INTRODUCTION
As the popularity of reptiles has grown, so has the demand for quality veterinary care. Today, reptile medicine represents a viable subset of companion animal practice. Reptiles are stoic and have evolved to mask signs of illness, which makes them a challenge to diagnose and treat. For veterinarians and technicians who are willing to become proficient, however, reptile practice offers many rewards.

SNAKE PROCEDURES
Capture and Restraint
Snakes are easy to hold because there is only one dangerous part to restrain. When approaching a snake that you do not know, the head may first be covered with a towel. This has the dual effect of blocking his view of the handler and providing him a sense of security. Restrain by grasping behind the head with one hand and supporting the body with the other.

Snakes do not have complete tracheal rings, so use caution that asphyxiation does not occur. Some colubrid snakes will emit a musky paste from the scent glands as a defense mechanism. Snakes that are used to being handled are much less likely to bite. Bites from non-venomous species, if they occur, are generally harmless. Use the buddy system when dealing with giant or venomous species.

Basic Exam Skills
Weigh the patient (in grams) at every opportunity. A decline in weight may be the only clue that there is a problem developing. Assess body score by examining the dorsolateral musculature. Check for mites or ticks in the gular groove between the mandibles and under the edges of scales. Examine the heat pits and eyes for mites. Look for retained skin especially on the head and spectacles. During the oral exam, look for petechiation and abscessation. Check the tongue and glottis for swelling, symmetry, and inflammation. Observe snakes for righting reflex and positional nystagmus when the head is moved side to side. Palpate the abdomen for masses and ova.

Sexing via Hemipenal Probe
Use a lubricated blunt probe (e.g. ball-tipped feeding needle, urinary catheter). Pass the probe cranially under the lateral edge of the vent flap, then flip the probe to aim it caudally. Direct the probe into a longitudinal canal that runs paramedian along the tail. If the probe passes 3 caudal scales (into the scent gland) it is female, if it passes 7-10 caudal scales (into the hemipenal canal) it is a male.

Venipuncture
**Ventral tail vein**: caudal to the cloaca with the snake in dorsal recumbency. A 5/8-1”, 21-25ga needle is angled at 45° craniodorsally, between caudal scales. Apply slight negative pressure once you are under the skin. If the needle hits a vertebral body, withdraw slightly and redirect. (Best for large snakes)

**Cardiocentesis**: restrain the snake in dorsal recumbency, watch for heartbeat, and locate the heart ¼ to ⅆ of the way down the body. Steady the heart with fingers and advance a 5/8-1.5”, 21-25ga needle at a 45° angle craniodorsally, under a scute, into the apex/ventricle. Blood usually enters the syringe with each beat. (Best for small snakes)
**Palatine vein**: paired veins run along the roof of the mouth. Ideal for IV injections while under sedation. Use a 25 ga., 5/8” needle on a 1 cc syringe. Pre-bend the needle slightly for easier approach. Place pressure on the vein after withdrawing to avoid hematoma. (May require sedation)

**Tracheal Wash**

Tracheal wash is the preferred method for sampling of respiratory pathogens. With the snake’s head elevated, a sterile urinary catheter is placed through the glottis while the patient takes a breath. Then, 3-10 ml/kg of sterile saline is injected. The snake is quickly tilted downward, and the fluid is aspirated back into the syringe. Because of the simple anatomy of the reptile lung, samples collected in this manner may actually be lung washes. Wet mount cytology of tracheal wash samples may reveal lung worm (e.g. *Rhabdias*, pentastomid) larvae or ova. Anaerobic and aerobic culture and sensitivity are also performed.

**Fluid Therapy**

Maintenance fluid rate for most reptiles is 15-25 ml/kg/day, and up to 5% of body weight may be given in a single dose if indicated. Subcutaneous or intracoelomic fluid administration is utilized in the majority of cases. In snakes, SQ fluids can be given along the lateral folds. ICo fluids are given ventrolaterally a short distance cranial to the vent, using care not to enter the caudal extent of the lungs.

IV catheters can be placed in most reptiles however a cut-down approach is usually necessary. The preferred site for snakes is the right jugular vein. A cut-down incision is made from 4-7 scutes cranial to the heart, at the junction of the ventral scutes and lateral body scales. After the vein is isolated, a catheter is placed in the usual manner and secured using tape, suture, and/or tissue adhesive.

Reptiles are slightly hypotonic when compared to birds and mammals. To prepare “Reptile Ringers Solution”, mix 2 parts Dextrose 2.5%/Saline 0.45% with 1 part lactated Ringer’s solution (or 1 part Dextrose 5%, 1 part Saline 0.9%, and 1 part Ringer’s).

**Tube-Feeding**

Snakes frequently present for lack of appetite. In some species (e.g. ball pythons) this can be considered a normal, seasonal occurrence. In others it may be attributed to stress or disease. Often, no abnormality can be found on physical examination or fecal testing. Force-feeding provides nutritional support for these patients while the clinician seeks to diagnose the problem and correct husbandry. In the majority of cases, force-feeding will stimulate a snake’s appetite. Medications (e.g. metronidazole, fenbendazole) are frequently added to the mixture to “shotgun” the problem before resorting to further diagnostic tests.

Oxbow Carnivore Care is used for this purpose. Mix to the desired consistency. Give 2.5-5% of body weight using a catheter-tipped syringe and lubricated 14-fr. red rubber catheter. A snake’s mouth can be opened with a rubber spatula or similar speculum. Its glottis will be located far cranially in the mouth and is easy to avoid. Gently massage the food caudally as it is given. After feeding, hold the snake’s head elevated for several minutes. Once he is moving forwards in a serpentine fashion it is ok to release him.

**CHELONIAN PROCEDURES**

**Capture and Restraint**

Turtles are generally easy to handle safely. Shy turtles may be encouraged to come out by pressing the rear limbs up into the inguinal fossae. Grasp the turtle’s head behind the jaws to keep it from retreating
into the shell. This may be easiest to do from below: turtles are more wary of threats from above them. A box turtle can be preventing from closing its shell by keeping a forelimb pulled out. Another trick is to place a turtle on a pedestal, such as a jar or pill bottle, so that his plastron is above the table surface and feet cannot touch. This will often encourage the turtle to extend its neck, head, and limbs. A dental pick or similar instrument can be hooked under the beak in order to apply traction when pulling the head out of the shell. Tranquilization is often required to examine and perform diagnostics in larger species.

**Basic Exam Skills**

Weigh the patient in grams. An underweight turtle will “feel” lighter than it should. Evaluate scutes and skin for lesions. Examine each tympanum for ectoparasites or abscessation. Look for nasal discharge or ocular swelling. If an oral exam is possible, look for stomatitis.

**Sexing**

Many chelonians exhibit secondary sex characteristics. Male box turtles have red irises; a female’s irises are brown. The plastron of most male land turtles is slightly concave, while the plastron of females is flat. In most chelonian species, the male’s vent is located near end of the tail, beyond the edge of the carapace. For females, the cloacal opening is near the tail base, even with the edge of the carapace. Male aquatic turtles have longer nails on the front feet and are smaller than females.

**Venipuncture**

* **Dorsal tail vein:** a 5/8”, 23-25ga needle is placed as cranial as possible on the dorsal midline of the tail, angled at 45-90°, and advanced while maintaining slight negative pressure. If the needle hits a vertebral body, withdraw slightly and redirect cranially or caudally. Lymphatic contamination is possible.

* **Jugular vein:** position a 5/8”, 22-25ga needle laterally, caudal to the tympanum, and direct it caudally, midway down the neck. Best site for blood uncontaminated with lymph. Hold off site to avoid hematoma. The right jugular is larger than the left.

* **Subcarapacial vein:** push the turtle’s head inside the shell, and place a 5/8-1.5”, 22-25ga needle on the midline, dorsal to the neck, through the skin just caudal to the cranial rim of the carapace. Direct the needle in a dorsal direction, aiming toward the junction of the cervical and thoracic vertebrae. Blood from this sinus is frequently mixed with lymph. Apply pressure to avoid a hematoma.

* **Brachial vein:** using a 5/8-1”, 25-22ga needle, aim superficially in the sulcus behind the elbow joint (yes, it points backwards!) on the front limb. A similar approach is used behind the stifle joint to access the popliteal vein on the hind limb. Both approaches are blind sticks, and samples are frequently mixed with lymph. (Easiest on large turtles)

**Fluid Therapy**

Subcutaneous fluids can be administered into any accessible fold of skin (e.g. ventral neck fold, inguinal fold). Intracoelomic fluids can be given into the inguinal fossa, cranial to the rear leg. Use sterile technique and be careful not to inject the air sacs at the cranial extent of the fossa, or to hit blood vessels along the ventral extent of the fossa. The preferred site for placing an IV catheter in chelonians is the right jugular vein. An intraosseous catheter can be placed into the plastrocarapacial bridge. Radiographs will confirm proper placement.

**Nutritional Support**
Chelonians occasionally take food from a syringe but are usually uncooperative. The glottis is found at the base of the tongue. To avoid aspiration, keep hand feeding formulas thick. Tube-feeding can also be used, but it can be very difficult to get the turtle’s head out and to open the beak. Anorexia in turtles usually requires days to weeks therapy to resolve. To avoid the stress and frustration associated with repeated treatments, pharyngostomy tubes are typically employed.

**Pharyngostomy tube placement:** Pre-measure tube length and mark the tube. Anesthetize the turtle and place him in sternal recumbency. Place a curved hemostat into the pharyngeal cavity and press the tip firmly outward against the right side of the neck. Make the exit site close to the edge of the carapace so that tube movement is minimal as the head moves in and out of the shell. Make a small incision over the hemostat tips. Push the hemostat tips through the incision and grasp the tip of the feeding tube. Pull the tube out the mouth, up to the premeasured mark. Lubricate the tube, redirect the tip of the tube in the hemostats, and feed it down the esophagus into the stomach. Secure the tube using a purse-string suture and a Chinese finger trap knot or tape butterfly/sutures (4-0 PDS). Cap the tube end and secure the tube over the carapace with tape.

Chelonians are usually fed every 24-48 hrs. The volume to be fed may vary between 2.5-5% of body weight daily, depending upon the species, diet selection, and the patient’s condition. Oxbow Critical Care or Carnivore Care, liquid enteral formulas (e.g. Ensure, Boost), psittacine hand feeding formulas, and fruit, vegetable, or meat baby foods can be used.

**LIZARD PROCEDURES**

**Capture and Restraint**
Crocodilians can be safely handled once the mouth is taped shut. A speculum is usually taped in place if procedures such as tube-feeding or endoscopy are planned. The eyes may be covered to reduce stress. Iguanas and many other species can be restrained by applying firm digital pressure over the eye sockets (vaso-vagal response). Lizards become calm within seconds, and the heart rate and respiration become slower. Trim the nails prior to examination to avoid injuring staff. Large species may be handled using a towel. Grasp most species behind the head and at the tail base. Be careful not to induce tail shedding in lizards.

**Basic Exam Skills**
Always weigh the patient. To auscult the thorax, use a wet gauze pad over the diaphragm of your stethoscope. This trick absorbs much of the scratching associated with reptile scales. Place the bell directly between the forelimbs to listen to the heart. Use a warm water bath to stimulate defecation and obtain a fecal. Palpate the hemipenal bulges and examine the vent for retained hemipenal plugs. Note muscle tremors or tetany. Assess body score by examining the tail base. Look for retained skin especially on the head and digits.

**Sexing**
Mature male green iguanas have larger femoral pores than females do. They can be probe-sexed in a manner like snakes. Male bearded dragons and leopard geckoes also have larger femoral pores than females do. These two species can also be sexed by “popping” the hemipenises: carefully exerting thumb pressure in a cranial direction along a hemipenal bulge. Crocodilians are sexed by examining the vent: the penis/clitoris is located on the ventroposterior surface of the cloaca near the vent.

**Venipuncture**
**Ventral tail vein:** with the lizard held in dorsal recumbency, place a 5/8-1.5”, 21-25ga needle on the ventral midline, approx. ¼-⅓ of the way down the tail. Advance the needle at a 45°-90° angle craniodorsally, while maintaining slightly negative pressure. If the needle hits a vertebral body, withdraw slightly and redirect cranially or caudally. A lateral approach to this vessel can also be used and has the advantage of keeping the patient in sternal recumbency.

**Ventral abdominal vein:** lies 1-2 mm within the coelomic cavity on ventral midline between the umbilical scar and the pelvic inlet. This vein can be visualized by transilluminating smaller species (leopard geckoes, fat-tailed geckoes, etc.). Obviously, there is a risk of iatrogenic injury to viscera when doing a blind stick.

**Supravertebral vessel:** located caudal to the occiput, dorsal to the spinal cord. Prep the area as for surgery. Use a 5/8-1.5”, 21-25ga needle. The approach is perpendicular, on the midline, caudal to the occiput. Apply suction and advance the needle until it enters the sinus and blood appears in the syringe.

**Fluid Therapy**
Subcutaneous fluids can be given into the lateral folds and over the shoulders. An IV catheter can be placed into the cephalic vein using a cut-down approach. This vein is located on the dorsomedial surface of the antebrachium. IO catheters can be placed into the femur, humerus, and proximal tibia.

**Cloacal Wash**
A warm water soak will stimulate defecation in many lizards and land turtles. With care, fecal samples can be manually expressed from snakes. Alternatively, cloacal and colon washes can be performed in most reptiles. A large gauge catheter is inserted into the vent (and further, into the colon, if desired), 10 ml/kg sterile saline is injected, the abdomen is gently massaged, and then the fluid is withdrawn. This procedure will stimulate voiding in many cases. Sample is used for a wet mount, floatation, and culture if indicated.

**Nutritional Support**
Lizards are usually syringe fed. Some lizards will readily open their mouths if the commissures are stroked. If this does not work, then pressure can be applied over the orbits (vaso-vagal maneuver) while simultaneously pulling downward on the intermandibular skin. Beyond the glottis (located at the base of the tongue) is the large pharyngeal cavity. Lizards can also be tube fed. Feeding regimens are typically q12-24 hrs.

Herbivorous reptile species (tortoises, iguanas, Uromastyx, etc.) need a formula high in fiber, quality protein, and carbohydrates, but low in fat. A timothy hay-based high fiber gruel (Critical Care, Oxbow Animal Health, 800-249-0366), fruit or vegetable baby foods, and liquid enteral formulas (e.g. Ensure, Ensure Plus, Sustecal) should be used for nutritional support. For carnivorous reptiles, a gruel made from high quality kitten food and liquid enteral formula (“Duck Soup”) is used. Hill’s A/D can be used for this purpose, but it is formulated from liver and may promote gout in cases with dehydration or renal disease. Oxbow Carnivore Care is an egg and chicken-meal based powdered formula for syringe feeding. Omnivorous reptiles (e.g. box turtles, bearded dragons) are fed a combination of the ingredients listed above. The volume to be fed may vary between 2.5-5% of body weight daily, depending upon the species, diet selection, and the patient’s condition.

**Injections**
Because of the renal portal system, most injections are given in the front half of the body. Be aware that many commonly used injectable medications can cause tissue necrosis IM or SC. Intravenous injections are technically more demanding in reptiles. The same sites used for venipuncture can be used. Intracardiac is usually reserved for situations where there is no other option. Reptiles do not have much excess skin when compared to mammals. Give SC injections along the lateral fold in snakes and lizards, the shoulders in lizards, and by shallow needle-insertion into the loose skin surrounding the limbs in chelonians. IM injections are made into the epaxial musculature of snakes, the limbs, shoulders, and epaxial muscles of lizards, and the limbs and pectoral muscles of chelonians. Pectoral muscles are accessed by inserting the needle parallel to the plastron under the leg. In all species, avoid drugs that require large injection volumes IM. ICo injections are given in the middle of the caudal quarter of the snake’s body. For lizards, ICo injections are given into the right caudal quadrant, cranial to the rear limb. Aspiration will help assure that you are not in the bladder. For chelonians ICo injections are given in the flank, near the junction of the skin with the shell, just cranial to the rear leg. Again, aspirate prior to injection in order to make sure you are not in the bladder.