat and if this antibiotic ointment is effective for the treatment of pinkeye in cattle. In other words, is the antibiotic effective against this organism?

Pinkeye in cattle is often not treated topically due to the labor involved in treating cattle on a daily or twice-daily basis. Antibiotics such as penicillin mixed with an anti-inflammatory drug like dexamethasone are injected into the dorsal eyelid. Oxytetracycline is an antibiotic labeled specifically for use in cattle to treat pinkeye. If antibiotics are given systemically, withdrawal times must be taken into consideration.

A client brings in a kitten she had adopted from a farm because the kitten has been scratching at her ears. The cat is examined and determined to otherwise be healthy. Ear examination shows, brownish ear discharge and redness due to scratching. White mites are seen moving under otoscopic magnification (the warmth of the otoscope causes them to move). It is determined that the kitten has ear mites (Otodectes cynotis). What should be done before treatment? Ear cleaning? Determination of whether or not the tympanic membrane is intact? Questioning the owner about other animals in the household? Do you know?

Before treating animals with ear disease it is important to determine what type of organism is causing the disease. It is also important to know if the tympanic membrane is intact because some cleaning solutions and topical medications cannot be used in animals with ruptured tympanic membranes. Otoscopic examination of the tympanic membrane is recommended before any type of intervention is done in ear care, including ear cleaning.

How contagious diseases are transferred among animals is important for both owners and veterinary professionals. Multipet households face additional challenges in regard to contagious diseases and their control. In the case of ear mites, it is important to know if there are other animals in the household. If so, they must also be treated at the same time as this cat.

Stay Connected

Helpful Web sites for Chapter 18 include:

<http://www.howstuffworks.com> supply search terms such as how the eye works, how the ear works, and other topics related to the special senses such as glaucoma

<http://pharmacotherapy.medscape.com> supply search terms of ocular and otic drugs to find information on drugs used in humans (and perhaps extra-label in animals)
Critical Thinking Questions for Chapter 18

1. Veterinary ophthalmology has become a big business. Research eye diseases of canines and how they can be prevented. Consider the use of genetic screening for inherited eye diseases, DNA testing (Optigen)® and CERF examination. What is the role of a veterinary professional in working with clients who maintain purebred canines and felines as breeding stock?

3. Hearing loss can occur in animals. Some forms of hearing loss are iatrogenic. Name some nontopical medications that can cause ototoxicity.

Your instructor can access these answers at <http://www.agriculture.delmar.com/> in the Instructor Center.
CHAPTER 19

Introduction

A new client brings in a six-week-old puppy for examination because he has developed diarrhea. The owners say that the dog has seemed lethargic, but assumed that was because he was in new surroundings. The dog has not been vaccinated nor have any fecal parasite exams been performed on his stool. On physical exam, the veterinarian notes that the puppy is moderately dehydrated, quiet, and slightly pained by abdominal palpation. During the physical examination, the puppy defecates a moderate amount of very watery, blood-tinged diarrhea. The veterinarian orders a fecal examination and blood work (including a parvovirus) titer to be done on this dog. Pending the results of the test, the dog is hospitalized, and isolated from other animals, and fluid therapy is initiated. The owners ask you why fluids have to be given to this puppy, because he is so small and does not drink a lot of water anyway. Can you explain to the owners why this puppy needs fluids, where he is losing fluids, and what type of fluids he will get? Is this puppy more at risk of developing dehydration than an older animal? What is the quickest way to get fluids into the puppy? Can you explain the theory of fluid therapy to this owner?

Dehydration occurs when the body loses more fluid than it takes in. In this case, the puppy is losing fluid through its stool (diarrhea). When the puppy’s fluid supply is decreased, a variety of complications may arise. These complications include electrolyte imbalance, which can affect muscle and nerve function, low blood pressure, increased heart rate, and increased respiratory rate. To avoid these physiological responses, fluids are given to counteract the effects of dehydration. Young animals are more at risk for developing dehydration since a larger percentage of their body weight is water.

The most commonly used method for rapid administration of fluids into animals is intravenous. Intraosseous routes may also be considered.

Parvovirus infection in puppies causes acute enteritis with vomiting, hemorrhagic diarrhea, and elevated temperature. The enteric form of parvovirus can cause severe dehydration from damage to the intestinal epithelium. Animals are usually infected by ingestion of fecal material from infected animals. Infected animals can shed virus in feces for about 2 weeks. Another form of parvovirus infection affects the heart and causes sudden death in puppies that are between 4 and 8 weeks of age.

Parvovirus is diagnosed via clinical signs and virus isolation from feces or by virus-specific serum tests if the puppy has not been vaccinated within 3 weeks. Treatment consists of prompt, intensive care, including fluid therapy and supportive care.

Stay Connected

Helpful Web sites for Chapter 19 include:

<http://www.howstuffworks.com> supply search terms such as how fluid balance in the body works, what osmosis is, and what diffusion is
<http://www.canismajor.com> search under existing Topic section, then select Health and Veterinary Information. Choose topics such as Is it an emergency?, First aid kit, ER for animals, and National Animal Poison Control Center.

<http://www.csuvets.colostate.edu> search under Emergency Medicine and Critical care. Choose from a variety of topics like Veterinary Emergency Medicine Pearls or Index Page for Other Critical Care/Emergency Medicine Page.

<http://www.vetmedicine.about.com> supply search terms emergency medicine to view articles on various techniques used in emergency medicine

<http://www.aapcc.org> select Poison Prevention and Education for information from the American Association of Poison Control Centers regarding toxicities that animals may be exposed to

For excellent information on species specific information on a variety of emergency drugs or fluids used in animals perform a google search under the search terms animal emergency drugs or fluid replacement in animals.

**Critical Thinking Questions for Chapter 19**

1. Why is the concept of hydration important? Explain what you know about this physiological concept.

2. Emergency situations in animals can vary greatly. What are treatment options/plans for the following emergency situations: uncontrollable seizures, diabetic emergencies (severe hypoglycemia), and ingestion of a toxin in which emesis is not indicated?

Your instructor can access these answers at <http://www.agriculture.delmar.com/> in the Instructor Center.
CHAPTER 20

Introduction

A client’s boxer has been diagnosed with lymphosarcoma. Owner and dog are sent to a referral clinic for a complete workup and discussion of treatment options. The client calls your clinic after taking his dog to the veterinary oncologist, who offered him a treatment plan consisting of two antineoplastic agents. The owner would like to have the treatments given at your clinic so that he will not have to drive 100 miles to the referral clinic. The oncologist is willing to prescribe the medication and let the client have the treatments done at your clinic. Do you know how to handle antineoplastic agents? Do you know how to administer these agents? What would you tell this client?

The risk of exposure to antineoplastic agents is greatest during drug preparation and administration, with the primary routes being inhalation of aerosols, direct contact, and ingestion of spilled or improperly handled drugs. Two other routes of exposure important to veterinarians and their clients include handling of discarded items that have come in contact with chemotherapy (e.g., syringes, catheters, gloves, and so on and contact with excreta from patients treated with antineoplastic agents). Animal care workers in the veterinary clinic are at particular risk for exposure because they clean the animal cages, and they should be adequately trained in special handling procedures for these patients. Pregnant workers should avoid any exposure to antineoplastics. It is also important for veterinarians to give veterinary clients information on appropriate handling of drug and animal waste.

Most antineoplastics are expensive and should be prepared in a biological safety cabinet, which most veterinary clinics do not have. For these reasons, pharmacists are frequently asked to prepare chemotherapy for administration in the veterinary clinic and to compound and/or dispense prescriptions for at-home administration by the client. When a pharmacist prepares an antineoplastic agent for administration by a veterinarian in his/her clinic, the veterinarian should ask that a Material Safety Data Sheet (MSDS) and the drug package insert accompany the medication. The pharmacist is also a valuable resource for information on emergency procedures in the event of accidental exposure or extravasation of the drug, as well as potential side effects, drug interactions, precautions, or contraindications, etc. associated with a particular drug.

Chemotherapy safety should be discussed with clients before discharge of the pet. While it is important to point out potential hazards associated with human exposure to these drugs, it is also important to avoid frightening clients. When antineoplastics are dispensed for at-home administration, medication vials, syringes, and bags must always be identified clearly with chemotherapy labels. The prescription label should also contain clear directions for use and disposal instructions. A procedure for safe disposal should be established between the veterinarian and pharmacist before dispensing. Medication should always be dispensed in a child-resistant container. Follow-up with clients is very important to make sure that the medicine is being given correctly and handled safely.
Antineoplastic drugs commonly used in pets are eliminated primarily in the urine and/or feces. In general, a 24-hour post-treatment period for special handling of chemotherapy patients has been recommended. This is the time frame when urine or feces are most likely to contain excreted drug and metabolites. Some drugs, however, are metabolized and eliminated more slowly than others. Individual animals may be slower to metabolize some drugs due to other factors, such as concurrent drug therapy interactions or altered physiological state. Therefore, a 72-hour special handling for patients receiving chemotherapy may be more appropriate. An even longer period may be needed for some drugs, such as carboplatin. Labeling of the medication should include a specified time period for special handling of animal waste.

Clients should be given written educational materials. Questions and answers should be reviewed with the client face to face (either by the veterinarian or pharmacist) to make sure there is a clear understanding of hazards and precautions.

References

1. “Safe Handling of Chemotherapy Drugs,” Vet Talk, Vol. 6, No. 1, 2, and 3, a bi-monthly newsletter of the American College of Veterinary Pharmacists.

Stay Connected

Helpful Web sites for Chapter 20 include:

- <http://www.osha.gov> supply search terms handling antineoplastic agents for guidelines from the U.S. Department of Labor on handling cytotoxic drugs
- <http://www.howstuffworks.com> supply search terms such as how cancer develops and how chemotherapeutic drugs work
- <http://pharmacotherapy.medscape.com> supply search terms of antineoplastic drugs to find information on drugs used in humans (and perhaps extra-label in animals)
- <http://www.fda.gov/cvm> supply search terms for specific information regarding antineoplastic drugs
- <http://www.canismajor.com> search under existing Topic section, then select Health and Veterinary Information. Choose topics such as Human cancer treatment goes to the dogs and Autoimmune diseases.
- <http://vetmedicine.about.com> search under existing topics of Cat Diseases A-Z or Dog Diseases A-Z and choose information on a variety of topics such as mammary tumors and skin tumors
- <http://www.southpaws.com> search under Topics of Interest and choose from a list of diseases including cancer in pets
- <http://vetgate.ac.uk/> supply search term antineoplastic agents to view information on a variety of antineoplastic drugs
- <http://www.drschoen.com> search articles (on bottom of page) to see a variety of articles on immunostimulants and herbal therapies
For excellent information on species specific information on a variety of drugs used in animals perform a google search under the search terms animal drugs for the treatment of cancer in animals, handling antineoplastic agents, or immunostimulants used in animals.

**Critical Thinking Questions for Chapter 20**

1. Since many antineoplastic drugs can cause diarrhea, what problems might come up for clients?

2. What are some other treatment options for animals with cancer?

Your instructor can access these answers at <http://www.agriculture.delmar.com/> in the Instructor Center.
CHAPTER 21

Introduction

A cat owner receives a reminder card from your clinic that her cats are due to receive their annual vaccinations. She makes an appointment and brings her cats to the clinic at the appointed time. She asks you about the safety of vaccines because she read in her cat magazine that some vaccines might cause cancer. Can you tell her how safe (or unsafe) vaccines are? Does one type of vaccine cause more adverse effects than other vaccines? Should she vaccinate her cats at all? Should she vaccinate them annually? Can you explain the importance of vaccination protocols and how they protect animals from disease?

It is important for animals to have protective antibody levels against infectious diseases to which they may be exposed. Titer tests may be performed to determine if an animal has a specific level of antibodies. A titer test is a procedure that measures the antibody levels in blood. If by chance one of the infectious agents has a low antibody level, the animal can be independently vaccinated for that disease alone rather than having the animal’s immune system bombarded with agents he or she does not need.

A common practice in veterinary medicine is annual revaccination. There may be no immunologic basis for annual revaccination because immunity to viruses may persist for years or for the life of the animal. Successful vaccination against most bacterial pathogens produces an immunologic memory that remains for years, allowing an animal to develop a protective anamnestic (secondary) response when exposed to virulent organisms. Some veterinarians feel that only the immune response to toxins requires boosters (e.g., tetanus toxin booster in humans is recommended once every 7–10 years). The practice of annual vaccination should be examined with regard to its efficacy unless it is required by law (i.e., certain states require annual revaccination for rabies). Some university experts now recommend vaccinations every 3 years, and other university clinics recommend titer testing to determine need.

One concern, however, is that titer levels may not accurately indicate the immune status. A titer is a reflection of the quantity of circulating antibodies (immunoglobulins) to a given antigen. Cells in the body produce the antibody. These cells retain the ability to produce antibodies toward a given antigen for quite a long time, usually for life. On re-exposure, they can produce antibody within 48 hours. A low or absent titer, therefore, does not mean the body is unprotected.

Vaccines can also be affected by the age of the animal. With young animals, antibodies (maternal antibody) may be passed from the mother to the kittens via the umbilical cord and via colostrum (the first milk). This antibody may protect the young animal, but it also can interfere with vaccination. For this reason, we often vaccinate young animals several times in the hope that we will give a vaccination shortly after the maternal antibody diminishes to a level that will not interfere with vaccination. There is some movement in the veterinary community toward titer-testing puppies and delaying the first set of vaccines until 8–9 weeks of age. The rationale behind this movement is to avoid overstimulation of the immune system.
Most vaccines are administered as “cocktails,” which are a combination of many vaccines in one shot. Vaccines can also be given individually to minimize stress on an animal’s immune system. If an animal has an immune system imbalance or chronic disease, veterinarians may postpone vaccination until the animal is in an optimal state of health. Vaccinating animals when their immune system is compromised can lead to a worsening of their present problems or a weakening of their immune system. Multiple vaccinations, particularly with combination vaccines, may be one of the greatest contributors to vaccine-induced illness. Limiting vaccination to one or two doses of appropriately indicated vaccines could greatly reduce disease from vaccination.

There are a variety of concerns regarding vaccines, including the following:

- Vaccines may or may not provide any protection. This may result from poor vaccine performance, (as with feline leukemia virus, feline infectious peritonitis virus, and ringworm vaccines).
- There may be a lack of exposure risk to a particular infectious disease (therefore, not all vaccines need to be given to every animal at all times). Each animal and its risk of contracting a particular disease needs to be considered on a case-by-case basis.
- Some vaccines actually induce illness worse than the diseases they are designed to prevent.
- Polyvalent vaccines may cause more adverse reactions than monovalent vaccines.
- Vaccines with adjuvants may cause more adverse reactions than those without adjuvants.

Stay Connected

Helpful Web sites for Chapter 21 include:

- [http://www.howstuffworks.com](http://www.howstuffworks.com) supply search terms such as how the immune system works and how vaccines protect the body
- [http://www.usda.gov](http://www.usda.gov) supply search terms such as vaccines for cattle, vaccines for horses, etc.
- [http://www.canismajor.com](http://www.canismajor.com) search under existing Topic section, then select Health and Veterinary Information. Choose topics such as Vaccinations: Shield against canine diseases, Annual vaccinations come under scrutiny, and Rabies.
- [http://vetmedicine.about.com](http://vetmedicine.about.com) search under existing topics of Cat Diseases A-Z or Dog Diseases A-Z and choose information on a variety of topics such as vaccine related diseases
- [http://www.ianr.unl.edu](http://www.ianr.unl.edu) select search key and supply search terms vaccine types to view Understanding Vaccines
- [http://www.msu.edu](http://www.msu.edu) select search key and supply search terms vaccine use in animals to view a variety of articles on vaccine use and controversy surrounding the use of vaccines
- [http://www.canine-epilepsy-guardian-angels.com](http://www.canine-epilepsy-guardian-angels.com) search the Table of Contents then supply search term vaccine to view many articles on vaccine use

For excellent information on species specific information on a variety of drugs used in animals perform a google search under the search terms animal vaccines or issues of vaccine protocols in animals.
Critical Thinking Questions for Chapter 21

1. Some practitioners recommend monovalent vaccines to their clients because they feel that giving one agent at a time is optimal. Other practitioners recommend polyvalent vaccines in the hope of avoiding some vaccine reactions by giving one injection with multiple agents in it. Which do you think is best, and why?

2. Arboviruses are a group of viruses that are transmitted by arthropods (arthropod-borne viruses). There are vaccines for some types of arboviruses. What are some other ways to prevent infection by arboviruses?

Your instructor can access these answers at <http://www.agriculture.delmar.com/> in the Instructor Center.
CHAPTER 22

Introduction

The owner of a male German Shepherd dog comes into your clinic to get your opinion about his dog, which has been very protective of him lately and will not let other people or dogs near him. His dog is particularly aggressive toward other male dogs. This owner is very concerned and wants to know what he can do to prevent his dog from injuring someone or their animal. He suggests filing the dog’s teeth or extracting them altogether, building an enclosure for the dog, or surrendering his dog to the animal shelter. He thinks that if he could get some medication to calm his dog down, the dog would not be so aggressive. What suggestions can you offer this owner? Is medication the best answer for management of this dog’s behavior? What are some ways to avoid behavior problems? What do you do in behavior cases in which rapid resolution of the animal’s problem behavior is needed?

This owner should be advised that there is not a “magic pill” that will alleviate this dog’s aggression. Behavior modification must also be instituted along with medication to ensure that this dog’s aggression is dealt with effectively. It would be beneficial for the dog to have a physical examination and some baseline blood work done to determine if he has some systemic disease that may be attributing to his aggression. Another thing the owner could do is to have the dog neutered. Neutering may help curb some of his aggressive nature.

The next step would be to take the dog to a trainer who can help him with the dog’s aggression. Training may include the use of special halters, leash command training, and limiting physical punishment for the dog since it may escalate the dog’s degree of aggression. Until the dog’s behavior has been modified, the owner has to take special precautions to make sure the dog is well supervised and not allowed to roam. Any discussion of the dog’s aggression and the plans to alleviate it should be documented in his medical record.

Stay Connected

Helpful Web sites for Chapter 22 include:

<http://www.howstuffworks.com> supply search terms such as how behavior-modifying drugs work and neurotransmitters of the nervous system

<http://pharmacotherapy.medscape.com> supply search terms of behavior-modifying drugs to find information on drugs used in humans (and perhaps extra-label in animals)

<http://www.fda.gov/cvm> supply search terms for specific information regarding drugs used for behavior modification

<http://www.canismajor.com> search under existing Topic section, then select Health and Veterinary Information. Choose topics such as Deceiving appearances, The Tellington touch, TTouch helps end submissive urination, and More on Touch.

<http://vetmedicine.about.com> search under existing topics of Cat Diseases A-Z or Dog Diseases A-Z and choose information on a variety of topics such as aggression and fear separation
<http://www.micromedex.com> select Healthcare services online then supply search terms behavior-modifying drugs to view a variety of articles on these drugs

<http://rxlist.com> supply search term of the drug name you are interested in obtaining more information on

<http://canines.com> select Canine Library then supply search terms of behavior-modifying drugs to learn more about these drugs and their use in animals. This site also contains information on a variety of training methods and behavior modification techniques.

For excellent information on species specific information on a variety of drugs used in animals perform a google search under the search terms behavior-modifying drugs used in animals.

**Critical Thinking Questions for Chapter 22**

1. Can you think of reasons that sedative drugs, like acepromazine, would not be a good choice for treating animals with aggression?

2. Selective serotonin re-uptake inhibitors (SSRI) have become popular drugs for treating obsessive-compulsive disorders in animals. Give some examples of obsessive-compulsive disorders in animals.

Your instructor can access these answers at <http://www.agriculture.delmar.com/> in the Instructor Center.
CHAPTER 23

Introduction

A client comes into the clinic and says she is interested in maintaining her cat’s health by using herbal supplements. She uses a variety of herbal supplements herself and wants to know if she can use some of these on her cat. You check her file and see that her cat has had a heart murmur ausculted on PE for the past few years but has not had a cardiac workup yet. You know that people can buy herbal supplements without a prescription and without their doctor’s advice, can they really cause any damage? Do you know for sure? Which herbal supplements could you recommend (or discourage) based on this cat’s history?

Staying current on the use of herbal supplements is key to maintaining safety and efficacy of these agents in animals. Continuing education (meetings, journals, books, monitored Web sites) play a major role in the success or failure of herbal supplement use in animals.

Pet owners try to cure their pet’s ailments with many home remedies and supplements recommended by their friends. They may not seek out veterinary advice about treatments they want to use on their pets.

Herbal supplements are really medicinal plants and hence may have side effects associated with their use. They can interact with prescribed medications and may have side effects. This cat should have a thorough cardiac work-up to assess the status of any heart condition before supplementation is considered.

Human herbal supplements are regulated as dietary supplements under the Dietary Supplemental Health and Education Act of 1994 (DSHEA). Herbal supplements are not “prescribed” for a particular condition but are recommended for structural and functional claims (“good for the immune system”). They do not carry specific health claims, such as preventing joint disease, and they are not regulated for quality or purity (only the name of the plant and the plant part used is provided on the label).

Herbs to avoid with cardiac disease include, but are not limited to, gingko (can cause heart palpitations and interfere with aspirin, coumadin, and heparin) and ginseng, which can increase heart rate and blood pressure. Problems often occur when high doses of herbs are used.

Stay Connected

Helpful Web sites for Chapter 23 include:

<http://www.howstuffworks.com> supply search terms such as how herbal medicine works, how acupuncture works, and how chiropractic works

<http://www.canismajor.com> search under existing Topic section, then select Health and Veterinary Information. Choose topics such as Alternative diets and holistic treatments, Homeopathic medicine, Canine acupuncture, and Veterinary chiropractic care.

<http://www.drschoen.com> search articles (on bottom of page) to see a variety of articles on immunostimulants and herbal therapies
<http://www.naturaldatabase.com> select Product Search to obtain information from the Natural Medicines Comprehensive Database

<http://www.aapcc.org> select Poison Prevention and Education for information from the American Association of Poison Control Centers regarding toxicities of herbals and other medications and plants

<http://www.herb.org> provides links to a variety of sites and contains password protects information from the Herb Research Foundation

<http://www.herbalgram.org> select Plant ID Contest, Common Herbs, or ABC Clinical Guide to Herbs to obtain information from the American Botanical Council on herb use

<http://www.altvetmed.com> select Articles to view a variety of articles from the American Holistic Veterinary Medical Association

<http://www.herbmed.org> supply search term of the herb of interest to obtain information on human clinical studies, traditional and food use of herbs, and adverse effects of herbs

<http://www.fda.gov/cvm> supply search terms of the herb of interest or Center for Food Safety and Applied Nutrition for information on special nutritional supplements used in animals

For excellent information on species specific information on a variety of drugs used in animals perform a google search under the search terms alternative animal drugs or complementary medicine in animals.

**Critical Thinking Questions for Chapter 23**

1. What are some problems you may encounter when seeking information on the use of herbal supplements in animals?

2. Herbal toxicities may be seen in animals with owners who are overzealous about the use of herbs in their pets. Overzealous owners may give their animals “too much of a good thing” and cause more harm than good. What are antidotes for herbal overdoses?

Your instructor can access these answers at <http://www.agriculture.delmar.com/> in the Instructor Center.