

Coral Snake Research

A research team took these venomous reptiles into their care.

By Joseph F. Gemano, Jr.

Many herpetologists are aware of the dangers of venomous snakebite. The development of new antivenin is a particularly important part of the work done by herpetologists, and one that I have been lucky enough to participate in. Although there is little commonly known about coral snakes, their venom and developed antivenin, I consider my work with this species especially memorable.

The snakes seemed to thrive and grow under the research team's care, who became adept at raising and caring for the North American coral snakes, several species of the South American coral snakes and even some of the tiny *Micruroides euryxanthus* (Sonoran coral snake).

Photography by Joseph F. Gemano, Jr.

During the 1950s, I worked in a laboratory at the University of Florida Medical College where we were primarily interested in the way crotalid snake venom was made by the gland of the snake and the way it worked in the body of the prey.

Because of the publicity our work with the venom of crotalid snakes received, we attracted the attention of many of our rural neighbors in North Florida, and often received gifts of local coral snakes. The coral snakes were of various sizes and were brought to us in Mason jars, buckets, picnic coolers and school lunch boxes. Many of them were so small, that we made no attempt to feed them, mostly because we knew of no food they would eat that was not harder to catch than the snakes themselves.

Several were really large and beautiful specimens, ranging up to a meter in length, and we did recognize the waste in simply allowing these to die in captivity. After several unsuccessful feeding attempts with an assortment of natural foods, H. Brewster, a coworker, suggested that we use strained baby food, diluted with some liquid and fed through an infant feeding catheter (a small tube available from the hospital's pediatric department). This was a natural development of the procedure we were using with hard-to-feed eastern and western diamondback rattlesnakes and cottonmouth moccasins. With this group, we found that the live small mammals we offered sometimes went untouched and often damaged the reptiles. Dead food was refused. To cope with this, we had developed a feeding mixture that we fed using the "caulking gun" technique we had seen used by Bill Haast, then owner of the Serpentarium, a Miami, Florida snake exhibit. As part of his routine, after breathtaking freehand catches, Bill milked and then fed his specimens in this manner.

Any competent reptile collector reading this account today will be immediately turned off by this force-feeding approach, finding it both dangerous and traumatic. These sentiments were echoed by almost all of the curators of reptiles whom I met on my visits to various zoos throughout the world. In the laboratory, we rationalized it simply because it suited our purposes. It was necessary for us to collect venom from our snakes for the work we were doing, and occasionally for treatment of snake diseases. Since we intended to keep the snakes alive for years, they had to be fed. We could not afford the luxury of the death of a valuable specimen injected with the biochemicals we were using to promote venom production. We did recognize the danger involved and, working very carefully, achieved our objective with no bite accidents over the 17 years we did this work.

For our coral snake diet formulation, we proceeded cautiously. Today, herpetologists are flooded with information on the affect of diet on health, but even in the 1950s we knew there were many enzymes made by the venom gland. In addition, we had observed that "pet" arrow poison frogs kept in terraria in the lab lost much of the toxicity in their skin secretions when fed laboratory-raised fruit flies. Considering all this, the thinking that went into the formulation of our coral snake diet went as follows:

1. The snakes' natural diet was high in protein.
2. All of the molecules in the venom in which we were interested depended on sulfur atoms for their toxicity (the sulfur atoms formed "bridges" to hold the toxins in their proper shapes), therefore it was deemed necessary to provide a diet with some sulfur-containing material.
3. The prepared frozen meal might, prior to its use, be depleted of vitamins, so a nutritional supplement should be included. It would be ridiculous, as well as untrue, to suggest that the first diet we prepared was perfect and that our method of feeding was successful from the start. At first, the food mixture was either too wet, so that the snake regurgitated

what we fed, or too dry, so it was impossible to squeeze through the thin catheter. After many trials, this is the formulation that worked best and which we used to maintain a colony of more than 500 animals, some for a period of more than seven years:

100 milliliters reconstituted powdered milk (25 grams milk powder: 75 milliliters water)

3 1/2 ounces strained beef (1 jar)

3 1/2 ounces strained lamb (1 jar)

3 1/2 ounces strained liver (1 jar)

3 1/2 ounces strained egg yolk (the sulfur source) (1 jar)

15 milliliters liquid children's vitamins.

The combination was mixed in a blender until smooth and thin enough to be easily squirted through the catheter. It could be frozen until ready for use.

It was also important to develop a technique for safely feeding the animals in the colony-safely for us, and safely for them. To ensure safety, we always worked in pairs. No one ever worked with the snakes alone. When any handling was done, the antiserum (first a South American antivenin and later our own, raised in immunized rabbits!) was always on hand, and an emergency plan that had been coordinated with the emergency room staff beforehand was posted.

Because of their size, relative rarity and delicacy, the specimens required special care. They are not very aggressive and, with a little consideration, can be handled without difficulty. Their fixed fangs are so small that a leather work glove provides sufficient protection from the bite.

Even the larger specimens can be conveniently kept in a plastic "lettuce keeper." We chose a model with a sliding plastic top that could not be pushed off or become dislodged. Each cage also had a heavy glass "finger bowl" type of laboratory dish in it filled with 4 ounces of water. We decided air holes were unnecessary and dangerous, since they might provide an escape route for the smaller reptiles. We had no problems as a result of that decision. Each cage had a record tag on which was written how much venom had been milked from the animal, how much food mixture it had been fed and a comment on its general condition. All of this, and a cage change, was done at one time, about every two weeks. We got the impression that, within limits, coral snakes are rather hardy. Before funding by the United States Public Health Service, our snakes were given to us by local people who had heard of our attempts to raise a colony. Their enthusiasm and legitimate, but often excessive, concerns for their own safety sometimes got in the way of their collecting technique. When this happened, we added a few pretty mangled snakes to the colony, a couple slashed by a shovel or hoe with punctured sides and ribs showing through. Surprisingly, most of these lived to become part of our work. Our custom was to feed them after a day, especially if they looked dehydrated, and store these cages separately for daily observation and quarantine until they died or got well.

I received a letter from a Peruvian gentlemen who said he was the overseer at a silver mine and was often bored. He had taken up coral snake collecting, had many rare South American specimens, and would be delighted to send me some if I could use them and if I could tell him how to ship them. Naturally, I was glad to take him up on the offer and wrote telling him to send them in small Styrofoam boxes inside cloth bags sewn shut. (I meant to have him put the snakes in the bags.) The whole thing should be sent to me by Air Parcel Post.

In a few weeks, I received the first of what was to become 10 or 12 snakes he sent me. He had either misunderstood my instructions or did not want the snakes to be hurt rattling around, and had cut a small groove in a block of solid foam plastic, laid the snake in it and covered the groove (and the snake) with a flat sheet of the same material. He put the box and snake in a small cotton bag sewn tightly shut and covered the bag with plastic tape, stamps and "POISONOUS SNAKE!" labels. It seems unbelievable, but if the package got to us within three weeks, the snakes almost always lived. They were, however, the thirstiest snakes ever seen. Eventually, when drugs became a prominent consideration in international postal affairs, the U.S. Post Office became a little uneasy about these shipments, which their inspectors would not open, and asked us to stop the transfers, proving that all good things really must come to an end.

The snakes seemed to thrive and grow under our care, even with the milking two times monthly. We became adept at raising and caring for the North American coral snakes, several species of the South American coral snakes and even some of the tiny *Micruroides euryxanthus*, the Sonoran coral snake, which we were given from Dr. Frederick Shannon's

extensive collection after his sad death.

These interesting animals had an unusual defensive behavior of which we were ignorant before they came into our hands. We handled all these docile snakes by means of small (16-inch) "snake hooks" made from heavy aluminum wire (for moving and lifting them from one cage into another) and medium heavy leather work gloves (for picking them up for feeding and milking). When we attempted to pick up the euryxanthus, we heard a sound like cloth ripping. At first we thought this was coincidental, then accidental and a kind of expulsion of air from the body of the hungry snake before feeding. Finally, we realized that the snake was able to make this popping sound by forcibly expelling air from its cloaca whenever it wished.

The concept of snakes giving sonic warning is a familiar one. Even without a specialized sound-making apparatus, many species "hiss" to indicate fear or anger. Rattlesnakes are famous for the threatening warning they give using the specially developed device on their tails, but even non-rattling species can show displeasure by vibrating their tails. When they do this in the wild on a substrate like dry leaves, they can produce a heart-stopping sound.

We were sure we had made a new observation and were even thinking about the addition of a new unit of measurement to the biological lexicon: "The Microfart." Of course, when we got to the library, we found that these microfarts had been observed before and even characterized on an audiospectrometer. They are made not only by *Micruroides euryxanthus*, but also by *Ficimia cana*, the western hook-nosed snake. The noise is apparently a kind of (reverse) Bronx cheer. Scientific interpretation of the value of this behavior to the snake was variable, and there seemed to be little agreement, at least at the time we did this library research, on its significance. Some speculated it was a mating call and even an indication of sexual excitement, but in our experience, it was always associated with an aggressive-defensive behavior.

In our library work on the background of this small western coral snake we did unearth several misconceptions. One was that the venom was not toxic, or was not produced in sufficient quantity to be toxic to humans. The second was that the antiserum raised against the venom of the South American coral species would not neutralize it. Neither is true. Our preliminary North American coral antivenin made in rabbits from the venom of *M. fulvius* was also very effective in neutralizing its toxicity.

The chart appearing above is a summary of the distribution of the sizes of the approximately 417 snakes of the genus *Micrurus* we had in the colony in 1967. As can be seen, they ranged in length from 16 to 40 inches, with the greatest number being 26 to 30 inches long. We began this work in 1963 with an odd collection of about 50, most of which we had accepted as gifts from local friends in North Florida, and then were able to purchase almost 100 each year through 1967.

We began by keeping the snakes on shredded newsprint, but found that it tended to pick up moisture from the water dish and became moldy. From that, we switched to the crushed corncob, which was the standard bedding in many mouse colonies at that time. It was sterile and the snakes could burrow in the 1- to 2-inch-thick layer in each crisper "cage." It was usually sufficient to change the bedding when the snakes were fed and milked at the two-week intervals. Snakes acclimated to the colony, shed cleanly and completely, and several laid eggs in captivity. These, however, we were never able to hatch successfully. This was just as well, because we wouldn't have known what to feed the hatchlings, although we were occasionally able to induce newcomers to our colony, thirsty on their arrival, to drink dilute slurries of the food mixture.

There was some indication that the animals shed more frequently in the colony than in the wild (sometimes once a month), but as there were few data on the frequency of shedding in the wild, our observations were never confirmed.

The coral snakes in our care did well until, as often happens in the ivy-covered towers of Academe, we elected to move to a more desirable position at a university that had much to offer, except facilities for our colony. At that point, we made arrangements with Bill Haast at the Miami Serpentarium to take over the collection, move it to the land of perpetual sunshine, and provide the freeze-dried venom for the manufacture of the "new" (forthcoming at that time) Wyeth (Antielapid) North American coral snake antivenin.

Author's note and a word of caution: When I began this account, it was primarily in the way of a reminiscence for me and a historical piece for contemporary amateur and professional herpetologists. I had no idea that people who study and keep snakes today would think of using these techniques, because when we developed them, there was such great resistance to the "hands-on" methods they require. Imagine my surprise when, in the course of discussions during the writing, several new and a few old friends told me that they had no specimens of *Micrurus* in their collections because of the difficulties involved in keeping them alive. (A notable exception is George Van Horne of the Reptile World Serpentarium in St. Cloud, Florida, who uses an adaptation of the procedures outlined here with singular success.)

It may be, therefore, that some readers who have access to coral snakes purchased or collected from the wild, will attempt to keep them using the techniques described here. If so, and if they go about the project in a gentle manner, I have no doubt that they will be successful. Because they may never have handled coral snakes previously, however, I would like to add a few words of warning.

Coral snakes, remarkably similar to the krait in behavior, are not hard to pick up or to hold. A leather gardening or work glove (not a leather driving glove) offers a barrier to the fangs of all but the largest. They do not strike forward in the manner of the viper, but bite by moving their heads from side to side. It is a movement that is not hard to avoid even though it can be very fast. Handling them, however, is dangerous. Their venom is far more toxic than that of any other venomous snake in North America, and a bite can certainly result in a fatal outcome, even when antiserum is available and properly administered.

Before beginning, know clearly what steps you would take if a bite accident did occur. Be certain that your designated medical facility has the proper antiserum in stock, perhaps as many as eight to 12 vials, knows how it should be used and understands that respiratory assistance might be required in the treatment. Lastly, it is a good policy never to work with any venomous snakes alone and even though the venom of *Micrurus f. fulvius* is reputed to be slow-acting, this is still a precaution well worth following.