

factor for a profitable swine herd. This publication attempts to outline management practices that help keep pigs alive and profits high.

Farrowing

Preparation for Farrowing

The average gestation period for sows is 114 days. To prepare for farrowing, producers should know when sows are due. Producers should be ready for delivery prior to the due date because of individual variation in gestation.

Newborn piglets have a better survival chance if they arrive in a clean, warm, and sanitized farrowing facility. Research has shown that a break between farrowing reduces disease buildup. Many producers, however, only allow for a one-day break between groups of sows to maximize use of expensive facilities. If the facility is used continuously, cleaning and sanitation must be optimized to control spread of disease.

In addition, it would be beneficial to wash the sow with soap and warm water immediately prior to being put into the farrowing stall; this is rarely done for practical reasons.

Care at Farrowing

Three basic requirements for newborn pigs:

1. A good environment
2. Adequate and regular nutrition
3. Safety from disease and crushing

Individual attention from the producer at this point pays off with more live pigs. The amount of labor available may determine how much time you spend in the farrowing house. One dedicated team in charge of the farrowing

works well in larger operations. The table below indicates the scope and causes of piglet mortality.

Causes of piglet death (Leman and Knudson, 1972)

CAUSE	PERCENTAGE AFFECTED
Crushing	30.9
Starvation	17.6
Born Weak	14.7
Chilling	5.5
Transmissible gastroenteritis	3.9
Other diarrheas	12.9
Pneumonia	1.4
Others	13.1
TOTAL	100

Management — First Few Days After Farrowing

There are many essential chores to be done shortly after pigs are born. The navel should be disinfected the day pigs are born using tincture of iodine. If possible, match the number of piglets to the number of functional mammary glands. If several sows are farrowing within a 24-hour period, pigs can be transferred successfully from one sow to another if piglets are moved within the first 3 days of life and have received colostrum before transfer. Transfer bigger pigs in the litter, not the runts. Transfer of piglets may not be recommended during a disease outbreak; for example, pork producers were working through emergence of the new disease Porcine Epidemic Diarrhea (PED) in 2013 and veterinarians were recommending not moving piglets as a biocontainment measure.



“Newborn Pig: Clipping Needle Teeth”,

http://animalbiosciences.uoguelph.ca/~gking/Ag_2350/farrow.htm

Clip needle teeth, being careful not to crush the teeth or cut the gums. “Pigs are born with eight needle (sometimes called wolf) teeth located on the sides of the upper and lower jaws. Historically, needle teeth were clipped in newborn pigs to prevent potential damage to the sow underline and consequentially, a reluctance to allow nursing. Clipping needle teeth was also seen as a means for preventing injuries to the faces of littermates when fighting occurred. Some producers have totally abandoned the procedure or clip needle teeth only when sows are not milking well or if disease is present in the herd. [Based on a study performed at Virginia Tech], they suggest that “clipping needle teeth may be warranted on some farms to prevent pig and teat

injuries, and that the process has no positive or negative impact on pig and sow performance.” (Excerpt from [Virginia Tech Extension](#)) A controlled study comparing litters with clipped or intact needle teeth showed no difference in weight gain and mortality but demonstrated that piglets with intact needle teeth were more likely to have facial injuries. One of the students in the class of 2019 shared that she worked at a farrowing unit where they chose to stop clipping needle teeth for a time. They decided to start clipping needle teeth again because they found that when they were clipped, the piglets had fewer facial swellings and infections from biting each other and the sows were more comfortable and less likely to jump up and interrupt nursing of piglets because their underlines were not being traumatized by the needle teeth when piglets were suckling.

At the same time needle teeth are clipped, tails can be docked. Tail docking is performed to prevent tail biting and cannibalism among pigs later in life. Leave a stub on the tail about 1/4-inch long. Tail-docking is best done when the pigs are one day old. Ear-notching is practiced in some smaller herds. This identification helps select replacement animals from top litters and gives a check on age when pigs reach market weight. An [evaluation of welfare implications of teeth clipping, tail docking, and permanent identification of piglets](#) is available from the AVMA.

Iron deficiency develops rapidly in nursing pigs reared in confinement because of:

- Low body storage of iron in the newborn pig
- Low iron content of sow’s colostrum and milk
- Elimination of contact with iron from soil

- The rapid growth of the nursing pig

Iron deficiency is associated with inability to produce hemoglobin and subsequent anemia. There are many good sources of iron that can be used to prevent anemia. Iron-dextran injected in the muscle is an effective method. Injections are done in the neck. Common levels are 150-200 milligrams of iron as iron-dextran, usually given the first 2 days after birth. Don't give overdoses of iron because it may induce shock. Iron also can be mixed in the feed or in the drinking water. Supplying uncontaminated soil in the pig area is another method of supplying iron but is not used much in today's confinement systems.



Explain why, when, and how iron is supplied to piglets.

Management During Lactation

Baby Pig Scours

Baby pig scours are major ongoing problems for swine producers. Most common diarrheas are caused by various strains of *E. coli*. The symptom of *E. coli*-induced diarrhea is a watery, yellowish stool. Pigs are most susceptible from 1-4 days of age, at 3 weeks of age, and at around the time of weaning. Although pigs are born with little disease resistance, this resistance increases as they absorb antibodies from their mother's colostrum. Because pigs' ability to absorb antibodies decreases rapidly from birth, it becomes important that they feed on colostrum soon after birth. Colostrum provides the only natural disease

protection they will have until their own mechanism for antibody production begins to function effectively at 4-5 weeks. Disease resistance is lowest at 3 weeks. It is wise to avoid unnecessary stress (castration, vaccination, worming) at this time. In treating common scours, orally administered drugs are usually more effective than injections. You should use a drug effective against the bacterial strain on your farm. It is important to remember that many viruses also can be the cause of baby pig scours. A dry, warm, draft-free environment is of primary importance in reducing scours. Sanitation is also very important in reducing the incidence of baby pig scours.

Castration

Boar pigs can be castrated any time before they are 4 weeks old. In most states, it is legal for the farmer to perform this surgery in pigs and it is done before the piglets are one week old.



List your five (5) take-home points – What are things you want to remember from this chapter as you progress through the curriculum and into your career?



EXTRA RESOURCES

- Clipping of needle teeth:
http://www.sites.ext.vt.edu/newsletter-archive/livestock/aps-01_11/aps-0431.html

- Valgus and varus: www.acvs.org/large-animal/angular-limb-deviation
- Pediatric course information from Dr. Peggy Root: <https://sites.google.com/a/umn.edu/margaret-v-peggy-root-kustritz/home/archived-courses/cvm-6451—pediatrics>

8.

Dentistry

Learning Objectives

- Describe normal tooth eruption in dogs and cats
- Describe appropriate home dental care for dogs and cats
- Describe the procedures that comprise a dental prophylaxis in dogs and cats
- Explain the difference between the teeth of dogs and cats, and horses
- Describe routine dental care (floating) in horses including procedures and equipment used

Preventive dentistry routinely is practiced in dogs, cats, and horses. Some preventive dentistry may be provided for small exotic pets; that information is included in those specific modules later in the course.



SMALL ANIMAL PREVENTIVE DENTISTRY

Puppies and kittens are born with no visible teeth. The deciduous (baby) teeth erupt over about the first 6 weeks of life and then are replaced by the permanent teeth by about 4-6 months of age. The incisors are lost first, then the premolars and finally, the canine teeth. The canine teeth are reliably lost at about 6 months of age and this



Retained deciduous teeth in a dog (Photo courtesy of Drs. Gary Goldstein and Kevin Stepaniuk)

knowledge can be used to judge age of puppies or kittens. Most teeth are lost when the animal is eating and so are swallowed. This does not harm the puppy or kitten. Some dogs will grow in their adult teeth next to their deciduous teeth, without the deciduous teeth falling out. Those deciduous teeth should be removed as soon as possible as they may cause or worsen an abnormal bite and predispose the animal to dental disease.

One year, students found a chart on DVM 360 that stated that the sequence of eruption of adult teeth in small animals was incisors followed by canines followed by premolars.

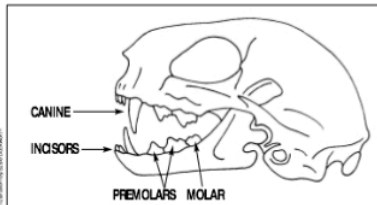
I checked with a veterinary dentist for clarification. When talking about animals losing their baby teeth, you have to differentiate eruption from complete replacement. Incisors always are first. Premolars and canines may erupt through the gum near the same time but because canines take longer to completely erupt, they are the last to be completely replaced in the mouth. So the sequence to remember for small animals is incisors – premolars – canines.

Determining Age of Cats and Dogs Through Their Teeth

How to Determine a Cat's or Dog's Age

Examining teeth is one of the best ways to determine the approximate age of a cat or dog. Look at the degree of growth to determine the ages of kittens and puppies, and look at the degree of wear to determine the ages of adult cats and dogs. The diagram and chart below can help.

Be aware of two things that can throw off your estimate. First, an animal who has received dental care will have better-looking teeth than an animal who has not received such treatment. Second, variations exist among animals, even two from the same litter. Teeth are only a rough indicator of any animal's actual age.



Animal Sheltering
"HOW TO" SERIES

Shelters are depositories for animals of all types and ages, from the cute, unwearied kitten whose eyes are barely open to the graying, noble 17-year-old shepherd mix who can hardly stand on his own. How can you figure out the age of an animal who falls somewhere in between these two extremes? Start by looking at the teeth.

Note: The location of teeth in a dog's jaw is similar to the cat's jaw shown here.

"Determining age by examining teeth",
<https://www.goldenacresdogs.com/dog-teeth-by-age.html>

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ESTIMATE D AGE	CAT'S TEETH	DOG'S TEETH
2-4 weeks	Deciduous (baby) incisors coming in	No noticeable tooth growth
3-4 weeks	Deciduous (baby) canines coming in	Deciduous (baby) canines coming in
4-6 weeks	Deciduous (baby) premolars coming in on lower jaw	Deciduous (baby) incisors and premolars coming in
8 weeks	All deciduous (baby) teeth are in	All deciduous (baby) teeth are in
3 1/2 – 4 months	Permanent incisors coming in	No noticeable permanent tooth growth
4-5 months	Permanent canines, premolars, and molars	Permanent incisors coming in; some growth coming in of premolars and molars

5-7 months	All permanent teeth in by 6 months	Permanent canines, premolars, and molars coming in; all teeth in by 7 months
1 year	Teeth white and clean	Teeth white and clean
1-2 years	Teeth may appear dull with some tartar build-up	Teeth may appear dull with some tartar (yellowing) on back teeth
3-5 years	Teeth show more tartar build-up (on all teeth)	Teeth show more tartar build-up (on all teeth) and some tooth wear
5-10 years	Teeth show increased wear and disease; pigment	Teeth show increased wear and disease visible on gums
10-15 years	Teeth are worn and show heavy tartar build-up	Teeth are worn and show heavy tartar; some teeth may be missing



Describe the sequence and timing of eruption of adult teeth in dogs and cats.

Periodontal disease in small animals is caused by plaque and formation of pockets. On clean teeth, a biofilm develops in minutes and plaque in hours, with that plaque maturing over weeks and eventually mineralizing into calculus (tartar). Plaque is composed primarily of bacteria, and also contains water, saliva, minerals, and food particles. As the host's immune system responds to formation of plaque, inflammation and disease develop under the gum line. This is gingivitis, inflammation of gingival tissue resulting from build-up of plaque and calculus and secondary accumulation of bacterial by-products and endotoxins. Gingivitis is reversible. If the process is not stopped, inflammation affects the periodontium and the supporting structures of the teeth. This is periodontitis and it is irreversible.

Periodontal Disease in Small Animals

STAGE OF DISEASE	CLINICAL SIGNS	PATIENT/CLIENT RECOMMENDATIONS
Healthy	No evidence of disease, gums are coral pink, gingival margins are razor sharp	Brush teeth daily, provide dental toys and chews, present the animal for an oral examination every 6-12 months, plan for the first professional dental cleaning at 1 year of age (small dogs, cats) or 2 years of age (larger dogs)
Stage 1	Inflammation of gingival margins, halitosis, gum edema, some bleeding upon probing of gums	Professional dental cleaning (consider full mouth dental radiographs), continue to brush teeth daily and provide dental toys and chews

<p>Stage 2</p>	<p>Moderate gingivitis, probing may show loss of attachment at tooth of up to 25% and pockets 3-5 mm in depth with more bleeding with probing, halitosis, teeth are stable</p>	<p>Professional dental cleaning (full mouth dental radiographs), continue to brush teeth daily and provide dental toys and chews</p>
<p>Stages 3 and 4</p>	<p>Severe inflammation, bleeding gums and exposed tooth roots with tooth instability, severe halitosis</p>	<p>This is a level of disease requiring extensive dental treatment. The goal of preventive dentistry is to keep this level of disease from developing.</p>

BRUSHING DOGS' OR CATS' TEETH: FOR PET OWNERS

Here is an excerpt from a text for pet owners regarding how

to brush their dog's or cat's teeth: To slow the development of dental disease, you can brush your pet's teeth. If possible, you should accustom them to this practice when they are young, however pets of any age can be trained to accept brushing of teeth. Plaque usually accumulates on the surface of the teeth against the cheek. Only toothpaste specific for dogs and cats should be used. A soft, nylon-bristle toothbrush designed for dogs and cats, or a pediatric human toothbrush can be used. Brush once daily and do not worry about rinsing. Your animal will require a professional cleaning and polishing under general anesthesia periodically over its life. Your veterinarian will examine your animal's teeth every time they do a physical examination and can give you advice regarding dental care.

Many products are marketed as means of maintaining good oral health in dogs and cats. These include foods, chews, oral rinses, and products to be dissolved in the drinking water. Some products have been proven to show some benefit, as described by the [Veterinary Oral Health Council](#).



Brushing a dog's teeth, (photo courtesy of Marie Kustritz)

What procedures constitute a professional dental cleaning? Controversy exists regarding use of anesthesia for dental cleanings in dogs with minimal dental disease. The [American Animal Hospital Association](#) recommends that all dogs and cats undergoing a dental cleaning be maintained on an inhalant anesthetic with a properly cuffed endotracheal tube in

place. A complete oral examination usually is best done with the dog or cat under general anesthesia.

Dental prophylaxis (commonly called a “prophy”) is performed on animals with a healthy mouth or very mild to moderate gingivitis. A thorough oral examination is performed. The teeth, including subgingival areas, are scaled with an ultrasonic scaler and curettes, and are then polished. This is the goal of preventive small animal dentistry. The [2013 AAHA article by Holmstrom et al](#) outlines current recommendations for high-quality small animal dentistry in practice.

Conversation Points to Help Pet Owners Understand Preventive Dentistry

- Periodontal disease and infection are common; 91% of dogs and 85% of cats have some degree of dental disease. Dental disease can be painful and may cause the animal to change eating and drinking behaviors or other behaviors in ways that affect their overall health and how they interact with other animals and family members.
- Periodontal disease is preventable. Just looking at your own pet’s teeth is not enough, because gum disease starts beneath the gum line.
- Preventive dental care can slow or

stop the progression of periodontal disease.



How often and why should a client brush their dog's teeth?



EQUINE DENTISTRY

Basics of Equine Dentistry

- Horses have deciduous (baby) teeth that are lost as the permanent teeth begin to erupt. There is a [chart](#) in the Extra Resources folder demonstrating timing of loss of deciduous teeth in the horse if you're interested. Once permanent teeth begin to erupt, they continue to erupt over the horse's life. There is a link to information in the Merck Manual about how to use examination of teeth to estimate age in horses.

- General anesthesia is induction of complete unconsciousness through the use of drugs. Horses (or any animal) under general anesthesia cannot stand. Specifically with horses, there are concerns about getting the horse down as you induce anesthesia and getting the horse up as it awakes from anesthesia. As you might imagine, as the horse loses and gains consciousness, it has abnormal balance and to have something that big lurching around is a danger to the animal and to the humans working with it. Outside of injury, horses also undergo a decrease in gut motility while under general anesthesia, which may be associated with colic after the anesthetic episode is done. For these reasons, we try not to induce general anesthesia and instead more commonly try to do standing sedation in horses, where they are given drugs that decrease anxiety and pain but do not induce complete unconsciousness.
- Floating is the term used to describe the removal of sharp points and small abnormalities of bite to make the horse more comfortable. The float is a rasp and as such, smooths and levels as it is used. Horses, as herbivores, need the occlusal surfaces of their teeth to be rough. You would never purposefully float the occlusal surfaces of teeth on a horse.



List your five (5) take-home points – What are things you want to remember from this chapter as you progress through the curriculum and into your career?



EXTRA RESOURCES

- 2017 WSAVA Dental guidelines:
https://www.wsava.org/WSAVA/media/Documents/Guidelines/Dental-Guidleines-for-endorsement_0.pdf
- Estimation of age by examination of the teeth in horses, cattle, and dogs:
<https://www.msdrvvetmanual.com/digestive-system/dental-development/estimation-of-age-by-examination-of-the-teeth>
- Products that benefit oral health in dogs and cats: www.vohc.org
- Procedures for a professional dental cleaning:
<https://www.aaha.org/aaha-guidelines/dental-care/dental-care-home/>
- Current recommendations for small animal dentistry in practice:
<https://www.ncbi.nlm.nih.gov/pubmed/23443202>
- Basics of equine dentistry:
https://pressbooks.umn.edu/app/uploads/sites/7/2019/08/8_Equine-Dentistry_Dr.-Linn.pdf
- Normal equine dentition:

<https://sceniccityvet.com/veterinary-services/dental-care>

9.

Behavior

Learning Objectives

- Explain principles of animal learning including use of positive and negative reinforcement
- Describe reinforcers and punishers unique to dogs, cats, horses, and birds
- Describe natural behaviors in birds
- Explain how captivity alters behavior in birds
- Describe a functional behavior assessment for birds
- Describe enrichment strategies for birds
- Describe various forms of restraint commonly used in horses
- Describe how to manage horses to permit training, veterinary examinations, and loading into a trailer
- Describe tools of the trade used in small animals
- Explain how to housetrain a dog

- Explain how to crate train dogs and cats
- Explain how to choose a new puppy
- Describe how to read body language to recognize stress or aggression in dogs, cats, and horses
- Explain how to minimize stresses in dogs
- Explain litter box management for cats
- Explain how to introduce a new cat into a household

This chapter does not include information about assessing behaviors or moving and handling cattle.



BEHAVIOR OF BIRDS

The big take-home point from this chapter is that all behavior has function.

Birds physically have a different brain from mammals with a much smoother surface. Historically, people thought that meant that birds had a less complex brain and were, therefore, less capable of high level thought (“bird brains”). We now know that is not true.

Research into behavior has demonstrated that behavior in birds, as in many species, is a blend of genetics and

physical adaptations to environmental change. Long-term evolutionary change to adapt to the environment in birds includes physical adaptations such as wings, beaks, and vocal structures to permit communications. Long- and short-term adaptations also occur in learning. People have addressed the science of understanding learning and behavior through three models. The ethological approach is species-specific and focuses on genetic adaptations through natural selection. The medical approach considers behavior to be a symptom of something we can diagnose and potentially treat or cure. The behavioral approach looks at the interaction between the observable behavior and the observable condition and asks how this specific animal is responding to this specific environment. All three models have their place.

Birds adapted over millennia to take advantage of specific niches in the environment. Their free-ranging (natural) behaviors include foraging, social interactions, self-maintenance (grooming), and resting. Some natural behaviors are not conducive to life in captivity.

If you consider domestication, dogs have been selected by humans for years for their value as companions and part of that is their ability to “read” humans. Birds (except for chickens) are not domesticated and there are so many species that it’s difficult for any one person to know the specific set of behaviors common in that bird species. Birds will therefore show maladaptive behaviors, which are normal behaviors expressed in an abnormal setting. These may include things like calling out (birds need to call loudly to be heard in noisy tropical environments), personal space boundaries (different species of birds have widely differing natural territories), wood chewing (making nest cavities), and flinging of food (birds in the wild have abundant food and can be messy eaters). Birds

also may show truly abnormal behaviors, such as feather destructive behaviors, biting, excessive vocalization, excessive egg-laying, and perch potato syndrome. Birds may show these behaviors because they have too little control or too little mental stimulation in their captive environment, in their perception, or because they are truly malfunctioning, with abnormal physiology, neurochemistry, or brain development.

A brief history in aviculture may help our understanding of current behavior concerns with caged bird species. Prior to the 1970s, birds were captured in the wild and imported. Captive breeding began in the 70s and 80s and was required after the Wild Bird Importation Act was passed in 1992, which banned importation of captured wild birds. Birds can be very long-lived so you may still see some birds that were wild caught but most of the birds we see were captive bred and raised by humans. In an attempt to do the best possible for these birds, we raised them in environments with good biosecurity, and wing-clipped and weaned them early, so we could hand feed them and they would bond to humans. This was not the best strategy. Some birds are reproductive R-strategists (lay many eggs and provide little parenting) and some are reproductive K-strategists (lay few eggs and provide a lot of parenting, often in flocks) and we did not have enough information to let us know how to raise these varying types of birds. This created many birds with the equivalent of “orphanage syndrome”, which is seen in primates that fail to thrive despite having received all necessary physiological needs because of lack of emotional attachment. The current gold standard for raising birds is to choose healthy parents with good behavioral traits; leave young birds with the parents as long as possible; habituate them to humans by vocal signals, gentle massage, and light contact; allow them to

develop curiosity, socialization and exploration; and allow them to develop flight.



List the four (4) natural behaviors of birds.

Investigating Behavior Problems in Birds

Problems in birds may develop because their captive lifestyle does not mimic their natural lifestyle in any respect. Birds reproduce, molt, migrate and then start that cycle over in the wild. These are all energy-intensive behaviors that occur due to environmental triggers and hormonal cues. With constant lighting and temperature of indoor environments, presence of potential “mates” (including humans), abundant food, and nest box availability, birds may show normal reproductive behaviors that are maladaptive in the captive environment. Examples include pair bonding, courtship regurgitation, cavity seeking, nest building, and territorial defense. Birds may also undergo hormone toxicity, which is early onset of sexual maturity or prolonged triggering of reproductive behaviors.

A multidisciplinary approach is needed where medical conditions are investigated and a functional behavior analysis is performed. Some definitions to guide this discussion are:

- **Behavior** – what an animal does under certain conditions that can be observed – it is something an animal does, not something an animal is, and

it can be observed and measured.

- **Construct** – a label or interpretation.

It is important to separate behavior from constructs. If a bird bites, you may think he's mean. Biting is a behavior. Being mean is a construct. Constructs are not useful because they lead to circular thinking (he bites because he's mean and I know he's mean because he bites), they give you a false sense of having explained the behavior and so provide an excuse to give up, they can be self-fulfilling, and they can predispose you to trying harmful strategies to change the behavior.

To promote new behaviors, you need to empower the learner and give them a choice. You need to create a situation where the good behavior is more functional for the bird.

The ABCs of Behavior

A = antecedent (environment: what makes the bird show the behavior)

B = behavior

C = consequence

Predicting Behavior

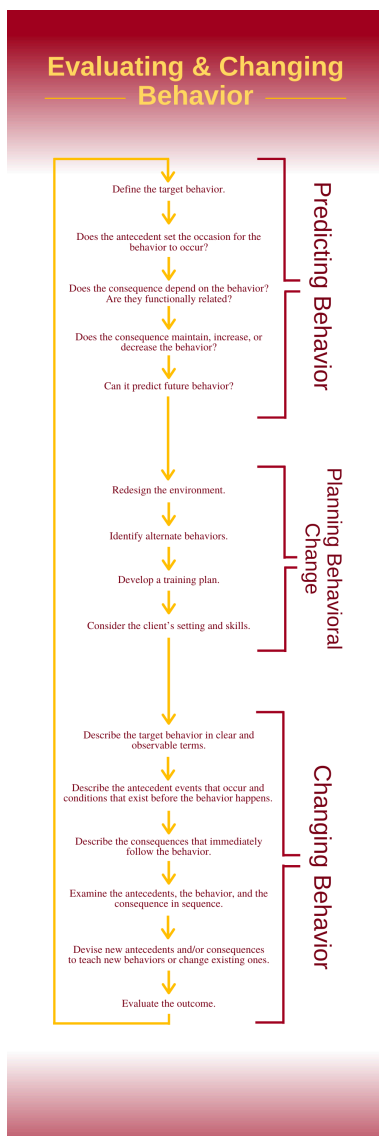
Identifying the antecedent, resultant behavior, and

consequences that follow does not always allow one to predict future behavior. Here is a checklist:

1. Define the target behavior.
2. Does the antecedent set the occasion for the behavior to occur?
3. Does the consequence depend on the behavior?
Are they functionally related?
4. Does the consequence maintain, increase, or decrease the behavior?
5. Can it predict future behavior?

As in other species, reinforcers increase behaviors and punishers decrease behaviors. Effective reinforcement has contingency (it always happens) and contiguity (it always happens immediately after the behavior) and is highly individual. It is the bird who decides if a reward is reinforcing (leading to an increase in that behavior) or not. Something you may think is a great reward may mean nothing to that bird. Begin by reinforcing a behavior already exhibited by the bird. Once the bird has mastered it, withhold reinforcement. This will lead to an “extinction burst”, which is an increase in behavior seen when rewards go away. Punishment decreases behaviors but may be associated with learned helplessness, generalized fear or phobias,

withdrawal from the training relationship, or apathy. If you want a bird to stop a behavior, try reinforcing an acceptable substitute behavior or an incompatible behavior (for



example, to stop biting, reinforce something else that occupies their beak).

When Making a Plan to Change Behavior

1. Redesign the environment
2. Identify alternate behaviors
3. Develop a training plan
4. Consider the client's setting and skills

Six Steps to Behavior Change

1. Describe the target behavior in clear and observable terms.
2. Describe the antecedent events that occur and conditions that exist before the behavior happens.
3. Describe the consequences that immediately follow the behavior.
4. Examine the antecedents, the behavior, and the consequence in sequence.
5. Devise new antecedents and/or consequences to teach new behaviors or change existing ones.
6. Evaluate the outcome.

Specific Problem Behaviors

Feather destructive behavior is self-inflicted damage where birds break and/or pull out feathers. It is not a diagnosis, it is a sign and causes are multiple. It has a relationship to neurological development and to lack of enrichment. It is most common in big parrots and those species that bond most strongly to humans. It is thought

to be related to syndromes in non-human primates (who, like birds, are intelligent, social, and altricial (immature) at birth) who injure themselves as a consequence of having been reared in isolation. This is similar to psittacine (parrot-like) birds that were taken from their parents at an early age, reared by humans, and individually caged at weaning or as juveniles. The self-wounding is a physiological positive reinforcer of the behavior and acts as a coping strategy. Enrichment may be beneficial (see below). Other behavioral interventions include distracting the bird from the destructive behavior, positively reinforcing for a different, non-destructive behavior, and using preventive measures by trying to identify cues that the bird is about to start picking. Drug therapies are rarely helpful.

Enrichment is about simulating activities in the wild and redirecting energy away from reproductive behaviors and toward survival behaviors. Chewing activities are good for enrichment. If food is part of enrichment, avoid high fat and high sugar foods, and refined carbohydrates.

For enrichment, provide both non-destructible and destructible items. Rotate them regularly and do not overload the cage. Examples include chew toys, climbing toys, foot toys, and puzzle toys. This may include things to shred (phone books, paperback books, catalogs, junk mail, paper cups), things to hunt for (toys filled with food), alternate perching sites, coils and ropes for climbing, play stands and gyms, an outdoor aviary, and opportunities to forage. In one study, foraging in the wild was shown to occupy 4-6 hours per day and foraging birds in the wild ate a large variety of fruits, seeds, nuts, berries, blossoms, and leaf buds, from up to 60 plant species. Caged birds generally eat for 30-72 minutes per day and expend no energy getting the food. Foraging toys can be used to make

birds “hunt” for their food as they would in the wild. Good examples of enrichment can be found in The Parrot Enrichment Activity Book by Kris Porter.



List four (4) abnormal behaviors of birds and describe some underlying causes of these abnormal behaviors.

Dr. Ponder’s Myths About Bird Behavior

- **Height dominance** (birds want to be higher than you no matter what and will bite if you try to get them down):

This does not occur and is actually a bad choice for birds, as they would be more likely to be attacked by aerial predators if they chose to perch very high in the wild.

- **Parrots must obey:**

This is the same idea as the need to exert dominance in dogs and is equally untrue.

- **Flock dominance** (one bird in the flock is at the top of the pecking order):

There is nothing to support this theory.

- **If it's green, it's mean:**

This is a construct!

- **Punishment doesn't work:**

Punishment may cause a decrease in behavior but also may have undesirable side-effects as described earlier.

- **Positive reinforcement takes too long:**

Positive reinforcement takes patience but is a good training tool.



BEHAVIOR OF HORSES

Horses are prey animals. They are precocial, which means they are born in an advanced state and are able to feed themselves almost immediately. They are able to run within hours of birth. All horses have an extremely reactive flight response. We must learn how to help them modify this response in order to effectively and safely train the horse to offer acceptable behaviors.

Their main response is flight. If they are unable to flee, they will fight (kick, strike, run over handler). Anyone within 10 feet of a frightened horse is at risk of serious injury.

In horses, the corpus callosum, which connects the right and left hemispheres of the brain, is underdeveloped. This means that horses may learn to do something on their right side and need to be trained also to do it on their left side, or that they may see something with their right eye and be unfamiliar with it when they see it with their left eye.

Horses have laterally placed eyes. This means that they have a panoramic field of vision with a narrow window of binocular vision and blind spots directly in front and directly behind them. They have monocular vision with poor depth perception from their nose to their hip on each side. They see few colors. They will tilt or turn their head toward an object, raise their head to see forward, and tuck their nose down to move their field of vision downward.

Horses have very acute hearing, especially for higher frequency sound waves. They can independently turn their ears toward sounds so you can monitor to what a horse is paying attention by watching where it is aiming its ears. When working with a horse, you want to encourage it to keep one ear on you at all times. If a horse has its ears pinned back, do not push it further as it is already uncomfortable and/or irritated and may lash out.

Certain areas on horses are very sensitive to touch. Horses frequently groom each other (allo-grooming). They prefer a stroking motion to slapping as we approach them. The areas most sensitive to touch are the ears, girth region, flanks, perineal region, nose, and legs. They enjoy forehead rubs and scratching of the withers.



Describe fields of vision in the horse and how you will use this knowledge when working with horses.

Anatomy of a Horse



“Horse Anatomy 101”, <https://www.ponydreams.com/horse-anatomy-external/>

Horses communicate mainly through body language and tension, not vocalization. They readily pick up on the body language of humans. It has been shown that people who are nervous when handling horses make those horses more nervous. It is important to have a calm demeanor around horses and to breathe deeply to help relax nervous horses.

Restraining Horses

Restraining frequently will be necessary when working with horses, and is used for the following reasons:

- **Safety!** No matter how sweet a horse it, every horse will react to something if it is scared or painful enough. Anyone within 10 feet of a horse is at risk of injury.
- **Time is money** for a veterinarian. We do not have time to train the horse so restraint often is necessary.

Be aware that all forms of restraint have pluses and minuses. There is no “one size fits all” approach to restraint as it varies with horse, procedure, and handler. Most veterinarians prefer to use the least restraint possible. You may need to complete some components of the physical examination before the horse is restrained, so you know you are seeing true responses and not those induced by the restraint used. This is especially true for sedation and other kinds of chemical restraint.

Types of Restraint

- **Twitches** – Rope or chain twitches can be applied to the end of the nose. This is supposed to cause release of endorphins and calm the horse but some horses will rear as it is released. A skin twitch is pinching of the skin and can be effective just before vaccination. Ear twitching, where the base of the ear is twisted, is rarely used and may make horses head-shy.
- **Lip cords or chains** – A cord (shoe-lace often

is used) or chain is run across the inside of the lip. This prevents the horse from backing up or rearing.

- **Chemical restraint** – A variety of sedative drugs may be used for restraint.
- **Hobbles** – These join the legs together. They are uncommonly used but may be seen in mares during breeding, to prevent the mare from kicking a valuable stallion.

Training Horses

Operant conditioning is training the horse to respond consistently to signals through positive reinforcement and negative reinforcement. Timing of reinforcement is critical to success of the training used. Horses, as prey animals, respond well both to negative and positive reinforcement. Incorrect use of punishment can lower a horse's motivation to try offering a response (the horse shuts down, often seen in abused horses) or create fear or desensitize the horse to the instruments of punishment (spur or whip, for example).

Negative Reinforcement

Negative reinforcement involves the use of pressure. Pressure (tactile, visual, auditory) is applied until the horse offers the desired behavior at which point the pressure is immediately released. Start with light pressure, then slowly increase the amount and frequency of the pressure. Pressure should be firm and steady, not abrupt or harsh. This can be used to teach horses to stand still, lower their head, step forward, back up, move laterally, allow handling of sensitive areas, and accept use of clippers or other instruments. Keys to negative reinforcement are to apply

pressure initially lightly, then gradually increasing with ongoing training; to hold pressure steady; to wait for the horse to respond – patience is a virtue; to release as the reward; and to praise the horse afterward.


Positive Reinforcement

Positive reinforcement may involve clicker training or some other verbal marker followed by rewards as in the dog, or scratching of the withers or forehead instead of giving treats. This kind of training is difficult to do when

mounted on the horse (also called being under saddle) and is better for ground work. Be wary of horses who are inclined to nip or bite – use a bucket instead of offering treats directly from your hands. This can be used to help desensitize needle-shy horses or to allow use of clippers around the head.

All horses learn best when they are relaxed. A nervous or fearful horse cannot focus attention on training. By going slowly with training, you will accomplish more in a shorter time. If you start to lose your ability to remain calm, it is time to stop the training session.

Negative Reinforcement



1. Apply steady, light pressure
2. Increase amount & frequency of pressure
3. Wait for horse to respond
4. Immediately release

Positive Reinforcement



1. Use clicker or verbal instructions
2. Reward with treats or scratching of withers or forehead

Methods for Training Horses

	DEFINITION	EXAMPL ES
Positive Reinforcement	The addition of a pleasant stimulus (reinforce) to reward the desired response and thus make the response more likely in the future (Skinner, 1953; McLean, 2003)	Clicker training – Food treats
Negative Reinforcement	The subtraction of something aversive (such as pressure) to reward the desired response and thus lower the motivational drive (Skinner, 1953)	Release tension on a lead rope to reward taking a step forward
Positive Punishment	The addition of an aversive stimulus to make a particular response less likely in the future	Yanking on the nose chain when a horse tries to bite you
Negative Punishment	The subtraction of a reinforcing stimulus to make a particular response less likely in the future	Walking away from a horse that paws at a stall door to get out

Good Horsemanship and Performing Veterinary Work

As a veterinarian working with horses, you will be required to assess the general demeanor of the horse, do a complete physical examination, take a rectal temperature, auscult the heart and lungs, take a pulse rate and respiratory rate, auscult the GI tract, do a dental examination, do a lameness examination, perhaps do a rectal examination and pass a nasogastric tube (for example, if assessing a horse for colic), and know how to load a horse into a trailer so it can be transported for emergencies or referrals.

Keys to Good Horsemanship

- Be mentally present, with no distractions.
- Project a quiet, confident demeanor.
- Be patient and fair in your contact with the horse.
- Be the leader.
- Move slowly and deliberately, with no quick or jerky movements.
- Be firm but kind.
- Avoid invoking the fight or flight response!
Never allow the horse's stress levels to escalate.

Performing Veterinary Work

Right or wrong, clients often equate good horsemanship with good veterinary skills where horses are concerned. Steps are:

1. Introduce yourself to the horse. Horses

communicate through body language. You must address the whole horse, not just the area of concern. Approach the shoulder at a 45 degree angle. Divert your eyes downward and have a calm, quiet demeanor. Stroke the neck and shoulder. Wait for the horse to relax – the horse's eyes will soften, he will drop his head, he will chew, he will cock one hind leg. Stroke with the stethoscope from neck to shoulder and then down into the axilla and wait a minute to assess the heart and take the pulse rate; heart rate will increase with initial contact.

2. To approach the head, stand off to one side, never directly in front of the horse. Rub the neck and slowly advance upwards. Retreat to a “safe zone” if the horse raises his head. Rub the forehead and withers as a reward.
3. To do an oral examination, rub the side of the mouth and insert one finger into the interdental space. Reward the horse by removing the finger. Slowly make more contact with the mouth and tongue. Stay to one side as much as possible and do not hold him tight but instead move as he moves.
4. To do an ocular examination, sedation may be required and local anesthesia may be required if an injury is present. Evaluate ocular reflexes (pupillary light response [PLR], menace, and dazzle) before sedating the horse. PLR is closure of both pupils in response to light in one eye. Direct PLR is in the eye in which light is being shown; indirect PLR is in the other eye. Indirect PLR testing is difficult to do without standing in

front of the horse. Use an assistant if possible to help manage the horse and be cautious. Menace is flinching or blinking as the eye is approached physically. Dazzle is flinching or blinking with sudden bright illumination of the eye.

Correct

- Approaching the horse's shoulder at a 45 degree angle
- Looking down and staying calm at all times
- Stroking the neck and shoulder
- Backing up if horse doesn't relax



Incorrect

- Standing right in front of the horse
- Approaching aggressively & quickly
- No gentle introduction to the horse

5. Nasogastric intubation is passing of a semi-rigid tube through the nose to access the GI tract of a horse. This can be done with minimal restraint. Desensitize the nostril to the presence of your finger in the ventral meatus about three times, releasing pressure of your finger as a reward. Then introduce the tube. The most resistance will be met in the first 3-4 inches of insertion. A nose twitch, lip cord, or sedation may be necessary in some horses.
6. To take a rectal temperature, the handler of the horse should be on the same side of the horse as

the veterinarian. Stand as close to the hip as possible. Be prepared to move quickly. Keep one hand on the hip as you approach the tail. Massage the underside of the tail; many horses will raise their tail as you do this. Gently touch the anus with the thermometer and insert with a rotating motion.

7. Rectal palpation is a dangerous technique because you are in a danger zone for being kicked and are in the horse's blind spot. Try to stand slightly to one side and make sure the handler is on the same side of the horse as veterinarian. Use lots of lubrication. Insert one finger at a time and do not force entry or exit.
8. To perform limb palpation, for example for a lameness examination, make sure the handler is on the same side of the horse as the veterinarian. Stand parallel and next to the limb. Feel down the limb as the horse is standing, feeling for heat, swelling, and pain. As you approach the lower part of the leg, give a verbal cue to the horse ("ask for the limb"). Gently squeeze the flexor tendons or pinch the chestnut to get the horse to lift the leg. When the limb is elevated, gently palpate the tendons and ligaments. Hold the limb until the horse relaxes and then release it.
9. For horses that are needle-shy, here are some things to try:
 - Have the handler cover the horse's eyes.
 - Have the handler or assistant distract

the horse with a large treat that they spend some time working on.

- Rock the horse back-and-forth on its feet while inserting the needle.
- Rub the skin vigorously, then pinch it, then slide the needle in.
- Use oral sedation if the horse is truly dangerous.
- Help the owner train (desensitize) the horse between appointments.

10. To load a horse on a trailer, use a trailer that is as open as possible. Make sure you are in a well-lit area with no obstructions. Reward any attempt the horse makes to step forward toward the trailer, and consider use of lip cords.



Which parts of a horse are most sensitive to touch? How does this alter your physical examination on horses?



SMALL ANIMAL BEHAVIOR

Dog Topics

How Dogs Learn

Dogs do what works for them! They learn by consequences; what is reinforced will occur more often and what is punished will occur less often. Reinforcers = if provided immediately at the time of behavior, make the behavior more likely – examples are food, toys, play, attention, petting, movement. Punishers = if provided immediately at the time of behavior, make the behavior less likely – examples can be physical, verbal, auditory, removal of a valued resource, removal of attention, or anything the dog finds unpleasant. Reinforcers and punishers must come within 1-2 seconds of the behavior in order to be effective. It is the animal who decides what is a reinforcer and what is a punisher.

Dogs don't understand the concept of being punished for past behavior, as is described below under house-training. Behavior that happens when the owner is absent frequently is misinterpreted as spite. Usually this occurs when the owner has accidentally trained the dog to perform the behavior when the owner is not present. The dog looks "guilty" but is actually exhibiting behavior meant to "cut off" aggressive behaviors from other members of their pack or group. He looks guilty to you but really he's just frightened of being punished for no apparent reason.



List five (5) reinforcers and five (5) punishers for dogs. What is the correlation between timing and use of reinforcers in dog training?

For many years, people adhered to a theory that all dogs were vying for the “top” or “alpha” position, and must be lowered in rank to eliminate problem behavior. Traditional suggestions were for humans to exert their dominance by rolling the dog on its back, shaking its scruff, going through doors first, eating first, and not allowing dogs on the furniture. We now know that dominance describes a relationship that sorts out who gets what and at what time. It is about resources and is a fluid trait, not a fixed or personality trait. It is not necessarily related to social status and depends on the resources and individuals in question. For us, this means that dogs are looking for a clear, humane, fair leader, not an alpha wolf. Most of the behaviors we consider to be problem behaviors have nothing to do with status or dominance and are just normal dog behaviors. Our goal is to teach our dogs how to behave rather than to dominate them.



Explain the concept of dominance in dogs. Is the goal for the owner to be the alpha dog in the pack? Why or why not?

Training the Dog to Do What You Want

Training generally is done with positive reinforcement. Make it fun for the dog do things correctly. The goal is to prevent wrong behaviors from starting and to keep the dog from practicing wrong behaviors. Try to avoid fear and pain when training. These may cause aggression, anxiety,

creation of new problem behaviors, and confusion, and are hard to use appropriately. It is impossible to predict how dogs will respond to fear and pain when training and punishment doesn't tell dogs what they should do. Dogs naturally repeat behaviors that benefit them, just like people. It is easier, faster, and less stressful to reward what we want instead of punishing what we don't want.

Responding to Unwanted Behavior

- Ignore (turn your back, look away, walk away)
- Redirect (offer the puppy a toy to chew instead of the table leg)
- Give an instructive command (“sit” or another obedience command generally is better than “no”)
- Remove any reinforcement (stop the game, walk away, remove the treat, take away the toy, etc.)
- Use training tools to interrupt the behavior (use a Gentle Leader to close the dog's mouth, hold a mouthing puppy away from you with a leash, put a puppy in a crate or away from you for a time out)
- Make sure you're not unintentionally rewarding a wrong behavior – allow a 4-5 second delay between wrong and right behavior before rewarding the right behavior

Tools of the Trade



- **Rewards** – Examples of rewards include clickers and food rewards (chicken, cheese, lamb lung, hot dogs, food rolls, all cut into small pieces). With clicker training, the dog is taught to associate the “click” sound with a food reward. The handler clicks when the desired behavior occurs, then gives the dog a treat. Timing is important – the click marks the behavior and the treat comes after the click. The click must immediately follow the behavior and then the treat appears up to several seconds later. When the behavior is solid, the click is phased out and a verbal cue replaces the click.
- **Collars** – Head halters include the Gentle Leader and Halti collars. Both allow control of the dog’s entire head. The Gentle Leader permits the handler to gently close the dog’s mouth and reduces pulling, barking, mouthing, and jumping. This is a great tool to prevent puppy biting. Use of these collars depends on the user recognizing when the dog is doing what you want and leaving some slack in the leash; it is release of pressure from around the nose and behind the neck that is the reward for good behavior. Martingales are wide collars that connect to a leash in a way that tightens the collar to prevent it from slipping over the head. These are commonly used in sighthounds (for example Greyhounds), which often have a neck that is wider than the head. This performs the same function as a choke collar but with pressure spread out over the neck by the width

of the collar. The limited slip design prevents escape and the collar can be fitted so as not to fully close. Buckle collars are those that are most commonly used. They may have a quick-release clip or an actual buckle. Dogs can back out of these if they are fitted too loosely. Prong or pinch collars, choke collars, shock collars, and citronella collars generally are not recommended by behaviorists. These can be used by experienced people in appropriate situations.

- **Harnesses** – Easy-Walk and Halti are some brand names for harnesses. These fit around the chest of the dog and clip in the front, which makes pulling by the dog less efficient. These give handlers more control over the dog. These should be removed when not in use. The Freedom harness is a halter that clips over the back and can have two leashes attached; this harness also is used to control pulling when walking a dog.
- **Leashes** – Leashes that are 4-6 feet in length are recommended for training. They may be made of nylon or leather. A lightweight leash with a small clip is recommended for use with the Gentle Leader. If a dog chews the leash, one can be made of tie-out material covered in rubber or made of small-link chain. Leashes can be used as drag lines, as described below for housetraining. If the puppy / dog is wearing a leash in the house, the owner can walk the dog off furniture or through doorways without physically touching them, which the dog may

perceive as a reward.

- Retractable leads generally are not recommended. They can be useful in wide-open areas with little to no traffic but are not recommended for use in crowded venues, near bike paths, for dogs not yet trained to walk well on a loose leash, for children to walk dogs, or for people to walk dogs while multi-tasking (for example, while texting). Retractable leads offer too little control and too much freedom of movement for the dog and are difficult to hold onto if the dog is out of control. The lock can fail and fingers can be severely injured if they become entangled in the leash cord.
- **Crates and kennels** – Crates / kennels are described below, under housetraining. To train a dog to enter a crate, toss treats into the crate and let the dog eat and exit at will. Then feed meals in the kennel and put in things that teach the dog that spending time in the kennel is good, for example Kong or food puzzle treats that the dog has to work at to get the reward. Gradually increase the time the dog spends in the kennel. If the dog does not want to be in the crate and is making noise, wait until the noise stops before opening the door.
- **Gates** – Gates can be made of plastic, metal, or wood. They are great for multi-dog households and households with dogs and children. They can be used to prevent dogs from dashing

through open doors but must be properly installed (or they can be knocked over) and of an appropriate height (or they can jump or crawl over them).

Management Techniques

Puppies are always learning, even if we're not present. It is better not to let them practice doing things incorrectly, because they will get really good at whatever they practice. It is easier to prevent problem behaviors than to eliminate them once the animal is showing them. Management is about setting puppies and adult dogs up for success and requires us to be thinking about how best to keep the animal on track when it is not being supervised. Often, this involves changing behavior of the owners to ensure good behaviors on the part of the dog.

Housetraining

Housetraining is a necessity for all dogs, young and old. Young dogs need to be trained if they are to live inside as house pets and older dogs should be re-trained every time they move to a new home location. It is unrealistic to expect dogs of any age to readily understand our expectations of them regarding housetraining as we travel with them or move to new residences. When training, proper and consistent management is crucial to success and expectations must be age-appropriate.

Basics of Housetraining

- Take the puppy / dog out every hour on a leash – Do not let them run free outside until after they have urinated or defecated.
- Take the puppy / dog out immediately after it finishes eating, after it has been playing, and

after it wakes up.

- Reward the puppy / dog immediately after it urinates or defecates, not after they get back in the house – you want them to learn that the reward is for eliminating, not for going back in the house.
- Keep the puppy / dog on a leash when indoors and use it to keep the animal physically attached to someone at all times.
- Confine the puppy / dog to a crate or enclosure (ex-pen (see below) or small room) when supervision isn't possible.



“Precision Pet Ultimate ExPen”,
[https://www.amazon.com/
Precision-Pet-Ultimate-ExPen-Block/dp/B00028IX7M](https://www.amazon.com/Precision-Pet-Ultimate-ExPen-Block/dp/B00028IX7M)

If you're going to use a crate, crate-training requires use of a crate that is big enough for the dog to stand up and move around and to lie down comfortably, but not so big that the animal can urinate or defecate in the back of the crate and lie in a dry spot away from that area. You may, therefore, need to purchase more than one crate as your puppy grows,

or to put something in the back of a large crate to decrease the usable space for a time. You may or may not choose to put something on the floor of the crate. Newspapers may stain dogs, especially if they get wet, and dogs may chew on towels or other soft bedding. The maximum number of hours a puppy should be in the crate is its age in months

plus one – for example, a 2-month-old puppy should not be left in the crate for more than 3 hours at a time. For adult dogs, start with shorter durations (for example, 3-4 hours) and gradually increase duration. People are often eager to get puppies to sleep through the night very quickly but that is not a realistic goal; their urinary bladder is only so big. If they do sleep through the night, you should not expect them also to be able to hold their urine for that same length of time during the day. The crate should not be used as a punishment. It is a safe place for the dog and can be used not just for housetraining but also to control chewing; to manage multiple animals in a household, especially as they're first being introduced; and when traveling.

Accidents will happen while you're housetraining a dog. All should be cleaned with an enzyme-based cleaner, which will biologically break down the urine and feces and remove the smell. Smell is a strong indicator to animals that they should use that spot for elimination again. Remember that their sense of smell is much stronger than ours; just because you can't smell it, that doesn't mean they can't smell it. If you are worried you're not seeing all of the places where the dog has urinated, a blacklight flashlight can be used to help locate stains. Be aware that the blacklight is picking up protein so it also will identify places where the dog has drooled.

Puppies / dogs should not be punished for accidents you find after the fact. Punishment at that point is not associated in their mind with having urinated or defecated. If you catch them in the act, scoop them up and hurry them outside and if they do even one drop out there, heavily reward them. Do not punish them if you catch them in the act; it may teach them to urinate or defecate where no one can see them and it does not help them learn what we want them to do.

Other tools that may be used for houstraining are potty pads and belly bands. Potty pads are useful for those dogs that have limited mobility or live in places where it is hard to get outside (for example, high-rise apartments or houseboats). The puppy / dog is taken to the potty pad instead of being taken outside and is rewarded for urinating or defecating on that surface. All other aspects of houstraining are the same as above. Owners can purchase commercial potty pads or use newspaper; if you use newspaper, you need many layers to keep urine from soaking through. Belly bands wrap around the prepuce and penis of male dogs and are intended to prevent leg-lifting accidents and marking with urine on vertical surfaces. They should only be used when the dog is supervised and must be removed when the dog is taken outside or placed in a crate.



Describe as you would for a client how to houstrain a puppy.

Choosing a New Puppy

Recommended sources for new puppies are shelters or humane societies, rescue organizations, and reputable breeders. You will see below that it is not recommended to purchase puppies from pet stores; this does not include pet stores holding adoption days for local humane or rescue organizations. Reputable breeders do genetic and infectious disease testing on their bitches and stud dogs before breeding, use best practices for socialization and care of young pups, and screen prospective owners to ensure the new owners understand the personality and adult size of the chosen breed. The American Kennel Club has a [quiz](#) available to help perspective owners understand

various dog breeds and which breed is best for them and their situation. In general, it is not recommended to get a new puppy from a pet store, which may be receiving their animals from puppy mills and other unregulated breeders, or from “backyard breeders” and from those offering puppies “free to good home”, who often do not do genetic and infectious disease testing of sires and dams and may, therefore, produce pups with significant congenital defects and/or disease.

The average family wants a dog who:

- Likes men, women and children
- Enjoys being petted and touched
- Is relatively easy to walk and train
- Will settle down during family downtime

Red flag phrases do not describe bad dogs but dogs that may be the wrong fit for the average dog owner or families with children, as it suggests it may be a dog that is anxious around strange people or new situations, has far more energy than the owner is ready for, or may require extensive work and training to prevent problem behavior. Red flag phrases for many family pets are:

- Takes a while to warm up to people
- A one-person dog
- Very protective of me – Dogs with any of the above



designations may be fearful or shy, may be reactive or aggressive, or simply may be a less social breed.

- Field bred or working lines – These suggest dogs that are very focused on having a job (herding, for example) and who will be bored and likely destructive in many home settings.

Should I get a dog for protection? The answer is “no”. Dogs are already hard-wired for caution toward strangers and will spend more time with our friends and families than with intruders. The dog decides what is scary and that can be unpredictable. Aggression brings a lot of liability and can be difficult (if not impossible) to resolve. A watch dog is not the same as a guard dog – watch dogs, also called alarm dogs, warn their owner that something is not right, usually by barking, but do not engage with the threat.

Socialization Guidelines

The American Veterinary Society of Animal Behavior [states the following](#): “The primary and most important time for puppy socialization is the first three months of life. During this time puppies should be exposed to as many new people, animals, stimuli and environments as can be

achieved safely and without causing overstimulation manifested as excessive fear, withdrawal or avoidance behavior. For this reason, the American Veterinary Society of Animal Behavior believes that it should be the standard of care for puppies to receive such socialization before they are fully vaccinated”.

Good socialization venues for puppies are “puppy kindergarten” classes, often held at training facilities and humane organizations; [“puppy parties”](#); supervised play groups; trips to safe and approved human environments (family and friend’s homes for example); and places where puppies can be introduced to gentle, socially appropriate dogs. Socialization venues to be avoided include dog parks, which can be unsanitary and contain uncontrolled and untrained dogs; anywhere the pup would be roughly handled, for example by young children; anywhere the pup would get too much exercise, for example on a long hike; anywhere the pup would be overstimulated and stressed; and anywhere the pup would find frightening.

Preventing Dog Bites

To prevent dog bites and to be able to teach people how to prevent dog bites, you must know the following:

- What dog should I choose? What are you looking for in a dog? Remember that a dog cannot be trained automatically to know who is a “good” person and who is a “suspicious” person – people may believe they need a “protection” dog without knowing what that might mean.
- Learn behavior basics. Can I identify warning signs (body language)? Can I recognize signs of aggression?

- Learn and teach others how to greet a dog and what to avoid.

Aggression is a behavior, not a personality trait. Any dog or cat will show aggression if sufficiently stressed. Approaching a dog can be a source of serious stress and danger, so it's important to know [how to properly greet a dog](#). Determining the dog's triggers is key to maintaining safety. Finally, no dog is guaranteed not to bite, just as no human is guaranteed never to yell at or shove another person.

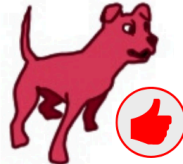
Dog Body Language

Colleen Pelar has created a simple system to help us all remember what some body language of dogs means:

- **“Enjoyment”** is associated with the dog having a loose body, open mouth, and squinty eyes – there is no need to intervene.
- **“Tolerance”** is associated with the dog having a closed mouth, still body, ears back, and the whites of the eyes showing – try to improve the situation to calm the dog and you may need to intervene if a human is threatened.
- **“Enough already”** is associated with stiff body, teeth displayed, staring,

freezing, growling, snapping, and trying to flee – the dog must be removed from the situation immediately without punishment. If the dog has reached this point, we have already missed several warning signs and we do not want to punish the dog and teach it not to show us those warning signs.

Evaluating Canine Behavior



Helping Dogs Cope with Stressful Events

- Keep the environment as predictable as possible. If the dog is crate-trained, bring the crate. Bring familiar chew toys and items with family members' scent. Limit unnecessary handling and stress.
- Pair new or frightening things with good things. If it is a noise, try introducing it at a low volume or at a distance (for example, thunder). If it is a new place, do it in stages (first is the car ride, then the ride and walk in the parking lot, then the ride and through the parking lot into the vet clinic). Pair any new experience with a high-value reward and remove the reward when the trigger is not present.
- Prevent stress as much as possible. Use medications if necessary. Do not try anything new when the dog is already stressed (for example, training procedures).
- Comfort the animal as necessary. Comforting dogs and cats does not reward fear! Fear is an emotion, not a volitional behavior. Soothing will either reduce the fear or do nothing; it will not increase it. The comforter's body language and stress levels are key – the dog can sense if you're saying it's okay with your mouth but your body is tense.

Cat Topics

Litterbox Management

Most behaviorists will recommend uncovered litter boxes that are of a size appropriate for the cat(s) – they should be able to easily get in and out and to scratch to cover whatever they produce. Uncovered boxes are preferred by many cats because they can easily escape them if feeling threatened and foul odors are not readily trapped within the area of the box. There are many types of litter available. Most behaviorists will recommend unscented clumping litter that is deep enough that the cat can scratch and not expose the bottom of the box. Cats will definitely have preferences for the type and amount of litter they want to use and the size and placement of the box.

Number of cat boxes in the household should be number of cats plus one. So if you have one cat, you should have two boxes and if you have four cats, you should have five boxes. People may complain that they don't have enough room for multiple boxes. Cats are particular about how they use the box and some will want to urinate in one box and defecate in another. Cats also may guard boxes and prevent other cats in the household from using them, so there have to be enough boxes so everyone can use one.

Boxes should be placed away from where food and water are provided, in a semi-private location away from disturbances and high traffic, in an area that is somewhat open so the cat does not feel cornered or trapped (do not put litterboxes in a closet, for example), and should be spaced out into different parts of the home to prevent the guarding problem described earlier. It is not valuable to have three boxes if they are all placed right next to each other.

Feces and clumped urine should be scooped out at least once daily. Avoid use of deodorizers, cat box liners, and perfumed litter – this is designed for humans, not for the cats. Use of these products can mask the smell of the box but may lead to owners cleaning less frequently. Cats also

may be bothered by these smells and textures. All litter should be dumped out, the box completely cleaned with warm water and mild detergent, and new litter placed in the box every 2 weeks. Do not add new litter to a dirty box. A good way to remind clients of the need to clean the box is to let them know that cats don't like a dirty toilet any more than we do, and we certainly would not be content if toilets only flushed every couple of days.

So what causes litterbox problems?

- Insufficient cleaning
- Not enough boxes
- Wrong size (too small or too large)
- Tension between pets
- Substrate preference (clay, sand, newspaper, etc.)
- Stress (change in routine, new furniture)
- Medical problem (constipation, urinary tract infection)
- Litterbox location suddenly changed
- Not enough privacy and/or escape routes
- Stress, outdoor intruders

What doesn't cause litterbox problems?

- Spite
- Anger
- Jealousy
- Stupidity

If a cat is presented for the problem of inappropriate urination / defecation (not using the box), it is valuable to take a very detailed history about the number and size of the box(es), where they're placed, what kind of litter is used, how the box(es) are cleaned, and if any changes have been made in the litterbox routine. Empathize with the client and then educate.



Describe as you would for a client how many litterboxes they need, where they should be placed, and how they should be maintained.

Introducing a New Cat

A single indoor cat generally enjoys only about $\frac{1}{4}$ of what would be its natural territory if it lived outside. Each addition of a new cat increases the likelihood of stress and behavior problems. Before you get that second (or third or fourth) cat, ask yourself if you're getting the cat to be a buddy for your current pet(s) or if you're getting it for yourself – are you grieving the loss of a pet, or are you bored or lonely? Those are not bad reasons to get a cat but you have to consider how your needs may impact stress levels in your current pets. You also need to be ready for the extra time, energy, and money required, and to be prepared for all outcomes, including possibly having to find a new home or to permanently separate the cats within your home if they can't learn to get along.

Make sure you have enough litterboxes for the new number of cats, toys, bowls, beds and perches, and maybe a calming spray, such as [Feliway](#). Make sure you have some hiding places. These will reduce stress, prevent conflicts, and allow escape from other pets. Examples are cat condos, tunnels, paper shopping bags, and visual barriers, such as screens.

When selecting a new cat, don't worry too much about the gender of the cats involved. Age and temperament are the most important factors. Adult cats will usually accept a new kitten much more easily than they will accept a new adult cat. Cats are territorial, and your cat may resent an adult feline intruder. If you're able to choose from a group of kittens, avoid a kitten that's hissing, growling or engaged in serious battle with his mates. If owners prefer to adopt an adult cat, success depends largely on the personality of your present cat; if he's easygoing and the new cat is also laid back, you may have little trouble if you introduce them slowly and correctly.

When introducing a new cat, first impressions are really important. Keep them separated for about one week and make sure the new cat has been examined by a veterinarian before being brought into the home. Feed the cats on opposite sides of a door. Slowly move the bowls closer to the door over the week and gradually crack the door open for a moment while they're eating. In the second week, switch which room each cat is in or swap their bedding. In the second to third week, supervise time when they're together for 15-30 minutes. During that time, give them equal attention and create good associations with them being together and getting play time and affection. Giving them this gradual introduction sets the tone for the relationship (letting them "work it out" or "fight it out" can seriously damage the relationship). They may be wary of each other at first and it will take time to determine if they're going to be best buddies, roommates, or enemies. As they're working this out, they may be stressed and stop using the litterbox or may do territorial spraying, which is spraying of urine on vertical surfaces. If they really hate each other, try re-introducing them gradually, seek

help from a professional, permanently separate them in the home, or find a new home for the new cat.

When introducing cats to dogs, do not force interactions. Keep the dog leashed whenever the cat is in the area and let the cat approach the dog at its own pace. Reward the dog with treats whenever the cat is visible. Always make sure the cat has plenty of escape routes. If the dog attempts to chase the cat, move him further away. Keep them separate if they cannot be supervised.

Dogs vs. Cats

Similarities between dogs and cats are that they both:

- Attach strongly to their human families
- Enjoy interactive play with humans
- Primarily use body language to communicate with those around them
- Are natural predators
- Respond to the laws of learning (behavior that is rewarded gets stronger)

Dissimilarities between dogs and cats are:

- Cats generally tolerate less physical contact than dogs
- Cats receive far less socialization and environmental stimulation than dogs
- Cats are carnivores, dogs are omnivores
- Cats are nocturnal, dogs are crepuscular (active at dawn and dusk)
- Cats climb and perch in high places to feel safe
- Body language – see below

Small Animal Body Language

	DOG	CAT
Tail	Wagging tail usually indicates pleasure	Lashing tail indicates arousal and aggression
Exposed Belly	Cut-off or calming signal	Social discomfort, potential defensive aggression (can use claws on all four feet) – if a cat’s belly is exposed while it’s sleeping, that is a sign of relaxation
Self-Licking	Anxiety or physical discomfort	Normal grooming behavior

Carrier Training

To train a cat to enter a carrier, first place the carrier next to the cat’s food dish. Leave it in this location for a few days. When the cat no longer appears afraid of the presence of the crate, feed the cat inside the crate with the door open. You can also throw treats for the cat into the carrier and let the cat run in and out. Once the cat is comfortable doing that, add a verbal cue (for example, “kennel up”). When the

cat is very comfortable, close the door and feed treats or the regular diet through a gap.



List your five (5) take-home points – What are things you want to remember from this chapter as you progress through the curriculum and into your career?



EXTRA RESOURCES

- Puppy socialization position statement:
https://avsab.org/wp-content/uploads/2018/03/Puppy_Socialization_Position_Statement_Download_-_10-3-14.pdf
- Puppy parties for socialization:
<https://dogtime.com/puppies/1206-dunbar-puppy-parties>
- How to properly greet a dog:
<https://drsophiayin.com/app/uploads/2017/08/How-to-Greet-a-Dog-Poster.pdf>

10.

Nutrition: Basics

Learning Objectives

- Describe broadly how nutrition is associated with health and disease prevention and management in animals
- Define and describe function, digestion, and use of water, fats, proteins, carbohydrates, vitamins and minerals
- Describe common types of feed
- Describe common feed processes
- Describe broadly how nutrient content from plants is determined
- Explain the 6 steps of ration formulation and why each is required
- Describe the effect of total feed intake as a limiting factor and how it can be managed
- Describe specific nutrients and how they figure into ration formulation (energy, protein, fiber and non-fiber carbohydrates, macro- and microminerals, vitamins, water)

- Demonstrate use of a Pearson square for ration formulation
- Describe the “cut and fit” method for ration formulation
- Explain linear programming as a component of ration formulation
- Take a minimal diet history in small animal medicine
- Define “complete” and “balanced”
- Explain broadly the nutrient content associated with statements on the front label of pet food
- Describe the formulation method (determined in two ways) and the feeding trial method for creation of a nutrition statement on a pet food label
- Explain how ingredients are listed on a pet food label
- Explain the proximate analysis (= guaranteed analysis) on a pet food label
- Compare products on a dry matter basis
- Describe appropriate use of feeding guidelines on pet food labels

GENERAL NUTRITION INFORMATION

Nutrients are chemical substances obtained from food and

are used to provide energy, to build structure (bone, muscle, etc.), and to regulate growth, maintenance, and repair. There is an optimal amount of intake of any given nutrient; if too little is taken in, the animal is deficient and if too much is taken in, toxicity may occur.

- **Water** – Water acts as a solvent for transport of dissolved substances through the body, it is



required for hydrolysis reactions of other nutrients, it helps maintain normal body temperature, and it provides shape and resilience to the body. Young animals have a higher percentage of total body water. The body in animals ranges from 40 to 80% water. Water requirements vary with age, body surface area, ambient temperature, state of health, amount of exercise, and life stage (growth, maintenance, pregnancy, lactation, etc.). Water is taken in directly (drinking) and indirectly (eating and in some species, through the skin).

- **Energy** – Energy is not a nutrient but is what is generated as nutrients are broken down. The



energy in food is chemical energy. The body converts chemical energy to mechanical, electrical, or heat energy. Gross energy (the full amount taken in) is higher than digestible energy (gross energy minus energy lost in feces), which is higher than metabolizable energy (digestible energy minus energy lost in urine and gases from the GI tract). Net energy is metabolizable energy minus the heat increment, which is the amount of energy lost in fermentation and in metabolic processes. Net energy is what is available to the animal to use and it is not used with the same efficiency for all processes.

Besides water, animals take in vitamins, minerals, fats, proteins, and carbohydrates. Fats, proteins, and carbohydrates are the nutrients that are broken down to provide energy.

- **Fats** – Fats are one type of lipid. Lipids include fats; sterols (for example, cholesterol); mono-, di-, and triglycerides; fat-soluble vitamins (A, D, E, K); and phospholipids. Lipids provide energy and are a structural component of cell membranes. Fatty acids are made from acetyl CoA and NADPH in the cytoplasm of the cell



and are a linear chain of an even number of carbons with hydrogens along the length and on one end (the methyl end) and a -COOH group on the other (the -COOH is what makes it an acid). Fatty acids with no double bonds are “saturated”, those with one double bond are “monounsaturated” and those with multiple double bonds are “polyunsaturated”. Those fatty acids denoted as “omega 3” fatty acids have a double bond three carbons away from the methyl end and those denoted as “omega 6” fatty acids have a double bond six carbons away from the methyl end. Phospholipids make up the cell membrane, preferentially permit substances to cross the cell membrane, and when added to foods, act as an emulsifier. Cholesterol is a base lipid that is the precursor to many other substances in the body including bile acids in the GI tract, sex hormones, adrenal hormones, and vitamin D.

When ingested, fats remain separate from fluid components in the stomach until they are emulsified. Bile has affinity both for water and fat. Exposure to bile in the small intestine breaks up large fat globules, exposing more surface area to enzymes in the digestive fluid. Glycerol and small lipids move

directly into the bloodstream. Large lipids combine with bile to form micelles that are water-soluble and move directly into cells. Most of the bile released into the small intestine is reabsorbed and sent back to the liver (= enterohepatic circulation of bile). Some bile moves through the GI tract and is excreted in feces.

The fat-soluble vitamins are A, D, E, and K. All fat-soluble vitamins are effectively stored in the body and so need not be taken in daily. Because they are stored, toxicity is possible if they are consumed in excess. Water-soluble vitamins are not stored and toxicity is rare. Vitamin A is also called retinol acetate and supports vision, cell differentiation, and reproduction and growth. It is available in plants as beta-carotene; not all species can readily convert beta-carotene to vitamin A. Vitamin D is also called calciferol. It can be synthesized by the body and functions in calcium metabolism. Synthesis is stimulated by exposure to sunlight; not all species readily can synthesize vitamin D even with sunlight exposure. Vitamin E is also called tocopherol. It is an anti-oxidant. Vitamin K is also called menadione. It is a component of the blood-clotting cascade.

The terms “fat” and “triglyceride” are synonymous, as fats are made up of three fatty acid chains and glycerol. Fats in the diet efficiently provide energy, transport and store fat-soluble vitamins, increase palatability and satiety, and reduce dustiness of feed. Fats produce energy by being broken down to acetyl CoA, which then enters the Krebs cycle (also called the citric acid cycle or tricarboxylic acid cycle [TCA]), where it is oxidized to produce CO₂ and ATP. As a general rule of thumb,

lipids contain 2.25 times more gross energy than protein or carbohydrate (9 kcal/gm for fat versus 4 kcal/gm for protein and carbohydrate). Fats are considered energy-dense nutrients.



Describe how fats are broken down after ingestion and how and where they are absorbed in the intestinal tract.

- **Proteins** – Proteins are made up of amino acids and are required in the diet both to provide essential aminoacids that cannot be synthesized by the body and to provide the nitrogen needed for other essential compounds such as heme, nucleic acids, and creatinine. **Essential** (also called



indispensable) amino acids are those that cannot be produced by the body quickly enough to meet demands for normal growth; these vary by species. There generally are 10 essential amino acids (threonine, tryptophan, valine, arginine, histidine, lysine, phenylalanine, leucine, isoleucine, methionine) that can be remembered using these mnemonics – **These Ten Valuable Amino acids Have Long Preserved Life In Man**

or **PVT TIM HALL**. Most true carnivores (for example cats), also require taurine so the mnemonics can be changed to – **These Ten Valuable Amino acids Have Long Preserved Life In Mutts and Tigers or PVT TIM T HALL**. Conditionally essential amino acids are only required for specific life stages. Examples include an increased need for glutamine in animals with sepsis, and increased need for arginine in individuals with liver or kidney disease, or in burn patients. **Limiting** amino acids are those essential amino acids in a diet that are present in low enough quantities that their concentration controls rate of protein synthesis. Complete proteins are those food sources that provide all essential amino acids and usually readily support ongoing protein synthesis. These usually are from animal sources. Plant proteins are more likely to be incomplete and/or limiting. A prominent example is lysine, which is limiting in corn. Complementary proteins are two protein sources that are themselves incomplete but that together provide all essential amino acids.

In ruminants, protein must pass through the rumen to be absorbed. Protein broken down in the rumen is available to microbes for synthesis of high-quality proteins and the remainder passes into the small intestine. Factors that affect the extent of protein breakdown in the rumen include the chemical structure and solubility of the protein, how long it is retained in the rumen, the particle size, the rumen pH, and the stage of plant growth. The breakdown in

the rumen is vital; microbes in the rumen contribute up to 70% of the protein available for absorption in the small intestine. In some specific circumstances, which will be described later, ruminants are fed protein that will not be broken down in the rumen, called bypass protein, specifically to ensure that there is a large concentration of protein available for absorption from the small intestine.

In monogastric animals, proteins are broken down by pepsin and HCl into large polypeptides. In the small intestine, pancreatic enzymes (trypsin, chymotrypsin) break polypeptides down further into small peptides and amino acids. Absorption across the cell wall is sodium-dependent and requires energy (active transport).

Absorbed small peptides and amino acids are reassembled into new proteins in the liver and other tissues. Amino acids become tissue proteins (muscle, liver, etc.); enzymes, albumin, hormones, and other nitrogen-containing compounds; and are broken apart to provide energy. There is little storage of excess amino acids. Tissue proteins and serum albumin are a store of amino acids if necessary. When amino acids are deaminated, ammonia is produced. Ammonia and carbon dioxide combine to form urea, which is excreted.

Protein digestion is intertwined with energy use. If the cells are starved for energy, the amine group is removed and excreted and the rest of the molecule is broken down for energy. If the cells have a surplus of energy, the amine group is again excreted and rest of the molecule is converted to glucose and fat, and stored. It is valuable to think about energy needs when feeding protein because if the body cannot

use the protein, it will be excreted or “wasted”. Examples of circumstances where protein wasting occurs include lack of energy from other sources so the amino acids are used for energy only, if the diet supplies more protein than the body needs, if a single amino acid is provided in excess, or when the diet supplies low quality protein with too few essential amino acids. An example of a time when this information is valuable clinically is when weight loss is desired; an animal on an energy-restricted diet should get a generous amount of high-quality protein to help maintain lean body mass and ensure an appropriate intake of nitrogen intake to balance nitrogen use (= nitrogen balance).



Describe how breakdown of protein is associated with energy needs in the animal's body.

- **Carbohydrates** – Carbohydrates are an important source of energy in all species and are the primary energy source



in most plant products. At the molecular level, they are a “hydrate” of carbon, with C:H:O at a 1:2:1 ratio. Simple carbohydrates are monosaccharides (glucose,

fructose), disaccharides, (sucrose, lactose), and oligosaccharides. Complex carbohydrates are polysaccharides (more than 9 CH_2O units; cellulose) and fiber. Mono- and disaccharides are readily absorbed to provide energy.

Examples of polysaccharides include glycogen (storage form of energy in the body), starch (storage form of energy in plants), and fiber (structure in plants). Polysaccharides are not digestible by mammals as they resist hydrolysis by digestive enzymes. Rumination (cattle, small ruminants) and hindgut fermentation (horses) are required for breakdown of these kinds of carbohydrates.

In ruminants, dietary carbohydrates from forages like hay are primarily structural carbohydrates, such as cellulose, pectins, hemicellulose, and lignins. Some are non-structural carbohydrates, such as sugars and starches. Carbohydrates undergo microbial fermentation to form volatile fatty acids; this is described in detail later in these notes.

In monogastric animals, there is limited digestion of carbohydrates in the mouth and stomach. Breakdown of carbohydrates is mediated by pancreatic alpha-amylase and brush border enzymes in the small intestine and by fermentation of undigested and unabsorbed carbohydrates in the large intestine. Fiber is not digestible in small animals but serves other purposes such as preventing constipation and normalizing intestinal motility. Cats handle carbohydrates uniquely; this is described in detail later in these notes.



Define as you would for a client the following terms: carbohydrate, polysaccharide, glycogen, and fiber.

- **Water-Soluble Vitamins and Minerals** – These compounds are needed in minute quantities. Water-soluble vitamins are the B-vitamins and vitamin C. They are organic micronutrients, required in small amounts but essential. They are not stored in the body so deficiency states can occur more quickly than with fat-soluble vitamins. If deficiency does occur, often more than one body system will be affected. Toxicity rarely occurs. Water-soluble vitamins often act as coenzymes.

Vitamin C can be synthesized in many species. Primates and guinea pigs are two species that require a dietary source of vitamin C.

Names of B Vitamins

B1	thiamine
B2	riboflavin
B3	niacin / niacinamide
B5	pantothenic acid
B6	pyridoxine hydrochloride
B7	biotin (sometimes called vitamin H)
B9	folic acid
B12	cobalamin

Minerals are inorganic elements in food. Macrominerals are those required in higher concentrations in the diet and include calcium, phosphorus, magnesium, potassium, and sodium. These are responsible for the structure of the bones and teeth, maintaining an action potential across cell membranes, fluid balance, acid-base balance, storage and transport of energy, and for acting as second messengers and co-factors. Microminerals often are associated with a specific enzyme, hormone, carrier protein, or vitamin, and include iron, copper, manganese, zinc, selenium, cobalt, and iodine. Other mineral compounds are classified as ultra-trace elements and are needed in very small amounts. Examples include molybdenum, fluorine, nickel, silicon, chromium, and vanadium.



LARGE ANIMAL NUTRITION

BASICS

The Role of Nutrition in Large Animal Veterinary Practice

Some practitioners may choose not to include nutrition in the services they offer as a veterinarian. This is problematic because nutrition plays a key role in large animal veterinary care, especially in production medicine, and because avoiding nutrition issues removes your chance to help patients and clients, and is a loss of potential revenue. Feed is the largest input cost in animal production and what feed is provided varies with age, breed, production and gain needs, and pregnancy status of the animals, and season of the year, such that a given client may be responsible for a wide variety of different feeding regimens for the animals under their care. Feeding also is related to a significant number of large animal diseases, both directly (deficiencies and toxicities) and indirectly (through causing changes in metabolic and systemic disorders and in immune status and general health).

Animal Diseases Associated with Nutrition

SPECIES	DISORDERS / CONDITIONS ASSOCIATED WITH NUTRITION
Horses	<ul style="list-style-type: none"> • Laminitis (founder) = inflammation of the hooves, associated with sudden change in diet or overfeeding of digestible carbohydrates • Obesity, caused by overfeeding • Feeding of mares during lactation • Feeding foals and yearlings for growth • Wobbler syndrome – a neurologic disorder • Hyperkalemic periodic paralysis – a neurologic disorder associated with high potassium

<p>Cattle (dairy and beef)</p>	<ul style="list-style-type: none">• Rumenitis / acidosis = change in pH in the rumen and inflammation, secondary to increased carbohydrates in diet• Liver abscess• Milk fever = hypocalcemia = decreased calcium post-partum• Ketosis = breakdown of fats and release into the metabolism post-partum• Metritis = inflammation of the uterus post-partum• Lameness and laminitis• Displaced abomasum = twisted stomach• Anestrus = delayed cycling due to inadequate nutrition
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<p>Sheep and Goats</p>	<ul style="list-style-type: none">• Pregnancy toxemia = release of ketones secondary to a decline in nutrition and breakdown of fats in small ruminants carrying multiple offspring in late gestation• Copper toxicity• White muscle disease due to selenium deficiency• Anestrus, low twinning rate, and general poor reproductive performance due to inadequate nutrition
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Swine	<ul style="list-style-type: none">• Gastric ulcers in sows• Anestrus and prolonged non-productive sow days (days the sow is not pregnant when she could be pregnant) – due to inadequate nutrition• Dystocia = difficulty farrowing• Poor lactation / baby pig mortality due to inadequate nutrition• Poor growth rates in young pigs• Poor disease resistance
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Nutrition comes to the fore for large animal veterinarians because:

- Nutrition is often an option on your list for differentials for the cause of disease.
- Nutrition may be a limiting factor in production or performance.
- Inadequate nutrition may be a factor in development of disease.
- Improper nutrition is an unnecessary cost of

ownership / management of animals.

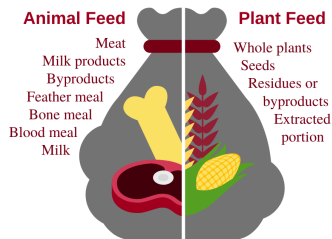
Our role occurs at several levels, from as simple as advising on questions of feeding to troubleshooting production problems to diagnosing disease to formulating rations to acting as a nutrition program advisor (closely linked in production agriculture with records management and analysis). Other nutritional resources with whom we may work include owners / farmers, feed company personnel, independent nutritionists, feed product companies, extension personnel, university experts, and agronomy experts who study crops and their nutrient content. In practice, you will have an opportunity to apply your knowledge of nutrition every day.



A producer tells you that she learned at an extension meeting that nutrition is not associated with disease conditions in large animals. What is your response?

Foods and Feeds

There is no hard definition that distinguishes “food” from “feed” but in general, food = what is actually eaten, mostly by people and non-farm animals (dogs, gerbils, birds, lizards, etc.) and feed = what may be mixed to produce animal food and/or what is fed to farm animals (cows, horses, chickens, sheep, etc.). Feeds may be



characterized by origin or major type of the feed (plant, animal, mineral, vitamin) or by how the feed is processed (dried; ground = pulverized to decrease particle size; pelleted = extruded under high pressure and steam and therefore partially cooked; flaked = rolled and flattened; steamed; cooked; extruded; ensiled = anaerobically fermented).

Animal Origin Feeds

- Meat
- Byproducts (protein sources from parts of the animal not used for human food)
- Meat and bone meal (cannot feed from ruminants because of concerns about bovine spongiform encephalopathy (BSE = mad cow disease))
- Blood meal (dried blood, great protein supplement)
- Feather meal (ground feathers, less digestible protein supplement)
- Milk and milk products (casein, whey, etc.)

Plant Origin Feeds

- Whole plants (corn, silage, alfalfa hay)
- Seeds (shell corn, wheat, oats, soybeans)
- Residues or byproducts (beet pulp = leftovers from sugar beet production, citrus pulp = leftovers from orange juice production, sweet corn stover, potato waste = leftovers from making French fries, almond hulls, cottonseed, distillers grains = leftovers from the bottom of

the beer vat, brewers grains, straw)

- Extracted portion = soybean meal, corn starch, molasses, corn oil

How do we determine what is in a plant? A variety of extraction processes can be used. Ether extraction is used to identify the amount of fats / lipids. Nitrogen extraction is used as an estimate of crude protein – about 16% of protein is nitrogen. Ash is what is left after burning a plant and is the mineral content. Acid and detergent extractions are done to define the two forms of fiber, which are hemicellulose (neutral detergent fiber) and cellulose and lignin (acid detergent fiber). Subtracting these from total carbohydrates yields the non-fiber carbohydrates, which are sugars, starches, and pectins.

Types of Feed

Types of feed include dry forages (grass or legume hay), straw (plant parts remaining after grains are harvested), corn stover (parts of corn remaining after corn is harvested); wet forages such as green chop (undried grass and legume hays), and silage and haylage; byproducts = commodities; grains; protein concentrates; and lipid sources. Grazing animals also get fresh forage on pasture.

- **Silage and haylage** – The whole plant is harvested and chopped into small pieces, usually while in a

vegetative state (before going to seed, more nutrient-dense). It is packed tightly to exclude air and is covered or sealed. Sugars in the plant feed bacteria that make acids in this anaerobic environment. As the pH drops, growth of microorganisms is inhibited, preserving the feed. This is also done with corn (“high moisture corn”). Silage and haylage are stored in upright silos (loaded from the top and so packs itself down, often cannot produce food quickly enough for large operations), silage piles (packed down by tractors), trench silos, or plastic bags (packed tightly by machines).

- **Dry feeds** – These include hay (grass or legumes (alfalfa or clover) that is cut, dried and then baled), grains, byproducts, minerals, and vitamins.
- **Hays** – Hays are best if cut early while in their vegetative, not reproductive, state (before they go to seed). If cut during the vegetative state, they have less cellulose and lignin and so are more digestible, and are higher in protein. Grasses include orchard, timothy, and fescue. Legumes include alfalfa and clover. If stored dry, it will provide > 85-90% dry matter. If wet, it will mold and decay as it oxidizes and

will lose nutritional value.

- **Straw** – Straw is the dried stems of crops that remain after those crops are harvested. “Straw should not be fed without supplementation because rarely does straw provide enough energy and protein to meet an animal’s requirements. However, straw is a good alternative in rations for cows and sheep if properly supplemented with higher quality feedstuffs. Differences in feeding value do exist among the straws. Oat straw is the most palatable and nutritious; barley straw is second and wheat straw has the lowest nutritional value of the main grains. Millet straw is more palatable and higher in energy and protein. Flax straw is lower in feed value than all the others because of its lower digestibility.”
<https://www.ag.ndsu.edu/drought/forages-and-grazing/feeding-straw>
- **Grains** – Grains are the seeds of the plant. These include corn, wheat, oats, barley, sorghum, millet, and rice. They are usually high in energy and starch and are highly digestible. Grains are a major source of dietary energy for domestic animals and humans.
- **Protein concentrates** – These often

are the seeds of plants as well, particularly legumes and oilseeds, including soybeans, cottonseed, rapeseed (= canola), and sunflower seeds. These often provide plant material after extraction of oils and often are a byproduct of some other process such as preparation of corn gluten meal or distilling. Others are animal byproducts such as meat and bone meal, blood meal, and feather meal.

- **Byproduct feeds** – These are leftovers from preparation of human foods and include beet pulp, citrus pulp, bakery waste, potato waste, brewer’s grains, almond hulls, apple pomace, cannery waste, soy hulls, and wheat midds. Use of these as animal feed often solves what would otherwise be a major environmental problem.
- **Minerals** – These are ground and otherwise processed rock. Macrominerals include calcium, phosphorus, potassium, magnesium, sodium, sulfur, and chloride and often are provided as dicalcium phosphate, limestone, magnesium oxide, sodium chloride, potassium chloride, and sodium bicarbonate. Microminerals include selenium, copper, iron, zinc,

manganese, cobalt, and molybdenum. There are important differences in biological availability, quality, and impact as fed to animals.

- **Vitamins** – Fat-soluble vitamins include A, D, and E. Vitamin K also is fat-soluble but rarely is added to large animal rations. Water-soluble vitamins added to feed are B vitamins such as thiamine, niacin, cyanocobalamin, and biotin. Vitamins usually are synthetic or fermentatively derived and are commonly added to rations without consideration for amount of those vitamins naturally occurring in other feed types.
- **Water** – Water is the single most important nutrient. It is cheap and is often ignored, for example by being limited in access or offered dirty. One must consider availability, cleanliness, flow, competition for water sources, and temperature.

There are a variety of ways nutrients in feed can be analyzed. You can find much information about nutrients in tables. For some feeds this is fine – salt is salt – but for others, the feed itself must be tested (for example, forages). Types of analysis include wet chemistry and near

infrared analysis. Feed analysis is best used for directly measurable components (fiber, macronutrients, protein) and is poor for constituents with wide variation or error in measurement (microminerals). Energy and non-fiber carbohydrates can be assessed by calculation. Be cautious of feed tables that come pre-installed in computer programs.

Feed quality is dependent on the right feed component being used (be cautious of similar names), feed being collected at the proper stage of maturity and properly stored and processed, the bioavailability of the nutrients, and freedom from contamination, toxins, and microorganisms. Feed delivery also can be a problem. Every single diet can be described as three diets – the one that is formulated on paper, the one that is delivered, and the one the animals eat. The goal is to make sure all three of these are the same for all animals intended to eat that diet.

FORMULATING RATIONS

Formulation is only one step and is not the end point. The key value is added by monitoring the implementation and the results of the feeding program. When in doubt, look at the animals! It is important to complete all 6 steps described below when formulating a ration.

1. Describe the animal.
 - Species, breed, age, sex, production/ rate of gain, stage of pregnancy/ lactation, exercise/activity, health status, environmental conditions – all

of these factors play a role. For example, ruminants who have not been weaned (lambs and calves who are still milk-fed) are not functioning as ruminants.

2. Describe the nutrient requirements.
 - This includes total food intake (usually best expressed on a dry matter basis [DMB]), energy (calories, essential fatty acids), protein (total and essential amino acids), fiber, macro- and microminerals, vitamins, and water. One must also consider how you feed animals in groups. If you feed the average animal in that group, you may be underfeeding high producing or fast growing individuals in the group. Diseased animals in that group (for example, those carrying parasites) also may require more nutrients. Feed intake is the limiting constraint to meeting nutrient needs in some animals because they cannot physically take in enough of a given ration to get all the nutrients available in that ration. This is particularly true of animals with high energy needs because of lactation, work, or life in harsh environmental conditions. This can be compensated for by adjusting animal comfort, access to feed (time, conditions, competition), physical

forms of feeds, water content, palatability, and balance of feeds to enhance digestion.

Formulating Rations

1

Describe the animal

- Species, breed, age, and sex
- Production/rate of gain
- Stage of pregnancy/lactation
- Exercise/activity
- Health status
- Environmental conditions

2

Describe the nutrient requirements

- Total food intake
- Energy
- Protein
- Fiber and non-fiber carbohydrates
- Macrominerals
- Vitamins

3

Describe the ingredients

- Type, form
- Nutrient content, quality, cost

4

Describe the feed delivery system

- Mix & order of mix
- Feed amounts, delivery & processing
- Monitoring delivery & consumption

5

Describe the ration or diet

- Simple calculations: Pearson square
- Simple calculations: Pearson square
- Linear programming ("least cost" diet formulations)
- The final question: "Would I really feed this ration to the animal being considered?"

6

Describe the results

- Body growth & condition
- Fecal consistency
- Behavior
- Family living/economic outcomes
- Quality of food produced
- Environmental impact

a. Energy

- Energy cannot be measured directly in routine feed testing and is instead inferred from studies. In monogastric animals, energy may drive consumption; once the energy needs are met, the animal stops eating. If they do not, they become obese. If the diet is highly palatable, excess energy may be taken in. Energy density can be increased by using fats in the diet. Energy density can be decreased by increasing fiber, particularly in carnivores and omnivores.

b. Protein

- Digestibility and types of protein

present play a role. “Bypass protein” in ruminants is dietary protein that, either by some means of alteration or because of the type of protein, is not broken down by microbes in the rumen. Essential amino acids are those that must be in the diet; these vary by species. For example, taurine and carnitine are essential amino acids in cats. Corn is lysine deficient so soybeans may be added in rations to provide lysine. Protein sources are processed by heating, grinding, extrusion, and cooking to increase digestibility.

Protein sources may be contaminated (for example, *Salmonella* sp, bovine spongiform encephalopathy).

c. Fiber and non-fiber carbohydrates

- Concerns include digestibility, physical form, palatability, association with other nutrients (for example, nitrogen-containing nutrients to help break down carbohydrates). The more mature the plant, the less digestible the fiber. These include sugars, starches, pectin, hemicellulose, cellulose, and lignin.

d. Macrominerals

- These are ground and processed rock and have variable bioavailability. They have reliably measured levels in feeds but levels present do not guarantee digestive availability. They typically are balanced for minimum needs and are adjusted for specific conditions.

e. Microminerals

- These are unreliably measured in feeds and are typically added to satisfy complete requirements in food animal diets – this means a set amount is added regardless of how much may be in other components of the diet. They

may interact with other microminerals (copper and molybdenum) or nutrients (selenium and vitamin E), or with macrominerals (most are divalent cations and so may alter each others' absorption).

f. Vitamins

- Typically added to satisfy total needs – as above, vitamins are added without calculating vitamin content in all components of the diet. Need for water soluble vitamins varies with species and some have special needs – for example, guinea pigs, like humans, cannot synthesize

vitamin C so it
must be supplied
in feed.

3. Describe the feedstuffs.

- Type, form, nutrient content, quality, cost

4. Describe the feed delivery system.

- Mix, order of mix, processing, feed delivery (amounts, timing delivery system), monitoring delivery and consumption

5. Describe the ration or diet.

- Doing the arithmetic. Computers do a lot of it. Work from an existing ration. Be careful about trusting the computer (Is the program up to date? Are the feed tables right? Are the nutrient requirements right?).

- a. Simple calculations:
Pearson square

This is straightforward math and is easy to calculate but is rarely used when formulating a complex ration.

A = % desired nutrient in first type of feed

B = % desired nutrient in second type of feed

C = % desired nutrient in formulation
 D, E and F are calculated

How to Use the Pearson Square

<p style="text-align: center;">Pearson Square all numbers on a dry matter basis!</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;"></td> <td style="width: 20%; text-align: center;">% nutrient</td> <td style="width: 20%; text-align: center;">difference</td> <td style="width: 20%; text-align: center;">proportion of diet</td> </tr> <tr> <td style="border-top: 1px solid black;">corn</td> <td style="border-top: 1px solid black; text-align: center;">A%</td> <td style="border-top: 1px solid black; text-align: center;">D=C-B</td> <td style="border-top: 1px solid black; text-align: center;">D/F%</td> </tr> <tr> <td style="text-align: center;">GOAL</td> <td style="text-align: center;">C%</td> <td></td> <td></td> </tr> <tr> <td style="border-top: 1px solid black;">soy</td> <td style="border-top: 1px solid black; text-align: center;">B%</td> <td style="border-top: 1px solid black; text-align: center;">E=C-A</td> <td style="border-top: 1px solid black; text-align: center;">E/F%</td> </tr> <tr> <td></td> <td style="text-align: center;">sum</td> <td style="text-align: center;">F=D+E</td> <td></td> </tr> </table> <p style="font-size: small;">differences (D and E) expressed as positive numbers</p>		% nutrient	difference	proportion of diet	corn	A%	D=C-B	D/F%	GOAL	C%			soy	B%	E=C-A	E/F%		sum	F=D+E		<p style="text-align: center;">Example Pearson Square make a 22% protein mix with corn and soy</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%;"></td> <td style="width: 20%; text-align: center;">% protein</td> <td style="width: 20%; text-align: center;">difference</td> <td style="width: 20%; text-align: center;">proportion of diet</td> </tr> <tr> <td style="border-top: 1px solid black;">corn</td> <td style="border-top: 1px solid black; text-align: center;">8%</td> <td style="border-top: 1px solid black; text-align: center;">26%</td> <td style="border-top: 1px solid black; text-align: center;">65% 26/40</td> </tr> <tr> <td style="text-align: center;">GOAL</td> <td style="text-align: center;">22%</td> <td></td> <td></td> </tr> <tr> <td style="border-top: 1px solid black;">soy</td> <td style="border-top: 1px solid black; text-align: center;">48%</td> <td style="border-top: 1px solid black; text-align: center;">14%</td> <td style="border-top: 1px solid black; text-align: center;">35% 14/40</td> </tr> <tr> <td></td> <td style="text-align: center;">sum</td> <td style="text-align: center;">40%</td> <td></td> </tr> </table> <p style="font-size: small;">Everything must be on a dry matter basis!</p>		% protein	difference	proportion of diet	corn	8%	26%	65% 26/40	GOAL	22%			soy	48%	14%	35% 14/40		sum	40%	
	% nutrient	difference	proportion of diet																																						
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Create a 30% protein mix using corn (7.5% protein) and feather meal (84.0% protein). What proportion of each of these products do you need to make this mix? Calculate using a Pearson Square and show your calculations.

b. Cut and fit” formulation

- Start by including some of the largest components (fiber in ruminants, protein in monogastrics).

Add minerals and vitamins to meet needs. Fill remaining “intake space” with energy sources (carbohydrate, fats, fiber). Need to cut a little of something out of the ration to let something else fit in. Use trial and error until satisfied.

c. Linear programming

- “Least cost” diet formulations – This is performed after a ration is formulated as a way of trying to optimize some particular aspect, for example, cost, while meeting the nutrient requirements and pre-set constraints. This commonly is used in food animal formulation.

Results depend on accuracy of the definition of constraints and of nutrient content, and on the prices of feed used.

Understand the approach and nutrition first, then use the tool. This can be a dangerous black box for the unsophisticated.

d. The final question

- Would I really feed this ration to the animal being considered?

6. Describe the results.

- Production – Growth – Body condition – Health – Fecal consistency – Behavior – Family living/economic outcomes – Family lifestyle; how hard is it to feed this diet? – Quality of food produced (wholesome, nutritious) – Environmental impact (for example, are we overfeeding something that will end up in the manure)



What are the six (6) steps of ration formulation and why is each important?



PET FOOD AND SMALL ANIMAL CLINICAL NUTRITION

What is the role of the veterinarian in small animal nutrition? The veterinarian provides nutrition counseling for healthy pets, for disease prevention, and for use of therapeutic diets. They are the link between the pet food manufacturer and the pet owner. You must also consider whether or not you will sell pet foods at your clinic and if so, how you will decide which you promote.

Clinical Goals

1. To provide optimal nutrition
2. To provide nutrition to support health and prevent disease
3. To help clients select pet foods
4. To address client misconceptions

Pet food industry in the United States – About 87% of dog and about 95% of cat owners in the United States feed at least 75% of their animal's diet as commercial pet food. There are fewer than 100 pet food manufacturers and are about 5000 different pet food labels in the US.

Approach of the American College of Veterinary Nutritionists (ACVN)

Challenge:
Make a diet plan/assessment on every patient, every time



“The Circle of Nutrition,”

<https://www.aaha.org/aaha-guidelines/nutritional-assessment-configuration/nutritional-assessment-introduction/>

Percentages of Various Kinds of Foods Fed to Dogs and Cats

	CA TS	DO GS
Can ned	1	1
Mix of Canned and Dry	66	41
Dry	33	57

You should expect yourself to be able to physically examine pet food, calculate food dosage, and interpret pet food labels. You should always take a diet history which should include, at a minimum, what type of food(s) they're getting, how much they're being fed, and how often they're being fed.

Dogs and cats are fed a diet that is complete and balanced. Complete = all nutrients present and bioavailable. Balanced = feed to meet the pet's energy requirement and requirements for non-energy nutrients will automatically be met. This is very different from our approach as humans where we eat a variety of foods and hope for balance in our diet over time.

Pet foods and pet food labeling are regulated by the American Association of Feed Control Officials (AAFCO). The front of the package will have a name for each product.

The name tells you what likely percentage of a product is present.

Pet Food Package Labeling

INGREDIENT NAME	PRODUCT NAME	MINIMUM % OF INGREDIENT
Beef	All beef or 100% beef	95% beef
Beef and Chicken	Beef and chicken	95% beef and chicken with chicken at least 3%
Beef	Beef dinner	25% beef
Beef and Rice	Beef and rice formula	25% beef and rice with rice at least 3%
Beef	With beef	3%
Beef	Beef flavor	No minimum requirement

A new trend is unique game meats – for example, buffalo – 100% buffalo = buffalo meat with water sufficient for processing – This is not a complete and balanced diet and the label will reflect that.

Consumers read the brand name, then the guaranteed nutrient analysis, then the description of the food, and finally, the weight. About 1/3 of consumers in one study understood how nutritional adequacy was determined in pet foods and 2/3 did not. It is valuable for us to know how to read the labels so we can educate clients.

The label information panel must contain the following things: nutritional statement (adequacy claim), basis of nutrition claim, ingredient list, guaranteed analysis, manufacturer or distributor name and address, feeding directions, and universal product code.

Nutritional Statement

Nutrition in a diet may be determined either by the formulation method or by a feeding trial. If the formulation method is used, the label will have the following statement: "Diet X" formulated to meet nutritional levels established by AAFCO. Dog/cat nutrient profile for..." followed by which life stage is represented (maintenance, gestation, lactation, growth, all life stages). No animal studies are done. Nutritional statement by the formulation method is either calculated from known composition of ingredients in the diet or is determined by laboratory analysis of the food. Neither method considers digestibility or nutrient availability. Feeding trials are a superior way to determine nutritional adequacy. If a feeding trial is used, the label will have the following statement: "Animal feeding test using AAFCO procedures to substantiate that diet X provides complete and balanced nutrition for..." AAFCO feeding trials, for example for a maintenance food, must enroll 6-8 dogs, 1-6 years of age, with the food as the sole source of nutrition. The food is provided for a minimum time of 26 weeks, with a physical examination at beginning and end, body weight weekly, and labwork at the beginning, middle

and end of the trial. All results must be normal for the food to “pass”.

Two other options exist for the nutritional statement. “This product is intended for intermittent or supplemental feeding only” is on things like therapeutic diets, which are intended to be used short-term, under a veterinarian’s supervision. No nutritional adequacy statement is needed on treats and other food products that are not intended to be fed as the sole diet.



What are the three (3) ways that nutrition in a small animal diet may be determined according to AAFCO guidelines? Which is preferred and why?

Ingredient List

Ingredient versus nutrient – Nutrient = substance that must be consumed in the diet to provide a source of energy, substrate for growth or substance to regulate growth, metabolism, and energy production. Ingredient = the means to achieve nutritional and palatability goals – an ingredient may supply one nutrient, many nutrients, or none.

The ingredient list must show each ingredient, listed in descending order by weight and listed on “as is basis” (as it comes out of the bag or can).

Common Ingredients in Pet Foods to Provide Various Nutrients

	PROTEINS	CARBOHYDRATES	FATS
Dry Diets	Meat – Meat meal – Poultry meal – Poultry by-product meal – Fish meal – Corn gluten meal – Soybean meal	Corn – Rice – Barley – Sorghum – Potato	Animal fat – Fish oil – Vegetable oil
Canned Diets	Meat – Meat by-products – Poultry – Beef – Lamb – Fish	Corn – Rice – Barley – Sorghum – Potato	Animal fat – Fish oil – Vegetable oil
These ingredients provide...	Amino acids	Energy, some protein, some vitamins	Fats, essential fatty acids

Guaranteed Analysis = Proximate Analysis

Protein and fat are expressed as minimum amounts, and fiber and moisture are listed as maximum amounts. All are reported on an “as fed basis”. Any other nutrient information is optional. Amounts will be close but not accurate.

Comparison of products requires evaluation on a dry

matter basis (DMB). This allows you to compare foods with widely varying moisture content, knowing that you are not being misled by weight of moisture. As a rule of thumb, canned foods are 75% water and dry foods are about 10% water.

$$\text{Dry matter (\%)} = 100 - \text{moisture}$$

$$\text{DMB (\%)} = \text{nutrient (\%)} \text{ divided by dry matter (\%)}$$

Example:

A food is 12% moisture and 17% protein. What is percentage protein on a dry matter basis? Dry matter = $100 - 12 = 88$. Percentage protein on a dry matter basis is $17 \text{ divided by } 88 = 19.3\%$.

Dietary Protein Recommendations % Dry Matter Basis

	DOG	CAT
Minimum for adult (growth)	18% (22%)	26% (30%)
Minimum ideal	4%	8%
Recommended range	18-28%	30-45%
Common range	25-44%	35-52%

Dietary Fat Recommendations % Dry Matter Basis

	DOG	CAT
Minimum for adult (growth)	5% (8%)	9% (9%)
Recommended range	5-20 %	9-30 %
Common range	13-2 8%	11-1 6%

Feeding Guidelines

The general recommendation is to start at the low end of the recommended amount listed on the bag and to monitor body condition to ensure the animal is not being underfed or overfed.

Manufacturer or Distributor Name and Address

This permits the consumer / veterinarian to contact the company for accurate information that may not be readily accessed from the label and to bring forward concerns about the product.

Universal Product Code

This is a unique identifier of a batch of pet food and is valuable in face of a recall or other concern.



List your five (5) take-home points – What are things you want to remember from this chapter as you progress through the curriculum and into your career?

11.

Nutrition: Herbivores

Learning Objectives

- Explain the difference between ruminants and hindgut fermenters
- Describe the production cycle of dairy cows, sheep, and dairy goats
- Describe the normal feeding behaviors of cattle, small ruminants, and horses
- Describe the anatomy and functions of the four chambers of the ruminant stomach
- Explain the production of volatile fatty acids (VFAs) in the rumen and the fate of the various types of VFAs produced
- Describe body condition scoring in cattle, small ruminants, and horses and how body condition score is expected to change with physiologic state
- Explain changes in amount or ration fed in dairy cows and in small ruminants through their production cycle
- Define a total mixed ration and list