

# Rehabilitation of Eastern Gray Squirrels and Southern Flying Squirrels

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Revision 8-18-2020

**Basic care and feeding:** Infant gray squirrels can be raised successfully on a number of products. At the WRC, I primarily use two formulas, one for infants with their eyes not yet opened and the other for squirrels who have opened their eyes and are about four weeks of age-see my formula info in the glossary section. I prefer to weigh every incoming squirrel on a gram scale. The weights are recorded on the patient's intake sheet, and ideally, updated daily. I refer to the "Feeding Chart for Infant Tree Squirrels" in order to provide the correct amount of formula at each feeding per weight of the animal. There is a copy of the chart included in this manual. **There are several good sources on the internet which cover rehabilitation and care of gray squirrels: The squirrelforum.com is an excellent site with good information.**

Before squirrels are fed for the first time, they must be **warm**. Incoming patients should have their inner core body temperatures brought to normal levels which can take two hours or longer. At the WRC, I use incubators or heating pads. An incubator can be set to 90-95 degrees F. for squirrels without fur or those just beginning to grow fur and 85-90 degrees F. for fully furred babies. Setting correct temperatures of heating pads can be tricky, but with practice, you will learn. You will need to make sure that any heating pad you use stays on. Many pads sold today will automatically shut off in 2 hours. These cannot be used to maintain constant appropriate temperatures 24 hours per day. Be sure to research prior to purchasing. Recently, I have ordered several on Amazon which do not automatically shut off.

I first place infant receiving blankets in a microwave for about 20 seconds to get them warm to the touch but not hot. I place two folded receiving blankets into a plastic container (brand names, "Critter Totes", "Playmates") with a tight fitting lid that provides ventilation. Glass aquariums can also be used if they have a secure lid, but they are heavy to lift and rather large for baby squirrels. Small digital thermometers with probes can be purchased and are invaluable for determining proper temperature. The probe is placed inside the container beside the baby while the digital readout is outside the container and easily monitored, but any small, accurate thermometer will do. I also usually place several layers of folded towels on top of the heating pad and under the plastic container which holds the baby squirrel(s). Some heating pads can become very hot quickly; so it is best to begin with the lowest setting. Some pads do not get warm enough on "Low" and will have to be turned to the next heat setting, usually "Medium". After the heating pad is turned on, it is best to check the temperature every 15 minutes or so to avoid overheating an animal.

Dehydrated animals should never be fed formula because they will not be able to digest it. The pinch test can be used to check for possible dehydration. Gently pinch the skin on the side of the squirrel. If it remains "tented up" for more than a few seconds, the squirrel may be dehydrated. The longer the skin remains tented, the worse the dehydration. Sometimes, the squirrel's skin will look wrinkled along the stomach, abdomen, and sides in severe cases. The animal may look thin, and the spine may protrude sharply along the back. Sometimes the pre-admission history can help you to determine the

condition of the patient. If a mother squirrel was observed dead along the road four days ago, and now the baby squirrels were seen crawling from the nest and crying, they have probably been without food for 4 days. In cases of serious dehydration, **rehydrating subcutaneously** with fluids, i.e. Lactated Ringers, should be accomplished. (Refer to the section “Administering Fluids Subcutaneously”). 5% of the animal’s body weight is the amount to sub-q four times in 24 hours. Usually, you will only need to sub-q once or twice in order to regain normal hydration levels. You need to offer clear fluids orally, and Pedialyte can be used successfully. See the feeding chart for amounts to offer per the weight of the infant. In severe cases, I have even offered small amounts of clear fluids every hour for the first 12 hours. Fluids must be warmed to about 100 degrees F. to be palatable to the youngster. You must administer fluids very carefully so that the infant does not aspirate any into its lungs.

**Feeding implements:** I use o-ring syringes with Miracle or Catac nipples. A very small hole must be cut at the end of the Catac nipple. Miracle nipples already have holes in them. I always keep a human infant aspirator bulb handy while feeding. If the infant squirrel begins to blow fluid out of its nose, the bulb can help you to draw the fluids out and avoid aspiration into the lungs. Older squirrels seem to do a better job at sneezing the fluids or formula out. Ideally, you will feed without this occurring, but occasionally it can happen even to very experienced rehabilitators. For feeding neonates (7-15 grams), I use a .5 ml syringe and push the Catac nipple onto the syringe so that only half of it extends beyond the syringe tip. When I feed more than 2 babies, one at a time, of course, I keep the formula in a glass jar on an electric cup warmer. Since cup warmers become quite hot, I place a washcloth folded over twice on the warmer, then the jar of formula and check the temperature of the formula before each feeding.

**Caging:** After the squirrel’s eyes have opened and when they weigh more than 100 grams, they usually can be housed in a wire cage. I say usually because I have observed squirrels open their eyes at 50 grams in weight and some not until 130 grams in weight! You must use common sense- if a baby is 120 grams but doesn’t have its eyes opened, it should not be placed in a cage where it cannot find its way back into its nest; and a tiny 50 gram baby even with eyes open should remain on a heating pad. The wire cages that I use are easily constructed out of ½”x ½” wire with plywood tops and bottoms. If you use larger size wire, there is a terrible risk for the young squirrels in your care. Wire of 1” x ½” or 1” x 1” or 2” can and has caused broken legs in squirrels. I know of two cases of squirrels which each had a rear leg amputated after being caught, twisted, and fractured in the larger size wire. In both cases, the squirrels were being kept as pets because they could not be released, and one of these cost the owner \$400 for the ensuing surgery!

I hang a sturdy hammock in the cage as a nest and have used “Ferret Play Cubes” as well, but another word of caution - be sure to use material which cannot unravel into strings. Again, I know of a case where the squirrel chewed the hammock and got the stringy material wrapped tightly around its body and died. This was another pet squirrel, and the mortified owner called me for help just before the squirrel died in her hands. Let us learn from others’ mistakes! I place newspapers in the bottom of the cage, a sturdy ceramic food bowl (squirrels chew plastic ones), a glass water bottle attached to the outside of the cage with sipper tube inside the cage, sterilized beef bone for gnawing, and a few fresh branches daily (maple tree branches are yummy). The forage must be free of pesticides.

**Stimulation for urination and defecation:** Until the eyes open and for a while after that to keep bedding from being soiled, you will need to wipe the baby squirrels so that they can properly eliminate urine and feces. Gently wipe the genitals with a soft facial or bathroom tissue. Sometimes a dampened tissue works better. If you are having trouble with this procedure, try almost lightly tickling

the penis or vulva. This often works better than an actual wiping procedure. Do this prior to or after feeding each time.

**Solid foods:** You can begin to offer solid food after the eyes open, but the baby will still be fed formula 4X per day until weighing about 180 grams when I give 3 feedings per day. The solids can consist of the following: rodent blocks, food blocks sold by Henry's Healthy Pets, shelled pecans, walnuts, hazelnuts, roasted peanuts (unsalted), sunflower seeds, fresh fruits and vegetables: apples, Romaine lettuce, sweet potatoes, tomatoes, broccoli, carrots, mushrooms, corn, string beans, pomegranates, beets and their green tops, peaches, etc. Of course, the best foods, if available, are acorns, hickory nuts, and again, squirrels love those tree branches. You can also gather mushrooms from your yard-it's perfectly fine as long as they are free of any contaminants and sprays. By the way, squirrels can and do consume mushrooms which are lethal to man. The wild-growing poisonous mushrooms have no ill effects on squirrels or turtles for that matter, and they eat them with great relish.

Many nuts, fruits and veggies are too low in calcium content for a growing mammal unless supplemented with calcium carbonate. This is very important if you wish to raise a healthy squirrel to adulthood. I sprinkle  $\frac{1}{4}$  teaspoon of pure calcium carbonate per cup on all nuts, seeds, fruits, and veggies. Any spice or large salt shaker container once emptied, can be washed and sanitized thoroughly. After drying, you can spoon in your powdered calcium, snap or screw on the cap, and you can easily sprinkle calcium on the squirrel's foods.

When the squirrels are at 180 grams or so, their molars erupt from their hind gum area; and often, they will refuse to nurse for a day or two. This does not mean that they are now weaned, as they will benefit from receiving the formula until they weigh about 220 grams in weight. Once the squirrels in my care weigh over 220 grams, I wean them from formula. They are then housed in large, outdoor cages where they obtain natural sunlight which is necessary for proper calcium absorption.

**Outdoor Caging:** Once the squirrels are over 220 grams in weight and weaned, I move them to an outdoor cage/habitat. The cages are usually 8'X10'X8' or 6'X6'X6', constructed of  $\frac{1}{2}$ " X  $\frac{1}{2}$ " wire, with wire also covering the floor and secured to the sides preventing any possible intrusion by predators. The wire floors are filled in with at least 6" of clean fill dirt or builder's sand. The cages have a double door system for added safety and a metal or plywood, shingled roof. Tall tree branches can be placed inside the cage for climbing and chewing. The branches should be safely secured so that they do not fall over injuring the squirrels. I use bungee straps/tie downs for this which can be hooked through the wire cage sides and around the branch to hold it firmly in place. Chains can also be used to secure the branches from falling over. Heavy ceramic feed and water bowls can be placed in the cage. A word of caution: don't place these heavy crock bowls very high off the ground on ledges or feeding platforms because a leaping squirrel can knock the heavy bowls on to the ground causing injury to itself or others. I heard of one case in which a large crock dish on a ledge 4' off the ground was knocked over. A squirrel was found curled up under the crock dish. The squirrel recovered from a concussion and was later able to be released but just as easily could have died in this mishap.

I hang wooden squirrel bed boxes in the outdoor cages for the squirrels to sleep in. I used to use cloth towels placed inside for bedding, but now use soft fleece ever since I heard about someone losing their pet squirrel due to towel entanglement. My bed boxes have an entrance hole at the front and an escape hole in the back. If you will need to reach in the box to check your squirrels, you may wish to use screws or a hinge on the lid. A rectangular opening large enough to admit your hand can also be used as an opening. The boxes hang from two chains so that the box will not fall if one chain breaks or comes loose from the box. Upon release, you can tape a piece of wood over the openings with the

squirrels inside the box and hang the box, squirrels and all in a nice tree. You then remove the taped wood, and the lucky squirrels have a ready-made home. My husband, Ron, has climbed many a tree with his 30' extension ladder to hang squirrel boxes. One study that I read long ago stated that squirrels provided with wooden bed boxes in the wild averaged doubling their life spans compared to squirrels which did not have bed boxes. For instructions on building squirrel bed boxes, please refer to "Gray Squirrel Bed Boxes" and "Squirrel Nesting Box" pages at the end of this manual.

Diet in the outdoor cage should always include fresh acorns when in season, nuts, and vegetation from the area besides the regular squirrel fare of rodent chow or blocks, the squirrel blocks sold by Henry's Healthy Pets on line, nuts, seeds, fruits, and veggies. Don't forget to continue to use the calcium carbonate on all nuts, seeds, fruits, and vegetables offered.

I release squirrels after they have spent about a month or two in the outdoor cage, usually at 5 months of age depending on the individual squirrel's adaptation. A small opening can be made in the wire for the squirrels to come and go from the cage if a soft release is possible on the premises, or the squirrels can be loaded up and released at property where permission has been granted. Before hand, check out the location for suitable habitat, oak trees, a water source, no dogs, cats, cars, or hunters which could shorten the squirrel's life. Either way, if it is possible to safely hang the squirrel bed boxes 20-30 feet off the ground, it provides a safe home for the released squirrels. I do not recommend nailing boxes to trees, which could damage the trees. We hang them with two chains connected to the sides of the boxes with hooks, which can be placed over sturdy branches without harming the trees.

## **Injuries**

### **Wounds, cuts, maggots and fractures:**

Injuries which are oozing blood, pus, or have maggot involvement, should be carefully flushed with an appropriate solution, such as 1 % Chlorhexidine or Betadine mixed with saline "to look like the color of weak tea". Saline solutions used should be .9%, which will decrease the chance of drawing bodily fluids out of the surrounding tissues. Now for a word about maggots: although I have been called the "Maggot Queen" at times, I really hate dealing with them. If you can remove all of them by flushing, good and well; however, if there is a chance that some are in deep, or unseen, or in an area that cannot be flushed, Ivermectin kills them. Refer to the **Glossary** section of this manual under meds and wormers for instructions on diluting Ivermectin to be used for squirrels. This dilute can easily be given orally to kill any internal maggots. A drop can be administered to a puncture containing maggots, and it will kill them in the wound. By the following day, the wound should be thoroughly flushed to remove the dead larvae. I have orally treated several animals which had maggots deep in the rectum that I could not remove by flushing including several white tailed deer fawns and raccoon kits. By the next day, the dead maggots were expelled with the normal bowel movements.

Injured squirrels will often develop abscesses, which can grow quite large if the caregiver does not realize what that lump is! Abscesses usually need to be punctured with a large sized (18-20 gauge) needle or lanced with a scalpel blade, then drained and flushed with a Betadine or Chlorhexadine solution. This process must be done once or twice per day depending on how quickly the abscess recedes. Treatment with an oral antibiotic is recommended. I have used Clavamox, Baytril (Enrofloxacin), and Bactrim with good results. You may want to consult with your veterinarian to treat this problem.

Squirrels may also be admitted with fractures of the legs, spine, skull, or hips. Successful treatment will depend on the type of fracture and resulting involvement. Your veterinarian will probably have to be consulted in many of these cases; however, with experience, you will learn which fractures are in need of treatment and which heal on their own without veterinary care. Simple fractures of the legs and hips often will heal on their own if the bones are well aligned while compound fractures will need to be set or pinned while the squirrel is under anesthesia. Sometimes, there is no blood supply to the leg past the fracture point; and therefore, the leg cannot be saved. By feeling the temperature of the normal leg, you can compare it to the injured extremity to see if it is warm or cold. In some cases, the leg will have to be amputated or the animal may have to be euthanized. We were able to release a squirrel years ago which was born with only one hind leg. After her release, she survived very well and raised several batches of babies through the years. I have had one squirrel with a front leg amputation, and she was placed in a permanent shelter with other non-releasable squirrels.

Spinal injuries are usually a wait and see type of injury. I always give the patient some time to recover as there have been several cases which at first exam appeared to be paralyzed yet later regained full mobility. Sometimes by the third day, it is obvious that the animal is paralyzed; and there is no hope for recovery. When in doubt, my motto is to wait and see. One indication of paralysis is when the legs of the animal do not respond when the toes are pinched. A paralyzed squirrel will not usually have adequate quality of life, but each individual should be assessed.

Sometimes blindness can occur in cases of severe head trauma. I have found totally blind animals to be poor candidates as pets/educational animals. They tend to be startled easily by noises and often will bite aggressively when frightened. These cases must be assessed individually. I have had great success in the release of several one-eyed squirrels which have survived with normal life spans.

Some injured, adult animals admitted for care are in shock and may need to be placed on a heating pad even though they are fully furred and of adult weight. The heating pad should be placed under the container housing the squirrel as placement inside may result in the electrical cord being chewed. You can usually feel with your hands to determine if a squirrel is cooler to the touch than the normal warm body temperature. You can take the temperature rectally or by ear if you have those types of thermometers. If an adult squirrel cannot eat on its own when admitted, I feed them formula with a syringe and nipple as I would an infant. Some adults will chew through the nipples and must be fed with a syringe only. Head and spinal injuries can be treated with meloxicam which is available in oral and injectable forms and obtained through your veterinarian.

### **Internal Parasites:**

Squirrels can be admitted or develop symptoms while in care from various internal parasites. If a squirrel is observed with loose, bloody, light colored, or foul smelling feces, or has lack of appetite, you will want to have a fecal sample checked by your veterinarian, who can then advise you as to the treatment necessary. Squirrels can have coccidiosis, spirochetes, intestinal roundworms, hookworms, and even tapeworms, salmonella, e-coli, and/or giardia. We treat coccidiosis with Albon, giardia and spirochetes with Flagyl (metronidazole), worms with Ivermectin dilute or Strongid (pyrantel pamoate). See the glossary for information. Do not mix squirrels being treated for suspected parasites or diseases with other healthy squirrels until treatment is finished and all symptoms have been resolved. Although yeast infection is not a parasite, it, too, can cause internal problems and abnormal stool. A veterinarian can detect it by fecal exam, and it is easily cured with the drug, nystatin.

## **External Parasites:**

A dreaded parasite is the bot, also called warble or cuterebra. There are several web sites available on cuterebra with helpful information and photos. The “bot” fly lays its eggs on vegetation, and the unsuspecting squirrel breathes the eggs into its nostrils. In the squirrel’s lungs, the eggs hatch into larvae. The larvae eventually make their way to various areas in order to grow under the squirrel’s skin. While growing, a lump can be seen which soon develops a breathing hole; and the lump will grow very large and oval in shape if left alone. In the later stages, you can usually see the face of the larva inside the hole. These nasty larvae can be squeezed out or pulled out with a forceps when they are larger. In the early stage, they have to be removed by an incision or killed with ivermectin dilute. Some literature has stated not to treat bot larvae with ivermectin as blood infections could result from the dead larvae remaining in the squirrel’s body. I have successfully treated with ivermectin dilute in the early stage of the bot prior to a breathing hole being formed and have encountered no problems with blood poisoning or any other ailments. If a breathing hole is present, I pull the parasites out using a forceps.

Fleas, lice, and mites can be treated with Adams Spray for dogs, cats, kittens, and puppies. I usually do not spray from the bottle directly onto the squirrel to avoid eye contact with the spray. I spray a very small amount onto a wash cloth or cotton ball and then lightly wipe the squirrel’s fur with it. The bedding must be changed by the next day to remove dead fleas and eggs.

Sarcoptic mange will usually first be observed as crusty, scaly, flaky areas on the edges of the ears, around the muzzle, eyes, and tail. The squirrel will usually scratch itself often, sometimes causing breaks in the skin. Red spots or patches can also be observed, usually on the abdomen and stomach areas. In more advanced cases, loss of hair will occur, sometimes to the point of almost total hair loss. The skin will appear to be thickened, dry, and rough. Patches of skin will peel off with the fur. To effectively treat mange and skin mites, I use ivermectin dilute given orally. See the Glossary for full information. Change bedding frequently and clean the container or cage after each treatment to remove any eggs. With the squirrel placed elsewhere, you can spray the cage with Adams, let stand for 20 minutes, and then wash the bedding and cage thoroughly with soap and water. Isolate squirrels from those which do not have the parasites to avoid contagion. Also, use caution when handling animals with suspected mange as the mites can infect humans, causing severe itching. The mites do not reproduce in humans, however, to continue spreading.

## **Illnesses/Diseases:**

**Upper respiratory infection:** The symptoms of this disease are similar to those of the common cold in humans, primarily mucus coming from the nose and often drying on the nostrils, sneezing, labored breathing, and mouth breathing. This disease is commonly encountered in young squirrels, especially those which have suffered from exposure to damp or cold weather and is easily passed from one squirrel to the next by housing them together, sharing feeding implements, using one feeding dish of milk to draw up formula for all in care, or by placing a squirrel in a container previously used by a sick squirrel without thorough disinfecting. Of course, proper hand washing between handling or feeding separate individuals or groups is imperative.

Treatment: You can give children’s decongestant (types and dosages-see the Glossary), and use a baby nose aspirator bulb to regularly clear mucous from nostrils. Keep the squirrel warm, fed regularly, medicated, and the disease will run its course. Feeding can be very tricky when a squirrel has breathing trouble. Sometimes oral tube feeding is necessary (this is covered in a future section).

You can smear a thin amount of Vicks Vapor rub on the inside bottom of the squirrel's container. Next, place all of the bedding into the container on top of the Vicks and then the squirrel is placed on the bedding. The warmth from the heating pad will help to fill the container with the Vicks' vapors. I usually administer the antibiotics Baytril (Enrofloxacin) and Clavamox for upper respiratory disease.

**Aspiration Pneumonia:** This is caused by fluid in the lungs, often caused by aspiration from improper feeding. Untrained people will sometimes cause this by using improper feeding implements and poor techniques. Aspiration pneumonia may also occur in squirrels exposed to rain, water, and wet conditions.

The symptoms are labored, raspy breathing and clear, nasal discharge may be present. The gurgle of liquid in the lungs may be detected with a stethoscope or by holding the squirrel's chest to your ear.

Treatment: Many squirrels aspirated by the public or exposed to rain will die; however, there is some chance for recovery, depending on the individual squirrel's strength and response to treatment. Antibiotics of choice are Baytril and Clavamox. Bactrim (also called Sulfatrim or Septra) can also be used. Your veterinarian can recommend a good antibiotic for your squirrel.

For prevention of antibiotic-induced diarrhea, be sure to give benebac, lactobacillus, or probios. Animals placed on antibiotics may develop diarrhea because the antibiotics kill some of the beneficial bacteria in the animal's intestines. Placing some of these good bacteria in the animal's formula or food will help to replace these necessary bacteria and prevent diarrhea. Do this at a time when you are not giving the antibiotics.

**Fibromatosis:** This is an often lethal viral infection which causes lumps and bumps on the animal's body. There are some web sites on line which provide photos of the disease to help identify it.

Symptoms: Thickened lumps, which are hard rather than pliable to the touch as abscesses are. There may be a few or the animal may literally become covered with them.

Treatment: There is no treatment, and the virus is contagious, usually by insect vectors. We have seen a 50-75% mortality rate in squirrels presented with this disease. If you decide to give supportive care, you must isolate the contagious squirrel from all others as a precaution.

**Klebsiella Pneumonia:** This pneumonia strikes animals whose resistance has been weakened and, in some cases, in animals which have just finished antibiotic treatment. The pneumonia bacterium causes breathing difficulties, scarring of lung tissues, and is highly fatal.

Symptoms: Rapid breathing and heart rate will be observed. Squirrels will often prop themselves with heads and upper body out of their hammocks or bedding as they appear to have breathing difficulties. They may refuse offered formula and food. No nasal discharge or congestion is usually noted, but "dry" sneezing is frequent. It is easy to miss the symptoms, and the squirrels can die within 24-72 hours.

Treatment: Recently, I have administered enrofloxacin (Baytril) orally or by injection, and it has proven to be an effective treatment. Another antibiotic that I have used successfully for this disease is amikacin sulfate injectable. Adequate hydration must be maintained for all patients on this drug in

order to avoid kidney damage or failure. It must be given by injection rather than orally, which can be a draw back for some care givers.

**Toxoplasmosis:** Squirrels can become infected with this deadly disease from exposure to felines; cats or bobcats. Fecal matter of felines often contains the microscopic eggs of the toxoplasmosis parasite. These eggs are viable for extended periods of time (months) in the environment, and normal methods of disinfecting do not kill the eggs. If a bobcat (or house cat) has been housed in a cage built with any wood framing the base or sides, the eggs can infect the wood; and even pure bleach, ammonia, or other disinfectants will not kill them. Months later, squirrels housed in the cage will become infected and die from the toxoplasmosis infection. All infected wood and soil from a contaminated cage must be removed and replaced prior to using the cage to house other types of animals. Allowing contact of squirrels in care to house cats is a very bad idea. The squirrels can be exposed to toxoplasmosis and also lose their fear of cats which can have fatal results when the squirrels are released.

Symptoms: Unfortunately, the symptoms often appear when the animal is near death. Well fleshed, apparently healthy individuals will exhibit heavier than normal breathing and a lack of appetite 24-48 hours prior to death.

Treatment: There is no treatment. The microscopic larvae invade the entire body, especially the soft tissue organs making removal impossible. Mortality rate in squirrels can be 100%. The disease can be spread to humans by house cats but not by infected squirrels as they are a secondary host and do not shed eggs.

**West Nile Virus:** This newly arrived virus is transmitted by insect vectors (mosquitoes) and affects many species of animals including humans. There have already been several confirmed mortalities in the eastern gray squirrel in the United States. The squirrels may become emaciated and lethargic prior to death. There is no known treatment.



## Other problems

**Bloat** can occur from over feeding, feeding a hypothermic (cold) animal, internal parasites, and from mouth breathing when suffering from an upper respiratory disease or pneumonia. Most of the cases of bloat that I have treated have been ongoing when the animal is admitted-usually when the public has tried to care for the squirrel with little or no experience, and even less common sense. To help treat the bloat symptoms, administer simethicone. If caused by internal parasites, you will need to treat for that in order to eliminate the bloat. If overfeeding seems to be the cause, feed clear fluids for at least 24 hours to flush the squirrel's system of the undigested milk products. In some cases, bloat can be extensive, and sub-q fluids will need to be administered in order to maintain hydration. In order to treat successfully, you must determine the cause of the bloat since it is a symptom, not a disease in and of itself.

**Diarrhea** is a symptom of an underlying problem such as internal parasites, over feeding (the most common cause), feeding formula to a hypothermic animal, and so forth. I receive many animals from the public with such problems and must then attempt to undo the harm that has been done. In order to successfully treat the diarrhea, you will have to treat the cause. After admitting an animal which has been overfed, fed an improper formula, or fed while hypothermic (cold), there is often loose, light colored stool. The animal should be given only clear fluids for 24 hours, no milk formula. After 24 hours, the formula can be gradually reintroduced by adding 1 part formula to 3 parts water for the first feeding, then half formula, half water for the second feeding, then 3 parts to 1 part, and finally the squirrel is offered full strength formula.

For suspected internal parasites, a veterinarian's office should run a fecal exam and recommend medications.

**Sore penises** can develop from littermates or even a male squirrel himself sucking on a penis to the point that it forms a scab. This can develop into a very dangerous situation if not prevented very early. Sometimes squirrels will even suckle on a female causing a sore vulva, and in one observed case, the abdomen skin was sucked, leaving small red marks and bruising. Occasionally, a squirrel is admitted for care with an advanced case, and urination is not even possible.

Littermates causing the problem can be moved to another cage or container. Bad tasting products such as Bitter Apple, Triple Bitter, or Yuk can be tried. A homemade mixture of extra hot, hot sauce, habanero sauce and cayenne pepper has been very successful in eliminating the problem. It can be dabbed around the base of the penis and must be applied regularly such as at feeding times. Don't get these products on the sore area as they will sting the patient. These bad tasting products will often prevent further injury and if caught early, will do the trick. Polysporin antibiotic ointment can be used on the sore area to help the healing process. Tiny collars have been made from Dixie cups to surround the head, and socks or vet wrap have been placed over the abdomen to prevent an animal from sucking on himself. The sore penis can be soaked in warm water and may have to be squeezed to expel urine. In advanced cases, small forceps can be inserted into the tip of the urethra and then slightly spread to enlarge the opening. This is rather tricky, and you may want to have your vet do this or demonstrate it prior to attempting it initially yourself. This procedure usually has to be done several times per day for several days until the urethra is cleared and urination occurs normally. Scabs at the tip may be carefully removed to reexpose the urethra opening and treated with an antibiotic ointment. Since using this method, we have not had to have surgery done by a veterinarian to correct this problem.

**Electrocution:** A pet squirrel was brought to me for treatment after receiving a nasty electrical burn on either side of her mouth from chewing an electrical cord. Her owner thought that it would be safe to let the squirrel run around the house as long as she was present to supervise the squirrel. It only took a minute for the squirrel to bite the cord and receive a serious burn. I treated the squirrel with fluids and antibiotics. Thankfully, she survived the injury.

**Crushing injury:** I also treated another pet squirrel, which was admitted with a severe injury to the skull and one eye hanging out of the socket. The squirrel ran under a recliner, and when the owner put the footrest down, he heard a scream as the squirrel's head was being crushed in the mechanism. I could not save the eye, but did save the squirrel's life; and he later was good as new much to his owner's delight. I treated with fluids and antibiotics. The moral to these two tales is obvious; don't let squirrels have the run of your house or even one room unless the room has been totally cleared of all possible hazards. Your immediate presence will not necessarily prevent a fatal or severe mishap.

**Bloody mouth while feeding:** Blood is often seen in and around the mouth during feeding when squirrels are between 70-120 grams. I have received several frantic calls from volunteers whom I forgot to warn. The bottom teeth erupt at three weeks of age, then the top teeth at five weeks. When the squirrel baby nurses with these new top teeth, he will invariably bite his own tongue a few times until he learns how to suck properly. It can be quite alarming to a beginner squirrel mom or dad, though, to suddenly observe blood in the baby's mouth while feeding it.

**Malocclusion of the teeth** can occur whereby the top and lower incisors do not align properly. When this happens, the teeth continue to grow rather than trim each other in a normal fashion. Squirrels with permanent malocclusion should not be released as they may face a terrible death of starvation or injury from the teeth themselves. Squirrels admitted with injured mouths from falling should be monitored carefully. In some cases, when we have noticed the problem early, we have cut the teeth back to a normal length; and they have regrown correctly. This problem must be treated early to be successful so routine exams should be conducted while the animals are in care. To cut the teeth, fingernail clippers or small metal snips can be used carefully. Snip a fraction of an inch at a time until the teeth are normal in length. Check another squirrel to see what the teeth should look like. The bottom teeth are quite long in squirrels. This method can also be used in cases of permanent malocclusion whereby the squirrel is kept in care for life. The teeth should be trimmed every other week or so.

### **Metabolic Bone Disease (MBD)**

Wildlife rehabilitators some times receive a squirrel having convulsions or dragging its hind legs after the public has raised it for awhile. Of course, these can be symptoms of a concussion or a back injury, but when either of these symptoms is presented to me, I always ask about the diet and direct sunlight. Has the squirrel been weaned from formula, and if so, when and at what age? If weaned, what solid foods have been provided, and has calcium been added to these foods? What formulas were used, and has the animal received natural sunlight or light from a UV-B bulb? Unfortunately, many such animals raised by the untrained have developed metabolic bone disease. Usually, a furry squirrel even at 100-150 grams and 4-6 weeks of age looks "grown" to the public; and so the caregiver discontinues formula feeding and begins to give a diet of nuts, seeds, and fruits. Even if the squirrel is age appropriate for weaning, when the diet is not balanced with sufficient calcium and ultraviolet light has not been provided, the juvenile squirrel will develop MBD. Fifteen minutes a day of natural sunlight or light from a UV-B bulb is required if the youngster is going to metabolize the calcium. The ultraviolet rays (UV - B) from the sun do not penetrate through plastic or glass and are necessary for the body to produce Vitamin D3. Natural sunlight is recommended as more beneficial than UV-B

bulbs but is not always practical during the winter or other adverse weather. Vitamin D3 is in the squirrel formulas recommended in this manual. There are also squirrel and rodent diets such as those from Henry's Healthy Pets which contain vitamin D3. If these are provided, the UV light is not required, but can be provided as an assurance to maintain the health of the animal. When squirrels are housed in outdoor wire cages, they are exposed to natural sunlight and should be able to produce the necessary vitamin D3; however, they still require calcium in their diet.

**It is important to note that in 2019 there have been reported cases of metabolic bone disease developing in gray squirrels as well as in Virginia opossums raised on Pet Ag Esbilac brand of puppy milk replacement formula. The manufacturer has admitted that this product can be damaging to small mammals and is reportedly researching the problem. For further information on the Esbilac situation, go on the web to Chris' Squirrels and More and another site, The Squirrel Forum.**

I have had very good success in treating MBD by immediately placing the patient on a regime which provides a sufficient calcium intake. I place the squirrel back on formula and if the squirrel is old enough to eat solids, I also sprinkle the calcium carbonate powder liberally on all solid foods offered while avoiding offering foods high in phosphorous. I also provide a minimum of 15 minutes of sunlight or UV-B light from a bulb daily. These patients should be kept in the indoor-sized cages rather than outdoor cages to minimize overt exercise and possible stress fractures until they have fully recovered. Be sure to check the teeth for possible overgrowth also because this often occurs as well. If this happens, the teeth can be carefully trimmed a little.

Over the years, I have saved dozens of squirrels that were admitted with seizures, dragging their hind legs, unable to walk, and were on a path of destruction caused by ignorance on the part of the caretaker. This disease is totally preventable, curable in all but the final stages; and the treatments are easily administered. It is a disease frequently misdiagnosed even by expert medical personnel.

### **Oral tube feeding**

It is always best to receive this training from an experienced veterinarian, vet technician, or wildlife rehabilitator. If not performed correctly, death can result: therefore, I only recommend oral tubing as a last resort. In rare cases, a squirrel may have such a severe respiratory illness or an injury to the nasal area that does not allow normal syringe feeding. In such cases, the oral tube feeding will allow sufficient nutrition to be provided, thus saving the animal's life. For oral administration of fluids, you may use warmed Pedialyte if there is dehydration, or regular formula may be used for an animal whose hydration is normal. Depending on the size of the squirrel, a 3 ½ French catheter can be used for very small babies and a 5 French catheter can be used for larger squirrels. Hold the tip of the catheter at the base of the rib cage and gently stretch it along the animal's chest, neck and head to the tip of its nose and mouth. Be sure to follow the full curvature of the neck. With a permanent marker, mark the point of the catheter that corresponds to the very tip of the mouth. Attach the catheter to the end of the feeding syringe, and draw up the amount of liquids needed. Hold the squirrel with one of your hands in a flat position horizontally, not vertically, (lying flat in a prone position). With the other hand, slowly insert the end of the syringe into the squirrel's mouth carefully working it down into the stomach until the marked area on the tube is at the squirrel's mouth. The syringe plunger is then slowly pushed to administer the fluids directly into the squirrel's stomach. I usually administer less fluid than indicated on the squirrel feeding chart. Do not administer the fluids if there is any doubt as to the tube being properly placed.

## **Administering Fluids Subcutaneously**

This method of providing fluids to a dehydrated or unconscious squirrel is relatively simple, but again, it is safer for the patient if you observe someone else experienced in the procedure before you try it yourself. This is a safer method than oral tube feeding. Lactated Ringers (with no dextrose) is used. A bag can be warmed by placing it on a heating pad for awhile-monitor the temperature closely. Draw up the amount of fluids needed using a syringe and needle appropriate for the size of the squirrel. You are going to administer the fluids in four locations, two on the hips and two at either side on the shoulders. Gently pinch the skin of the squirrel between your forefingers and thumb, insert the hypodermic needle  $\frac{1}{4}$  -  $\frac{1}{2}$ " just under the tented skin, and inject one quarter of the amount of total fluids to be given. Complete this at all four injection sites. Sub-Q fluids can be given two to four times per day depending on the severity of dehydration, and age and size of the animal.

## **Southern Flying Squirrels**

Much of the care for flying squirrels is similar to that for gray squirrels. For baby flyers without their eyes open, I use my small squirrel formula. However, the feeding implement and technique that I have used successfully are unique. After heating a small, white cannula (the larger end) with a lit match, I push it firmly onto the end of a  $\frac{1}{2}$  ml

o-ring syringe. When I feed tiny baby flyers whose eyes have not opened yet (under 12 grams), I do so by placing the formula drop by drop on the tip of their mouth very slowly at first. They usually learn quickly and soon will easily lick the drops of formula with their tiny tongues. For babies whose eyes have opened or are over 12 grams in weight, I switch to a Catac nipple pushed onto a  $\frac{1}{2}$  ml o-ring syringe so that only half of the nipple is below the end of the syringe. At this size, the babies can usually nurse from the nipple without aspirating formula. If they have any trouble with this technique, I switch back to the cannula for a few days and then try again with the nipple feeding.

The smallest flyers that I have ever raised were only 1  $\frac{1}{2}$  grams, pink and naked with their umbilical cords still attached. I fed them every other hour, round the clock, for the first two weeks. I then went to a schedule of every three hours for a week, followed by every four hours. It was really one of the most difficult feats that I have ever encountered in more than 30 years of wildlife rehabilitation. By the way, the two babies grew to adulthood, and I released them in their bed box hung in an oak tree. Several years after that experience, I successfully raised two that were 3 grams each. Then several years ago, I admitted two infants which were 3 grams each. When I saw their size, I felt panic stricken as it had been more than 20 years since I had raised any so tiny. I told myself that I had successfully done this before, and that I could do it again. It was a labor intensive task, but I succeeded. These latest babies all grew up to adulthood as well and were released.

For the flying squirrels, a smaller entrance hole is cut in the wooden bed boxes than in the boxes for gray squirrels.

## **Glossary of Products- many products mentioned here are available on the web and on Amazon.**

### **Formulas for infant and juvenile gray and flying squirrels:**

For any age squirrel the "old" formula from the 1960's can be used **temporarily** in an **emergency** situation only until other formulas can be obtained:

5 ounces of lactose free whole milk, one egg yolk, 1/2 teaspoon light Karo syrup, mix or whisk well and strain it-keep refrigerated, and warm to about 100 degrees F to feed.

### **I always use bottled, purified water for making all formulas.**

For squirrels whose eyes are closed, I mix 1 part Fox Valley 32/40 to 2 parts hot water (130 degrees F.) For example: 1/2 cup Fox Valley powder (32/40) to 1 cup hot water.

For squirrels with eyes open or over 70 grams in body weight, I use Fox Valley 20/50 per manufacturer's instructions, i.e., one part Fox Valley powder to two parts hot water. 1/2 part heavy whipping cream can be added for increased weight gain if desired.

For all formulas (except the lactose free + egg yolk), mix 4 hours prior to use and heat the water to 130 degrees F. prior to adding the powdered product. Cool until the formula is just warm, then refrigerate.

### **It is best to use the feeding chart provided in this manual.**

Another way to estimate the adequate amount of formula to offer per feeding is to give 5% of the body weight.

Example: If the squirrel weighs 20 grams, multiply  $20 \times .05 = 1$  ml of formula

100 grams of body weight  $\times .05 = 5$  ml of formula. This will be a bit more than the chart shows, and you should reduce the amount of formula a little to avoid overfeeding.

## **Feeding Implements, Formulas, and Foods:**

**The Miracle nipple** fits on 1/2, 1, 3 or 5 ml syringes-order on line from Chris' Squirrels & More. Also from Chris', you can order **Catac nipples** and the Pet Ag elongated feeding nipples, which are much cheaper than Catac. They slide onto the end of a 3 ml syringe. They are a harder consistency and work ok for older squirrels. For gray squirrels under 20 grams, I prefer the Catac nipples.

**Feeding tubes:** # 3 1/2 and # 5 French catheters: vet offices, medical supply comp, Chris' Squirrels and More on line.

**O-Ring syringes:** on line-the Medi-dose group or Chris'

**Glass water bottles** can be ordered from Chris' and work great

**Formulas:**

**Fox Valley:** 1-800-679-4666 (Day one squirrel formulas) or order on their website or from the website, Chris' Squirrels and More

**Foods:**

**Squirrel blocks:** Henry's Healthy Pets web site or on Amazon

**Rodent Chow:** Chris', pet stores

**Sunflower seeds:** Wal-Mart, Feed stores, Tractor Supply

**Nuts:** pecans, walnuts, hazelnuts, and unsalted roasted peanuts-BJs, Costco, Wal-Mart, grocery stores

**Maple branches, Acorns and Hickory nuts-** collect these **only** at locations where no pesticides have been sprayed

**Fruits/Vegetables:** grocery stores, produce stands

**Food Additives:**

**Calcium carbonate powder-**Duda Company (on line), Pet stores, or Chris' Squirrels and More

**Beneficial Bacteria: Probiotics, Bene-BAC,** - on line: Chris' Squirrels and More

**Meds and Wormers:**

**Albon (sulfadimethoxine):** vet office, medical supply company.

**Bactrim also called Sulfatrim** (sulfamethoxazole 200mg/5ml and trimethoprim 40mg/5ml) - veterinarian

**Clavamox (tablets 62.5 mg add 1 crushed tablet to 3 cc water, then dose rate = .1cc per 100 grams body weight PO (oral) BID, 7 days)-** veterinarian

**Decongestant/Antihistamine (pediatric) over the counter** – Wal-Mart: for body weight 25-30 grams-1-2 drops, 30-50 grams-2-3 drops, 50-70 grams-.05ml, and so on. Start with a low dose, and increase in small amounts as needed. Can be given 4-6X over 24 hours every 4 hours

**Baytril (Enrofloxacin):** Vet offices

**Flagyl (metronidazole):** vet office, medical supply company

**Ivermectin 1%-** Feed stores, Chris', or on line

**Praziquantel (Cestex):** (tapeworms) vet office

**Nystatin:** for treating yeast infections – vet office

**Lactated Ringers solution:** vet's office, or medical supply comp.

**Nasal drops/spray-decongestant:** Wal-Mart or drug store-we use the generic brand

**Propylene glycol-** Jeffers, local feed store, on line, or veterinarian's office

**Providine or Betadine Solution** - vet office, or Wal-Mart

**Simethicone-**for gas relief in human infants, 1-2 drops for bloat – Wal-Mart

**Sodium chloride solution .9%:** vet office, medical supply comp.

**Strongid** (pyrantel pamoate 4.54 mg/ml): on line, vet offices, feed stores

**Triple Bitter or YUK:** pet stores, on line – Chris' Squirrels and More

**Vicks Vapor rub-** Wal-Mart pharmacy or drug store

## Medical Dosages

**Flagyl** (Metronidazole) 250 gram tablet

Mix one crushed tablet to 5 ml of warm water, and then administer .1 ml per 100 grams of body weight BID orally for 7 days

**Albon:** administer .05ml per 100 grams of body weight BID orally for 7 days

**Bactrim** (Sulfamethoxazole and Trimethoprim 200 mg/40 mg per 5 ml) - .05 ml per 100 gms body weight BID PO for 7 days. Bactrim is also a good medication for urinary tract infection.

**Clavamox** (tablets 62.5 mg add 1 crushed tablet to 3 cc water, then dose rate = .1cc per 100 grams body weight PO (oral) BID, 7 days) Keep the solution refrigerated.

**Ivermectin Dilute**=one part Ivermectin 1% to 19 parts propylene glycol

(This mixture must be shaken prior to use) Give orally to treat mange, mites, and to kill maggots. For mange give 3 doses, 14 days apart. Change bedding and clean the cage after each treatment.

Weight of squirrel	amount of ivermectin dilute
55 grams	.025 ml
110 grams	.05 ml
220 grams	.1 ml
440 grams	.2 ml

## Equipment/Supplies:

**Adams flea and tick spray for puppies and kittens, cats and dogs** –Wal-Mart or on line

**Bitter Apple or Triple Bitter** - Jeffers, pet stores, on line

**Crock Bowls:** on line, pet stores, feed stores

**Electric cup warmers:** on line

**Ferret Play Cubes:** are sold at PetSmart stores or on line, they make great squirrel beds to hang in climbing wire cages

**Gram scale:** Wal-Mart, on line

**Heating pads,** electric, on line - Amazon

**Hypodermic syringes, needles:** Jeffers, vet offices, feed stores

**Nasal aspirator bulbs:** Wal-Mart, drug stores, Target, on line-Amazon

**Plastic containers** with lids, called “critter totes, and playmates”- local pet stores-Pet Smart has them, and on line

**Infant receiving blankets:** Wal-Mart, thrift stores

**Wire** (½” X ½”), lumber and plywood to build climbing cages: feed stores, Home Depot, Lowe’s.

## *Daily Feeding Chart for Infant Tree Squirrels*

Weight in Grams	Maximum CC amount per feeding	CC amount to feed at various feeding intervals		
		4 Times per day	5 Times per day	6 Times per day
10	0.50		0.54	0.45
15	0.75		0.73	0.61
20	1.00		0.90	0.75
25	1.25		1.07	0.89
30	1.50	1.53	1.22	1.02
40	2.00	1.89	1.52	1.26
50	2.50	2.24	1.79	1.49
60	3.00	2.57	2.05	1.71
70	3.50	2.88	2.31	1.92
80	4.00	3.19	2.55	2.12
90	4.50	3.48	2.78	2.32
100	5.00	3.77	3.01	2.51
125	6.25	4.45	3.56	2.97
150	7.50	5.10	4.08	3.40
175	8.75	5.73	4.58	3.82
200	10.00	6.33	5.07	4.22
225	11.25	6.92	5.53	4.61
250	12.50	7.49	5.99	4.99
275	13.75	8.04	6.43	5.36
300	15.00	8.58	6.87	5.72