

THE VIVARIUM

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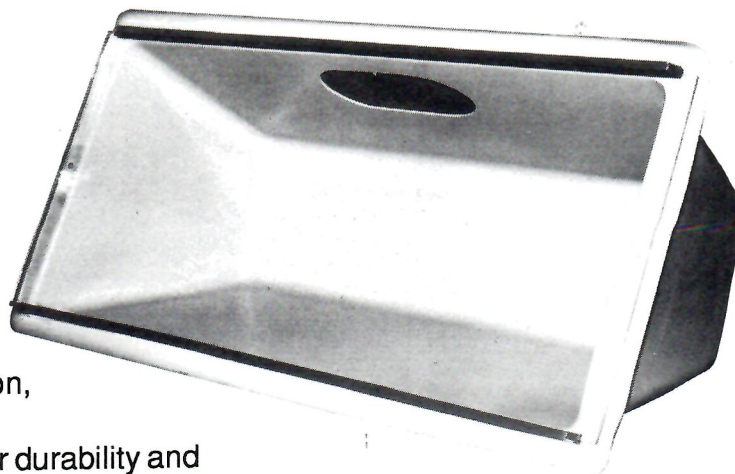
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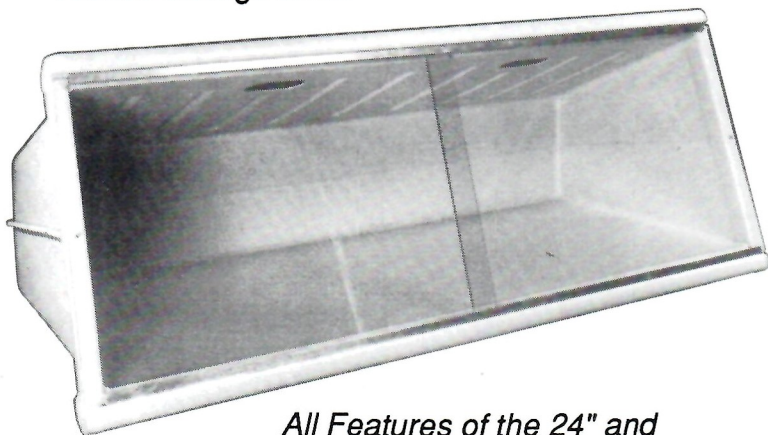
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THE VIVARIUM

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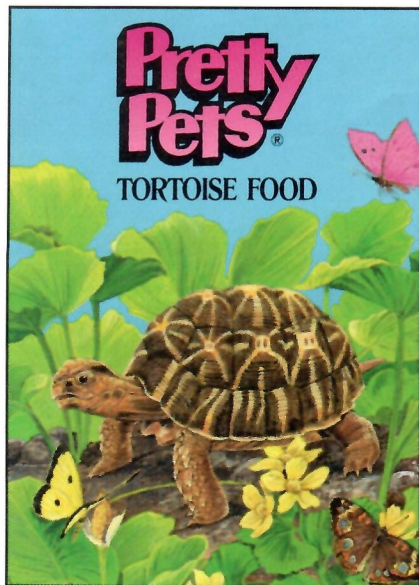
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Front Cover: The male Komodo dragon (*Varanus komodoensis*) at the National Zoological Park shortly after its arrival. Photo by Jessie Cohen, Graphics Department, NZP.

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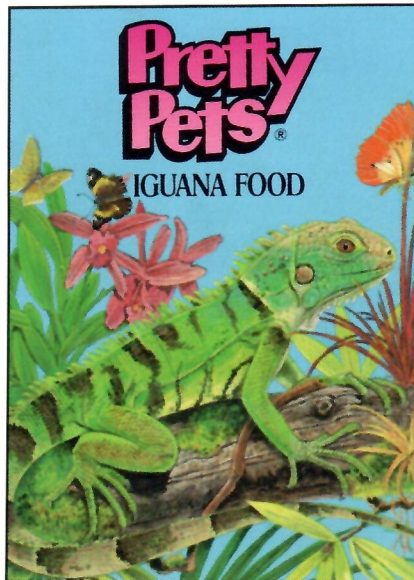


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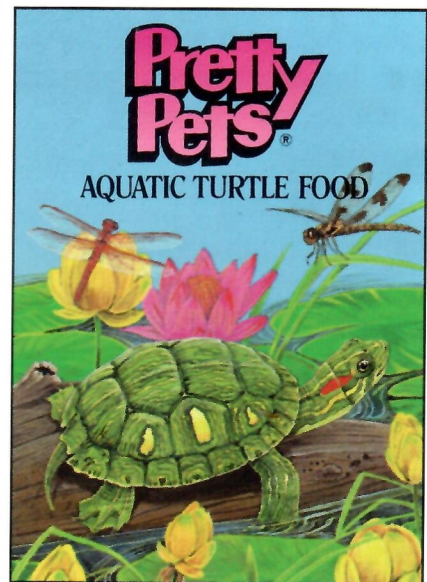
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Herp News

from Around the World

by
Ellin Beltz

RIBBIT & WEEP - FROGS IN THE NEWS

The story of the apparent decline in amphibian populations worldwide has appeared in so many guises and publications [New York Times Magazine, December 13, 1992, contributed by P.L. Beltz; The Express, July 31, 1992; contributed by Matt Aikawa; The Lakeland FL Ledger, March 14?, 1993, contributed by Melody Smith; New City, May 6, 1993, etc.] that I begin to suspect that the frogs have a master public relations person pounding the pavements on their behalf. Is this the case, or are the folks at the Declining Amphibian Task Force generating all this p.r.? I look forward to hearing from readers with information on the topic.

An anthropologist at the University of California at Berkeley carried frog mucus from Brazil to the National Institutes of Health (NIH) in Bethesda, MD. Scientists found adrenoregulin, a peptide, in the frog secretion which means the mucus may help create drugs to treat depression and stroke according to Thomas Spande, an NIH organic chemist. [Brazosport, Facts, 79(345), February 16, 1993. Contributed by Michael Colligan.]

Take one frog and call me in the morning? A chemist at the National Institute of Health is working with dendrobatid frog toxins to develop a new painkiller which may be more potent than any analgesic previously developed. One alkaloid, known as epibatidine was isolated from poison dart frogs from the Ecuadorian rain forest. It blocks different receptor sites in the brain where pain signals are processed than does morphine and may be 100 to 400 times more potent than the classic painkiller. Researchers hope to synthesize the compound in the lab since it is not feasible to extract sufficient quantities of epibatidine from the tiny frogs themselves. [Longevity/December 1992, contributed by Alan W. Rigerman.]

The New York Times [March 15, 1993] reports that Thekkedajh Menon, the owner of a large seafood importing company, was convicted for trafficking in tainted shrimp and

scheming to elude federal food inspectors. His offenses reported included labeling protected species of Bangladesh bullfrogs as shrimp. Contributor Alexander Semencic asked about the origin of the protection for the Bangladeshi bullfrogs. To the best of my knowledge, most species of frogs in that nation are now protected. The government recognized that overcollecting of large frogs in that country was having a negative impact on human health, since mosquito-borne diseases increased as frogs decreased.

SQUIRMING PANDA FOUND BY MANY

No, it was not a case of ophiphagy by a giant panda stuffed toy, but rather an attempt to smuggle the animals into the U.S. The live animals within included: two Indian star tortoises, three monitor lizards, a yellow-foot tortoise, a red-foot tortoise, three Nile monitor lizards, two hingeback turtles, and an elongated tortoise. [March 21, 1993: The Washington Post, Bryan McCarty; The Provo UT Daily Herald, David Webb; The Akron OH Beacon-Journal, Fred Buettel; The Hayward CA Daily Review, Mike Kilby; and March 23, 1993, The Jefferson City News and Tribune, Phil Jones.]

MAYBE IT WAS LOOKING FOR THE WINDSHIELD VIPER?

A student at the prestigious Northwestern University in Evanston, IL lost his pet snake somewhere in his Subaru after releasing the animal from "his usual traveling cage, a violin case" while driving back to school from his parent's home in Kentucky. Somewhere along the way, George the python did what snakes do best: find a nice warm place to hide and stay there. To get George out, however, took a Subaru dealer the better part of a day to strip the car before finding the python in what was left of the dashboard of the Legacy. The student wasn't even there to retrieve George having left on a skiing trip to Colorado during the search! So a mechanic at the dealership set George up in an escape-proof box with a heat lamp to await his owner's return. [Stars and Stripes, March

25, 1993, Brian A. Potter; Chicago Tribune, March 23, 1993, Eloise Beltz-Decker.]

MORE LEGISLATION...

Carroll County, Maryland legislator Richard N. Dixon recently proposed a ban on the importation of animals that eat other live animals on behalf of animal-rights activists. It would extend the prohibition currently in effect against skunks, foxes, raccoons, bears, alligators, crocodiles, wild cats, and poisonous snakes as house pets to virtually all carnivorous snakes, reptiles, amphibians and fish which many people keep at home. Bill opponents said domestic breeding and raising of snakes must be permitted to perpetuate certain species. "It's not like we're feeding people's pet bunnies to snakes,"

WATERFALLS & OTHER ACCESSORIES

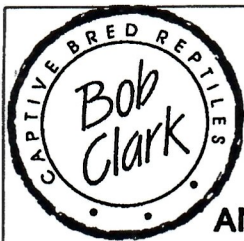
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said Michael Gulley a resident of Washington County reported to keep 200 snakes. A 19-year-old who testified before the representatives said, "Not very many people know the joys of owning a snake. People who don't own snakes want to make up rules about snakes, and I think that's very unjust."

BUT HOW WOULD SUCH A BAN WORK IN FLORIDA?

Officials say that rat populations have increased tremendously in the debris left by Hurricane Andrew August 24, and snake populations are on the rise as well. Todd Hardwick, owner of Pesky Critters said that he is not going after the snakes because they are not threaten-

ing to people and they will help keep the rats under control. [Stars and Stripes, March 31, 1993, contributed by Brian A. Potter.]

HISS-TICKY-TICKY, HA!

A suitcase found unattended at a food market in Clovis, CA was taken to an empty parking lot and opened by means of a small explosive charge. To officials' surprise, no explosives or old clothes were found, merely a 4-foot python. Micheline Beeson, the Clovis police spokesperson said authorities had no idea who planted the suitcase at the store or why, but added, "We do know there's a yo-yo out there somewhere." [Fresno CA Bee, April 6, 1993, contributed by Bill Bruce.]

A-COMMODE-ATING ARTICLE

AFH reader George L. Foster sent a clipping from The New Paper [February 22, 1993], from Thailand which tells the horrifying story of a python which has stuck its head out of a toilet in an old folk's home five times in the last five months. Finally, in desperation, the management tied a live chicken by the leg to the sink in the hopes the python would emerge, eat it and be trapped. It is suspected that the mother python could have laid her eggs in a canal, and the baby entered the plumbing system through a manhole cover according to Singapore Zoo supervisor Francis Lim. He added that the snakes are not aggressive. Why can't a story like this ever break in Flushing, New York? On a similar note, a clipping faxes by Derdra Smothers from the Daily News [October 25, 1992] finishes the story first reported by Dave Barry a few months ago. It seems a man in Canada was brought to court for flushing his four-foot-long ball python down the toilet after it appeared in his neighbor's commode. The man was accused of cruelty to animals because the snake suffered abrasions and "a bad case of snake pneumonia." The defendant explained he had left the snake soaking in the tub from which it must have crawled into the toilet and pointed out that it would be impossible to flush the python since it rolls into a ball when threatened. The defense lawyer brought a toilet filled with water to prove that the snake would enter it freely. However, the snake slithered away from the commode and towards its snake sack in court. The defendant was cleared of the charges anyway.

SKULLDUGGERY IN VIRGINIA

Two headless pythons were found by children playing in Fairfax County, Virginia. According to contributor Caroline Seitz of Annandale, a headless raccoon was also found and the snakes were incorrectly identified as reticulated pythons when they were, in fact, Burmese. Why on earth someone would de-

capitate three animals and leave the remains in a suburban area is unknown at present. [Washington Post, April 1, 1993, also contributed by Donielle Grabner.]

NOT A MARK ON IT

A dead 16-foot python was found in an alley in Lowell, Massachusetts by a man taking his daily walk. The man said, "He seemed dead, but he wasn't squished or anything like that." The snake was estimated to weigh about 125-150 pounds. Officials speculate that the snake was someone's pet and was just dumped in the alley after it died of natural causes. [The Lowell Sun, no date, contributed by Alan LaFreniere.]

AND NOW FOR SOMETHING A LITTLE DIFFERENT

A reader requesting anonymity sent a copy of the coroner's report on the Canadian man who was asphyxiated by his 10-foot pet Burmese python. Contributing factors were listed as: "1.) The snake was in the process of shedding its skin, an event which temporarily opacities [sic] the eyes and blinds the reptile. This may have made the snake more irritable. 2.) The snake may have been an irritable reptile anyway. 3.) The snake could have smelled food on (the deceased's) hand (since he had) been playing with a friend's cat, bit the deceased on the hand, and then coiled around (the deceased's) body. 4.) (The deceased) had been drinking, ethyl alcohol level 209 mg./100ml. blood) and this may have slowed his reflexes in dealing with the reptile."

TORTOISE NEWS

The Salt Lake Tribune [March 23, 1993, contributed by David A. Webb] reports that the plan to divide land between tortoises and developers has run into more trouble. After discussing how the Las Vegas agreements already reached may become a model for new methods of saving species proposed by Interior Secretary Bruce Babbitt, the article states that a permanent conservation plan to double the conservation acreage may be bitterly contested. The article is titled, "The tortoise and the share: enough land for all!"

A March 23, 1993 article from the San Francisco Chronicle [contributed by Matt Aikawa] reports that ranchers have agreed to limit sheep grazing in the Mojave Desert until a federal judge can hear the case. At stake is about a million acres of federal land in California, the economic interests of a dozen or so family-owned sheep ranches in the Mojave Desert and the well being of the federally endangered desert tortoises who live in the desert the ranchers want for their sheep. For additional information on this issue contact: the Desert Tortoise Council, P.O. Box 1738, Palm Desert, CA

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Grumman World employee newsletter [January 29, 1993, contributed by Fred Ledermann] describes a recent gopher tortoise relocation at the Melbourne Florida airport. "Doing the right thing was not the easiest way to go. It involved a mountain of paperwork... from four different agencies..." The relocation was performed by an environmental firm and will be monitored to see how the tortoises are doing next year.

Walt Disney World will expand over an area inhabited by gopher tortoises near Orlando. However, they have agreed to contribute money toward the study and conservation of the species to The Nature Conservancy and the University of Florida. The tortoise trade-off is a "new-style" environmental deal where the needs of the few are sacrificed for the presumed benefit of the many. [The Orlando Sentinel, February 1, 1993, contributed by Dennis Uhrig.]

"HOW TO RESUSCITATE A LIZARD" NO LONGER A JOKE

An eight-year-old boy in Whittier, CA saved his iguana's life by administering his best effort at CPR (cardiopulmonary resuscitation) after the creature was discovered lying inert at the bottom of the family's swimming pool. The boy's father, a doctor, said, "Water was draining out of its mouth and it wasn't breathing. I told my son 'It's no use, he's a goner.'" The boy said he learned CPR techniques from the movie "Alien" and he and his brother blew and pumped until the lizard was up and hissing a few minutes later. Readers may be familiar with the cartoon "How to Resuscitate a lizard" which shows a

waterlogged lizard being shaken, squeezed and given mouth-to-mouth to survive. Well, this young man just proved that technique works! [Whittier Daily News, April 29, 1993, contributed by David Wright.]

GECKO AGGRESSION MAKES THE NEWS

Thank heavens William Proxmire (WI) never heard of this! Scientists staged "wars between lizards" in old airplane hangers in Hawaii in a effort to learn why sexually reproducing geckos have displaced asexual lizards in urban settings throughout the mid and South Pacific. The local lizards, Mourning geckos, are about three-inches long and are typically all females, laying and hatching eggs without any male contributions. Since World War II, house geckos, native to the Philippines and Indonesia have displaced the all-female geckos in urban homes as the sexual geckos invaded the islands of Hawaii, Samoa, Tahiti, and Fiji. The gecko battles proved that the sexual lizards are bigger, hog the best feeding areas and without overt aggression displace the smaller, all-female species. [The Grand Junction, CO Daily Sentinel, January 15, 1993, contributed by Larry Valentine.]

NEBRASKAN TURTLES CAN REST EASY

A three-year effort by Angie Byorth, a Lincoln, NB real estate agent has paid off. Governor Nelson signed Legislative Bill 830 which eliminates commercial trafficking in native Nebraska amphibians or reptiles. He said it will "help people live in harmony with our friends in nature." The bill makes it unlawful to buy, sell, import, or export any native amphibian or reptile in or from the state of Nebraska. The director of Omaha's Henry Doorly Zoo stated concern about the removal of animals including milk snakes and western painted turtles to markets in New York and elsewhere. The bill will not affect youngsters or hobbyists, but is aimed at people who take animals for commercial trade. [Omaha World Herald Editorial, April 18, 1993 and article April 14, 1993, contributed by Jeff Elting.]

Thanks to this month's contributors! Also, many people deserve notice for sending items previously used (danged lead time!): Melody V. Smith, Mark Miller, Anonymous/Sharp Health Care, Fred Ledermann,

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You can become a contributor, too. Send clippings with the publication name and date (you can use the date slug from the paper), and your name firmly attached (tape preferred to staples) to Ellin Beltz, c/o AFH at the address on our masthead. The long lead time (60-120 days) may result in you being scooped, but your contribution will be acknowledged!

This is my sixth year of writing this type of column, and my fourteenth column for AFH. The clipping collection of items used has now expanded to a third drawer of my four drawer, extra long file cabinet. If anyone knows how to get these things transferred to CD-ROM, please let me know. The clippings are an interesting overview of reptiles in the American psyche. Believe it or not, attitudes are changing for the better in many places!



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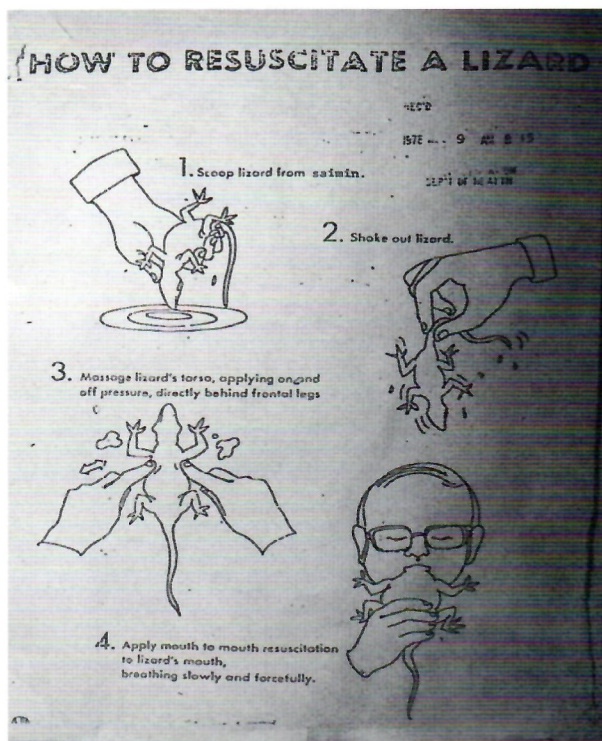
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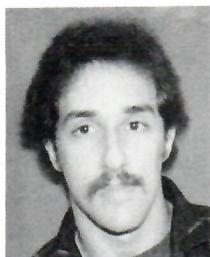


"How to Resuscitate a Lizard" poster. Photo by Dennis Sheridan.

THE VIVARIUM

Heating Herps in the 1990s

by
Dave Fogel



Dave Fogel will be featured regularly in The Vivarium magazine. Mr. Fogel has maintained a large collection of reptiles and amphibians over the past eighteen years. Nine years ago he engaged in a full-time endeavor, The

Herp House which specializes in herp husbandry and propagation, the sale of exclusively captive produced herps, herp literature, and supplies. He has served as recording secretary for the Northern Ohio Association of Herpetologists (NOAH), and has conducted numerous herp presentations.

I can recall some of those cold winters in the early 1970s when I was a high school student, when the lights in the terraria continued to burn day and night, week after week. Although this method did provide most of the desired temperatures, it did not duplicate photoperiods, and it was extremely inefficient. Twenty years later, there are a variety of heating devices that are being successfully incorporated into herptile enclosures.

It is important to keep in mind some heating basics. First, heat rises. This is an

important consideration when choosing heating devices for specific enclosures. The ambient (surrounding) air temperature where herps are being housed will be an important factor when choosing heating devices. When keeping large numbers of warm climate herps, heating an entire (well insulated) room can be a worthwhile investment. Additional cage heating devices must be considered to allow for individual herp thermoregulation.

A fluorescent lighting fixture equipped with cool white bulbs, or Vita-Lites® provides little heat. Fixtures equipped with a ballast do produce some heat, but when positioned on the top of the cage, the majority of the heat will rise into the air as opposed to heating the interior of the cage.

Substrate Heat

Pipe heat tapes are typically about one half inch (13 mm) wide and one eighth inch (3 mm) thick. Tapes range in length from three feet (91 cm) to over 100 feet (30 m). They are designed for wrapping water pipes to prevent freezing.

Pipe heat tapes are most effective when being affixed to long lengths of shelving which support a number of enclosures. In this application, the tape can be covered with an appropriate width strip of aluminum flashing for better heat dissipation. The tape should be run along the rear one third of the shelf to allow herps to thermoregulate by moving from the front to the rear of the cage. Pipe heat tapes can also be used effectively in upright shelving units, such as those that utilize shoebox, sweaterbox, or Rubbermaid® containers. In this application, lengths of tape can be run across the top shelf, down the side of the unit to the next shelf, down the opposite side of the unit to the next shelf, and so on until all shelves are covered.

In large units, several tapes should be used (one tape per every few shelves) for added control. When using pipe heat tape with wooden units, a dado groove can be

cut with a router bit or tablesaw blade in which the tape can be recessed for a flush fit. When heat tapes are being used with wooden shelves, I have covered the top surface to the shelf with vinyl flooring. This prevents a fire hazard, as well as waterproofing the shelf.

Another option is to run the length of tape through 3/4 inch (19 mm) to 1 inch (25 mm) diameter copper pipe, which can also be filled with sand to increase heated mass, beneath the cage floor.

Pipe heat tapes draw seven watts per foot and must be wired to a rheostat or dimmer switch to allow for precise temperature control. These can be wired directly into the non-heating head of the heat tape. An alternative method of control (which requires no electrical knowledge) is to plug the tape directly into a ready made "dimmer box".



Northern blue-tongued skink (*Tiliqua scincoides intermedia*) chooses a warm spot to bask under a 75 watt sun spot light. Photo by Dennis Sheridan at Chaffee Zoological Gardens of Fresno.

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Sierra mountain kingsnake (*Lampropeltis zonata multicincta*) utilizing a hot rock as a secondary heat source. Note that the hot rock is buried just under the substrate. Photo by Dennis Sheridan.

The heat tapes must be the variety without a built-in thermostat which typically activates the tape at about 40 F (4 C). The thermostat is easily removed, so it presents no real problem. One can even splice the rheostat into the place where the thermostat was. Cox Premium Series® heat cables are the finest tapes I have used. Unfortunately, they are no longer being manufactured. Smith Gates Easy Heat® heat cables seem to be the best alternative. The only drawback to pipe heat tape is that it can not be cut to size, and tapes are not available in many in between lengths. Pipe heat tapes are heavy duty and long lived. I have used them for ten years and highly recommend them.

Flex-Watt® is an almost paper thin tape that is available in various widths. Its composition is sheet plastic imbedded with heating wire. Flex-Watt® is manufactured for the horticultural industry. It is designed to warm plant roots.

Flex-Watt® heat tape is widely used among herpetoculturists. The main benefits to this type of tape is that it can be easily cut to any desired length and lies flat in most applications. Rheostats or dimmers should be in conjunction with Flex-Watt®.

The drawbacks are that for every section of tape cut from the 500 foot (152m) roll, a crimped electrical connection must be made along with a length of electrical cord. Due to the thin construction of Flex-Watt®, it is comparatively delicate. My experience has been that, as the tape ages, cold spots

form at irregular intervals.

Galvanized metal heat pads are available in two sizes, 13 x 21 inches (33 x 53 cm) (large) and 9 x 17 inches (23 x 43 cm) (small). The pads consist of a waterproof heating element sandwiched between two thin galvanized steel plates. A heavy duty cord and grounded plug exit the center of one end of the pad. The designed use is to heat small animal nest boxes.

There are many benefits to this type of heat pad when applied to herps. The entire surface of the pad heats evenly. The electrical consumption is only twenty watts. The pads are weather resistant, and no rheostat or dimmer switch is required. Galvanized heat pads are among the most reasonably priced of the herp heating devices.

The best application of the metal pad is to position the pad under the enclosure. This eliminates the need to drill a hole in the enclosure or enclosure top through which to run the electrical cord. With the pad outside of the en-

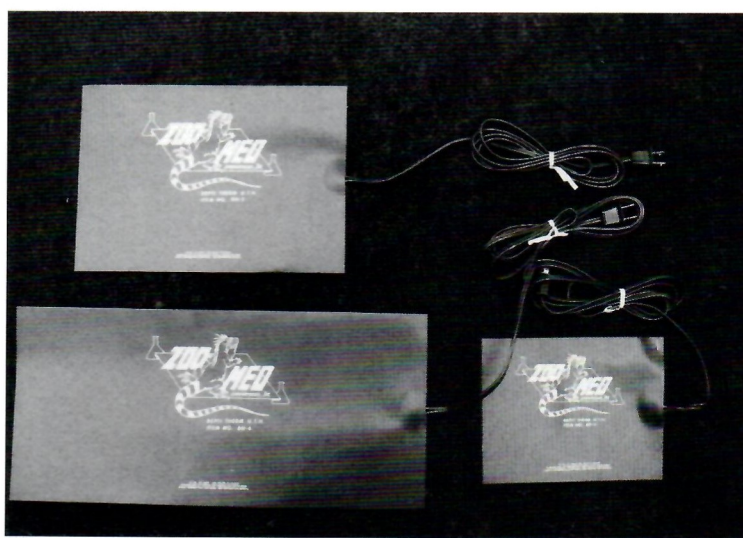
closure, it is maintenance free (no cleaning). The heat from the pad will radiate through glass or wood bottom cages. Metal pads are also ideally suited for use with thick plastic or fiberglass snake cages such as Neodesha®. Pad placement should be such that no more than one third to one half of the enclosure floor area is being heated. This will allow enclosure inhabitants to thermoregulate by moving on or off of the heated area as needed.

Galvanized metal heat pads are extremely durable and long lived. I have extensive experience with these pads and highly recommend them. Hopefully, in the near future, a larger size will be available as well.

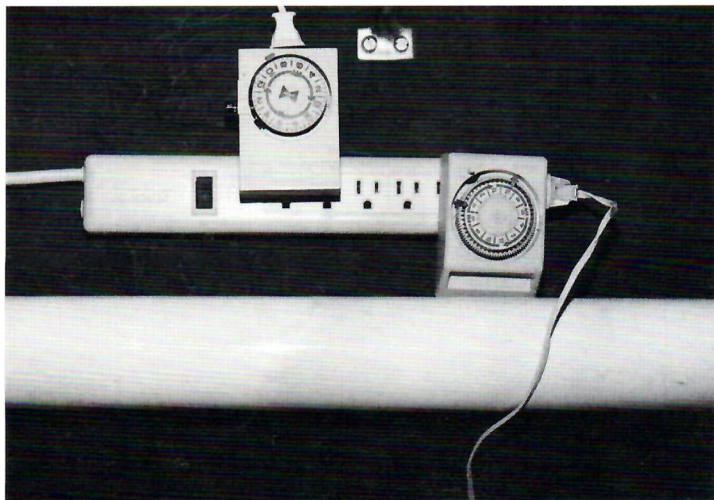
Fiberglass heat pads are available in six sizes ranging from 12 x 18 inches (30 x 46 cm), to 2-4 feet (61-122 cm). These were originally designed to heat pigs. Fiberglass pads are considerably thicker than the galvanized pads, and consume much more electricity. The main benefit to the fiberglass heat pad is the availability of large sizes. These are ideally suited for large tortoise enclosures, as well as heating large constrictor enclosures.

In most applications, the pads require a rheostat or temperature control unit. Mounting holes are provided at the pad corners which allow the pad to be screwed directly to the bottom of wooden cages. The fiberglass heat pads can be used in many of the same applications as galvanized pads, but are not as reasonably priced. "Pig heater" pads work well and are recommended.

In enclosure set-ups utilizing a "deep" substrate i.e., several inches of soil or sand, either of the previously mentioned heat



Under tank heating pads come in several sizes. If placed under a portion of the enclosure, the pad allows a reptile to select a range of temperatures. Photo by Dennis Sheridan.



Automatic timers are almost a necessity for proper lighting and heat sources for most herptiles. Note that the timers are attached to a multi-outlet grounded strip. Photo by Dennis Sheridan.

pads may be buried in the substrate to an appropriate depth.

Hot rocks were first introduced in the 1970s. They were specifically designed as a secondary heat source for heating ground dwelling reptiles, and compliment heating by overhead light bulb. The original hot rock consisted of a brick with an eight ohm, ten watt resistor cemented in the center of it and connected to an electrical cord which exited through the end of the brick. More advanced models have been available for some time. Some, such as Sizzle Stones®, have a somewhat naturalistic appearance. All hot rocks should be buried so they are just below the substrate.

Hot rocks of all varieties do warm to an effective temperature. Unfortunately, the materials being used in the construction of hot rocks do not always dissipate heat well. This can sometimes lead to the formation

of a small area of the rock becoming too hot and other portions of the rock remaining cool. There have been documented cases of thermal burns in reptiles resulting from the improper use of the earlier hot rocks. Compared to heat pads, hot rocks have far less surface area. Improved types of hot rocks, if buried in the substrate, are still quite useful as a secondary heat source for snakes and certain terrestrial lizards. Even the more advanced models should be regularly checked with the undersides of one's fingers to be certain they are heating properly and no "scorching spots" have developed through a malfunction. However, I can see no application where any form of hot rock can be utilized effectively as a primary heat source. Hot rocks in many types of enclosures can not be used as effectively as a secondary heat source as can heat pads or heat tapes. Unfortunately, hot rocks are often recommended for herps that will not use them properly, such as box turtles and fully arboreal lizards.

Another product on the market is **adhesive heat pads**. These are designed to stick to the bottom of herp cages. These pads are small with little surface area. I have spoken to individuals who have said that adhesive heat pads have become so

hot that they cracked the glass bottom of terraria and warped or melted plastic herp enclosures. I do not recommend their use.

Improved types of hot rocks, if buried in the sub-

used in conjunction with heat pads. Many lizard and tortoise species benefit from a "very hot" basking spot. This can be an area of the enclosure where such a bulb is mounted on the undersurface of the top of the enclosure or on a screen portion of the top. The spot bulb should be operating about two thirds of the daylight portion of the species' photoperiod. Large female boids which have successfully copulated can also be provided with a similar spot bulb set-up to provide extra heat during the gestation period.

Spotlight bulbs are an important source of heat for arboreal herps. Many arboreal species will not descend from branches to utilize substrate heat. For these species, the appropriate wattage heat bulbs must be supplied. The bulb placement should be such as to allow for thermoregulation. One end of the cage can be fitted with lighting fixture(s). Several branches should be provided throughout the enclosure, with some angling upward under the heat bulb(s). In this type of an enclosure set-up, the arboreal inhabitants can move across from branch to branch as well as up, and down to warmer or cooler areas of the cage. The light bulbs should not be within actual reach of enclosure inhabitants, as burns can occur. Locating the bulb on the ceiling rather than on the sides also minimizes burns, as burns occur when the animal lies on the bulb. Most reptiles cannot drape over a ceiling suspended bulb. In some situations a loose covering of the bulb with one quarter inch hardware cloth may be the only needed precaution. Red light bulbs can be operated as a heat source at night without affecting photoperiod.

Any heating devices may be connected to automatic timers for nighttime temperature drops.

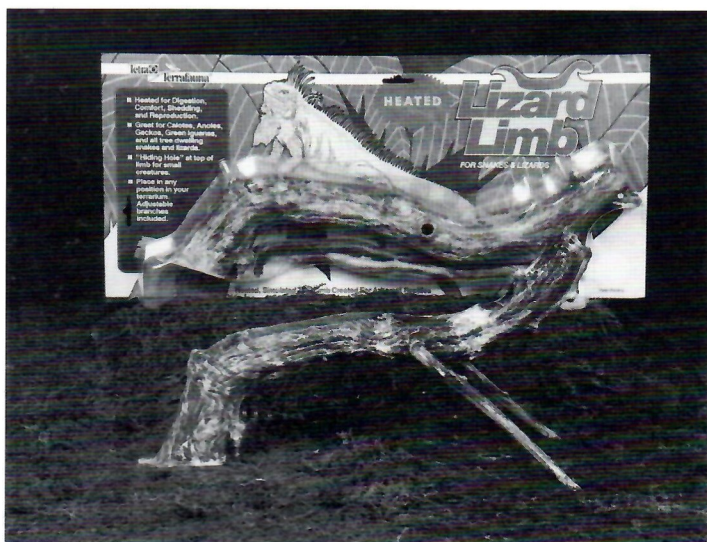
Aquatic Heating

When heating water for aquatic herps, I have had excellent results using the Ebo Jager® submersible heater. The heaters are available in several sizes and wattages and are fully adjustable.

Products for Precise Control of Heating Devices

An output limiting device is necessary where overheating is possible. One of these products should be used with any of the above heating devices where a rheostat or dimmer switch is called for.

The dimmer box is solid state, has a 600 watt rating, and can be mounted in a convenient location. One or two heating devices



Heated Lizard Limbs®, hot rocks and rock heaters can be used as a secondary heat source. All hot rocks and Sizzle Stones® should be buried just below the substrate at the "warm end" of the enclosure.

so hot that they cracked the glass bottom of terraria and warped or melted plastic herp enclosures. I do not recommend their use.

Overhead Heating

Spotlight bulbs in the 50, 75 and 100 watt range can be a useful heating supplement when

AFH Perspective

can be plugged into the dual receptacle. As a knob is turned clockwise, the neon indicator light intensifies as power increases, and heating device(s) become warmer. Dimmer boxes are available with a three or six foot cord, and contain UL listed material. One thousand and fifteen hundred watt units are also available.

The Microclimate thermostat® is available in 260 watt and 560 watt maximum models, and is also used to regulate herp heating devices. It is a proportional thermostat with a range of 64 - 92° F (18 - 33° C). Microclimates can accurately maintain preset temperatures, as ambient temperature differentials do not affect operation. Many features are available on the deluxe model such as programmable nighttime drop, digital readouts, high and low recorded temperatures, indicator light, and an alarm. The remote sensor is useful when incorporated into an incubator.

Although I have not personally used either of the temperature control devices, many are in use, and I have received only positive comments on both products from other herpetoculturists.

Sources for the Products Discussed in this Column:

Pipe heat tapes; Fiberglass heat pads; dimmer boxes: These can be obtained from a number of herp product dealers including Keith Wisner, 2947 Kenmore, Berkley, MI 48072. (313) 546-5287.

Galvanized heat pads: Available from a number of herp dry good dealers including The Herp House, 1750 Haines Road, Orwell, OH 44076. (216) 685-4615.

Microclimate thermostats, Flex-Watt® heat tape: Available from several herp product dealers including Bob Clark, 12316 Val Verde Drive, Oklahoma City, OK 73142. (405) 749-0797.

Thermal Regulator Model TR2 by Custom Reptile Network, 14 Francis Ave. Nyack, NY 10960.

Sizzle Stone (Hot Rock) by Tetra-Terra fauna, 201 Tabor Rd., Morris Plains, NJ 07950.

High Range Reptile Thermometer, Repticare Rock Heater (Hot Rock), Repti Therm U.T.H. (under tank heater). All by Zoo Med, Inc., 3090 McMillan Rd., San Luis Obispo, CA 93401-9946.

Hot Rocks® and Sizzle Stones®; adhesive heat pads; and Ebo Jager® submersible heaters (El Segundo, CA): Most pet shops which stock reptile supplies carry these products.

Spotlight bulbs: Most lighting dealers, especially large hardware stores, have these available.

Red light bulbs: Most large hardware stores carry or can order these items. 

On May 17 1993, William Bassett, a 47 year old businessman from Harahan, Louisiana died from a heart attack which apparently occurred during a struggle with his 16 foot reticulated python. This sad incident has been reported in numerous newspapers and was aired on television nationwide. When initially reported the papers stated that Bassett had been suffocated by his python following a struggle during which he stabbed the snake three times with a kitchen knife. The newspapers generated a lot of negative P. R. for keepers of large snakes with the following headlines:

"Snake crushes man." Houston Chronicle, May 19, 1993.

"Python squeezes its owner to death." The Times Picayne, May 18, 1993.

"Law didn't stop snake owner whose beloved pet killed him." The Times Picayne, May 19, 1993.

"Snake owners get creeps over death." The Times Picayne, May 19, 1993.

What received a small headline a few days later was the coroner's report.

"Coroner: Python grip didn't kill its owner." [citation missing]

Zoos were contacted by reporters about the incident. Andy Snider, assistant curator of the Audubon Zoo, according to The Times Picayne, said, "The zoo does not recommend snakes as pets, even those that are harmless." Andy Lieberman, reptile curator of the San Diego Zoo, was quoted as saying, regarding 16 foot snakes and presumably other giant snakes, "They're not pets and people who keep them as pets are foolish." The Times Picayne, May 19, 1993.

As should be obvious from the above, the irresponsible keeping and handling of large snakes can have consequences which could affect the rights of many herpetoculturists who keep these reptiles. Because of this incident, the AFH has decided to make available its guidelines for the responsible

keeping of large pythons and boas free upon request. The AFH recommends that a copy of its guidelines or similar guidelines be given to every new owner of a large boa or python at the time of purchase. The guideline which recommends that another person always be present during the maintenance and handling of any snake over eight feet is probably one of the most important and unfortunately one of the most ignored by snake keepers who think they know it all. If William Bassett had had someone present at the time of the incident, he would probably be alive today.

Philippe de Vosjoli, President



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LIZARD TALK

By Allison Alberts, Ph.D.



Dr. Allison Alberts is currently employed as Associate Physiologist at the San Diego Zoo's Center for Reproduction of Endangered Species. She did her graduate research at the University of California, San Diego, on the evolution of

chemical communication in desert iguanas. Her ongoing research projects include long-term field studies of Cuban ground iguanas, studies on reproduction in captive white-throated savanna monitors, and studies on communication and social dominance in green iguanas. She has had the opportunity to study lizards in many parts of the world, including Fiji, Mexico, Costa Rica, and the West Indies. She currently serves on the Lizard Taxon Advisory Group of the American Association of Zoological Parks and Aquariums and maintains a strong interest in lizard conservation.

Until relatively recently, amphibians and reptiles were often thought of as less sophisticated vertebrates, lacking the complexities of social behavior seen in warm-blooded animals. But herpetoculturists have always known better. Far from being inferior to birds and mammals, amphibians and reptiles possess a wide variety of intricate adaptations appropriate to their unique lifestyles and the array of microhabitats in which they are found. This is evident not only in the strategies they use to hunt for food, avoid predators, grow and thermoregulate, but especially in the diversity of social interactions they display. Lizards, in particular, exhibit a wide variety of social behaviors, especially in the contexts of territorial defense, maintenance of complex dominance relationships, and strategies for finding and attracting mates. One of the most important components of lizard social relationships involves the ways in

which lizards communicate.

Given the variety of colors, patterns, and visual displays seen among lizards, it is not surprising that many species have very good vision. The retinas of lizard eyes usually contain well-developed cone cells. The ability to distinguish color has been demonstrated in diverse lizard families, including agamids, iguanids, lacertids, and teiids. In addition, the field of vision of the two eyes may overlap, permitting lizards some degree of binocular vision. This is especially true for chameleons, which are able to move each eye independently. Although these visual abilities can be crucial for locating and capturing prey, they also play an important role in the reception of social signals.

Visual communication in lizards usually takes one of two forms, involving either passive changes in body color or active headbob displays. Color changes can be seasonal, developing slowly over a period of weeks, or physiological, occurring rapidly over seconds, minutes, or hours. By far the most common type of seasonal color change involves the adoption of specialized breeding colors. In one of the most striking examples, the heads of dominant male rainbow lizards, *Agama agama*, turn bright orange, vermillion, or yellow during the breeding season, whereas those of subordinates retain the dark reticulate pattern characteristic of non-breeding adults and juveniles (Cooper and Greenberg, 1992). Because dominant males only direct aggression toward brightly colored individuals, subordinate males can avoid unwanted attacks by remaining inconspicuous. Other well-known examples of seasonal color changes include the development of orange pigmentation in adult male green iguanas, *Iguana iguana*, and the deepening of the blue belly patches in male spiny lizards, *Sceloporus*, during the breeding season.

In several iguanids and agamids, gravid females develop reddish-orange patches at certain times of year (Cooper and Greenberg, 1992). These colors are associated with active rejection of courtship by females, which may include side-hopping away from males and even aggressive attacks. When shunning the advances of males, gravid females orient the orange patches toward the offending male and compress their bodies laterally so that the bright colors are maximally exposed. Hormonal studies have shown that increases in circulating levels of progesterone, testosterone, and estrogen are responsible for the emergence of orange coloration in gravid females. By visually communicating to males that they are no longer receptive, females may avoid unwanted courtship, save energy and possibly reduce their risk of exposure to predators.

Physiological color changes are particularly common among chameleons, which can quickly assume bright color patterns during bouts of sexual and aggressive behavior. In the elephant ear chameleon, *Chamaeleo brevicornis*, parts of the male's head and rostrum turn white during stand-offs and fights. During courtship, however, these areas turn red, and the eye coverings turn yellow, while a dark reticulated pattern appears on the flanks. The occurrence of two distinct color patterns, one for courtship and one for aggression, has also been reported in several other species of chameleons, including *C. nasatus*, *C. willsii*, *C. gastrotaenia*, and *C. parsonii* (Parcher, 1974). Although not well understood, the physiological mechanisms responsible for these color changes probably involve variation in levels of particular hormones and neurotransmitters.



Varanid lizards such as this white-throated savanna monitor (*Varanus albigularis*) rely heavily on chemoreception in their detection of conspecifics. Photo by John Phillips.

Both the Fiji crested iguana, *Brachylophus vitiensis*, and its close relative, the Fiji banded iguana, *B. fasciatus*, also display the ability to shift body color within a relatively short period of time (Gibbons, 1981). Normally, these lizards have a green background with vertical white or blue bands on the body and tail. In as little as five minutes, however, the entire background can shift from green to jet black. The changes begin on the back and sides, rapidly progressing to the underside, limbs, and head. These lizards are strongly territorial in the wild, and color change usually occurs during confrontations between adult males. However, darkening in males also sometimes occurs during the initial stages of courtship. Rather than having a specific communicative function, color changes in Fijian iguanas may simply signal that the animal is aroused.

Headbob displays constitute the other

major type of visual signals utilized by lizards. Despite the fact that these displays are found in a tremendous variety of species and are easily observed, their precise functions remain unknown. In many iguanid species, headbobs are given soon after an animal moves to a new location, suggesting that they may serve as an advertisement of spatial position, or aid in territorial defense. Sagebrush lizards, *Sceloporus*

graciosus, exhibit individual differences in the frequency of their display and their bobbing patterns, features that may allow lizards to recognize one another (Martins, 1991). Studies of grass anoles in Panama reveal that the form of the headbob display can be influenced by the environment in which the signalling lizard lives (Fleishman, 1988). The speed and amplitude of headbobs in these anoles maximizes their detectability against the background motion of vegetation in the wind.

Because chemical signals can persist in the absence of the signaller and are not blocked by

noted for their tongue-flicking behavior, in which the tongue is extended and touched to objects in the environment. The forked tongues of certain groups such as teiids and varanids may be especially adept at delivering chemical signals to the paired ducts of the vomeronasal organ (Simon, 1983).

Field observations suggest that male and female Komodo dragons, *Varanus komodoensis* may recognize one another using chemical signals. Males repeatedly touch their tongues to the body and head of their mates, especially around the eyes, nostrils, and at the junction of the hind legs and the body (Auffenberg, 1981). Such mechanisms probably operate in many other species as well. Certain lizards may even be able to recognize their kin using chemical cues. Three month old green iguanas spend more time in enclosures marked with odors from their siblings than



This Fiji crested iguana (*Brachylophus vitiensis*) photographed on the beach at Macuata Island, Fiji, provides just one example of the tremendous variety of color patterns found among iguanid lizards. Photo by Douglas Bolger.



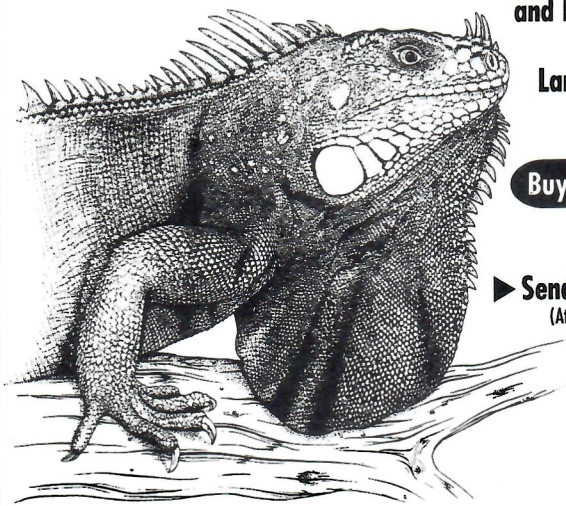
An leopard lizard (*Gambelia wislizenii*). Bright orange coloration can be common in gravid females of some species of iguanids, including leopard lizards. Photo by Allison Alberts.

vegetation or other environmental obstacles, they may be superior to visual signals for particular functions. In addition to their nasal olfactory apparatus, many lizards possess vomeronasal organs, structures that detect molecules brought in on the tongue. Although vomeronasal organs are also present in many mammals, they reach their highest level of development in lizards and snakes. Many lizards are

in those occupied by unrelated individuals (Werner et al., 1987). Female skinks of the genus *Eumeces* appear to recognize their eggs by smell. In this genus, females constantly turn the eggs in the nest, and if any are removed, females retrieve them by gently pushing them back into the nest with their snouts (Mason, 1992). When foreign eggs are experimentally introduced, females investigate them with a single tongue-flick and subsequently reject them. Blind-folded females are fully capable of making this discrimination, indicating that chemical rather than visual cues are involved in egg recognition.

Many male chameleons possess temporal pouches from which they secrete glandular deposits onto tree branches. These

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secretions, which are intensively tongue-flicked by other males, probably act as chemical signals to maintain male spacing (Mason, 1992). One of the most common scent glands in lizards, the femoral glands, may also function in home range marking. Femoral glands open to the exterior through a series of pores along the undersides of the hindlegs (Cole, 1966). Each gland contains a small amount of paste-like secretion that is rubbed off as the animal moves through its habitat. Femoral glands are better developed in males than in females and are most active during the breeding season. Different individuals possess chemically distinctive secretions, suggesting that they may be individually recognizable. In desert iguanas, *Dipsosaurus dorsalis*, femoral gland secretions strongly absorb longwave ultraviolet light, a feature that may aid in detection of secretion deposits in the environment (Alberts, 1989).

Although the eardrum is rudimentary or absent in many burrowing lizards, hearing abilities appear to be quite good in other species. Even so, most lizard groups do not employ auditory signals for social communication. One notable exception is the nocturnal geckos. One of the best studied species, the house gecko, *Hemidactylus frenatus*, employs three distinct types of calls, each with a different function (Marcellini, 1974). The most frequent vocalization is the multiple chirp, com-

posed of a series of up to eight or more short clacking barks. Multiple chirps are especially common before an animal moves out from a retreat to feed and are often answered by other, nearby individuals. Males usually emit the call when they detect another male. These calls may function to intimidate potential competitors, as house geckos can be highly territorial, especially around artificial light sources that attract an abundance of insects.

The churr call is heard much less often and almost invariably just prior to one male attacking another. This rapid series of quick chirps is short in duration but can be very loud, sometimes audible to humans up to 115 ft (35 m) away. Churrs are only given by males, and probably signal impending assault. The final type of call emitted by house geckos is the single chirp. Both sexes give this call, usually either when grasped by humans or occasionally in the midst of fighting. This call may aid a distressed gecko to escape, not only by startling the aggressor, perhaps prompting the gecko's release, but also through the expulsion of air, making the victim slightly smaller and possibly allowing it to wiggle free.

Although information concerning the ways in which lizards communicate is increasing all the time, there is still much that we do not yet understand. A great deal remains to be learned about the relation-

ships among the structure of signals, their social functions, and the physiological mechanisms controlling their production and reception. Simply by observing their animals and keeping careful records of the types of signals observed and the contexts in which they occur, herpetoculturists can make a valuable contribution to this growing body of knowledge. There is little doubt that unravelling the fascinating mysteries of how lizards communicate will eventually go a long way toward helping us understand lizard behavior in general.

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The Texas Rat Snake

(*Elaphe obsoleta lindheimeri*)

by
Hugh Blake

During my short and, as yet, relatively undistinguished career in herpetology, I've had the opportunity to work with a number of species of colubrid snakes. Some have been a real pleasure to work with, while others have been less than pleasurable. Some types of snakes are very clean, have a good disposition and are easy to work with. Then, there is the Texas rat snake (*Elaphe obsoleta lindheimeri*) (Baird & Girard, 1853). I've encountered several wild specimens in their native habitat and have generally found their disposition to be less than pleasant. Granted, almost all specimens will retreat if given the opportunity, but most will also strike repeatedly, if cornered. As if biting were not bad enough, they will usually also relieve themselves on you, if restrained. Captive raised specimens do calm down, but frequently still may bite, if handled.

The defensive posture of Texas rat snakes has been well described in literature (Forks and Forks, 1982) and can be intimidating to people not knowledgeable about these snakes. When threatening, the Texas rat snake will rear back into an s-shape with the forebody, and gape with its mouth, often extending its tongue. It frequently will rapidly vibrate its tail. If it is resting in dry leaves, the sound is not that dissimilar to a rattlesnake. There is also much similarity between the defensive posture of the cottonmouth (*Agkistrodon piscivorus*) and the Texas rat snake, suggesting mimicry.

Texas rat snakes are one of the few varieties of large snakes which can survive around people. Many of the calls that the Houston Zoo receives regarding a snake identification turn out to involve Texas rat snakes. Usually, the identification is based upon a shed skin, but occasionally the entire specimen, regrettably usually dead and often in pieces, is brought in. In human dwellings, shed skins seem to be most commonly found in attics. Indeed, most rat snakes are very good climbers and are frequently encountered by people in trees, barns, or attics. The display enclosure at the Houston Zoo reflects the type of envi-

ronment in which local visitors might encounter such a snake.

In the course of researching this article, I found that the common name for this reptile, Texas rat snake, was not widely used before 1960. Lindheimer's pilot snake, or the Texas pilot snake were the two most commonly used names in older references, but there were eleven other common names that at one time or another have been applied to this serpent. The name Lindheimer is after Ferdinand Jakob Lindheimer, a German botanist who arrived in Texas in the early 1800s after being shipwrecked off the coast of Alabama. It was Baird and Girard who originally described the Texas rat snake in 1836.

The range of the Texas rat snake extends from central and southern Louisiana westward to central Texas into the eastern half of Texas. Texas rat snakes are generalists and inhabit a variety of habitats, but are more common in drier deciduous forests than swampy areas.

These snakes are typically yellowish-brown with a series of 25 to 35 dark brown patches along the dorsal surface. The belly is off-white or yellowish. Several color variations have been developed through selective breeding in captive populations including a leucistic phase. This morph is entirely white except for pigmented eyes. A less frequently seen phase is the piebald morph. Piebald specimens look similar to the leucistic form except that brownish or off-white spots are present on the scales.

In captivity, Texas rat snakes will typically accept a diet of rodents as one might infer from their common name. Neonates are typically fed pink mice, larger juveniles freshly killed adult mice, and adults dead rats presented on a pair of feeding tongs. As with other rodent-eating snakes, it is important to get captive specimens to accept dead prey. Although rat snakes are powerful constrictors, they can still be bitten and injured, if trying to subdue live rodents. Generally, avoid handling for at least a day after feeding and avoid feeding too large of a food item to a snake as this

increases the possibility of regurgitation. All of the specimens that the author has worked with have had odiferous feces, regardless of type of prey accepted.

Captive *Elaphe obsoleta lindheimeri* not in breeding programs can be maintained in the mid to upper 80s° F (29-32° C) during the day and low 70s° F (21-23° C) at night year round. A hidebox should be provided for cover so that the snakes are not stressed. A water bowl should also be included. A sturdy tree branch or other prop for climbing is highly recommended as these snakes frequently climb and are often encountered at an elevated location in the enclosure. Paper makes an ideal functional substrate for these snakes. Artificial grass or Astroturf® will also work well. If artificial grass is to be used, have a second piece on reserve so that one can be used in the enclosure while the other is being washed and dried. Avoid small bedding chips that are meant for use with rodents as potentially this material can be accidentally digested by the snakes. Such ingestion can be a serious matter. Two problems with ingestion of wood chips are that it may cause irritation of the G.I. tract or impaction. Either of these ailments would need to be treated by a reptile veterinarian if, through poor management, they were allowed to occur.

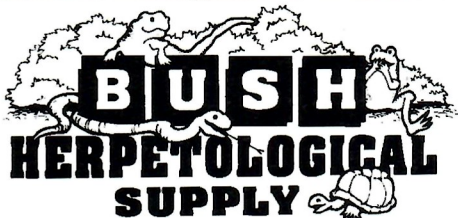
The Texas rat snake has been routinely bred in captivity. To stimulate breeding, each of the adult specimens should be separated and put into a cool area in the late fall for hibernation. The photoperiod should be reduced to simulate a shorter light cycle typical of the fall and winter seasons. During this period, eight to ten hours of light and fourteen to sixteen hours of darkness works well. Prior to cool down, the snakes should not be fed for two weeks to allow time for their gut to empty. The temperature may be brought down to approximately 60° F (16° C) for the duration of the brumation. Our specimens have been exposed to temperatures as low as 55° F (12° C) without problem. Because these snakes are native to a southern U.S. lati-



A leucistic Texas rat snake (*Elaphe o. lindheimeri*) Photo by Jeff Early.



A normal phase Texas rat snake (*Elaphe o. lindheimeri*). Photo by John Tashjian courtesy of the Houston Zoo.



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tude, they may not need as extended or as steep a drop in temperature as may some of the more northern ranging *Elaphe*.

After the two month brumation period, the specimens can be returned to their regular regime. Introduce the specimens for short periods of time, and observe if mating behavior commences. If so, leave the specimens together until any courtship and mating is finished, and then separate them. If no mating behavior occurs, separate the snakes and try a reintroduction again in a day or two. Some specimens may need to be lightly misted with water to help stimulate courtship behavior. It can also be useful to have multiple males available to stimulate dominance if housing a single pair together does not prove effective. After the initial mating, continue to separate and reintroduce the specimens. If the snakes are kept together continuously, the male may lose interest in mating with the female. Multiple matings may increase

specimens may ingest the eggs as soon as they are laid. We have experienced oophagy, the act of ingesting eggs of the same species, not only with this taxon, but also with our Honduran and Pueblan milk snakes (*Lampropeltis triangulum hondurensis*) and *L. t. campbelli* and western hognose snakes (*Heterodon nasicus*). It is typical for gravid female Texas rat snakes to refuse food. While this alone does not imply that the female is gravid, it is a good sign. The gestation period for *Elaphe obsoleta lindheimeri* is between 2 1/2 and 3 months.

Clutches may vary from several to up to thirty eggs. Our females typically lay three to six eggs. These are set up in a plastic shoebox containing damp vermiculite. Small air holes are present in the lid. The eggs are incubated at 78-80 F (26-28 C). We do not feel the level of humidity is critical. The vermiculite should be moist enough to cause condensation on the inside of the shoebox. The incubation time for the eggs is about two months if incubated within the temperature range mentioned.

Neonate Texas rat snakes can be initially set up in a well ventilated plastic shoebox with a water bowl and a hidebox. After the first shedding, most will accept pink mice. Periodically, mist the enclosure with warm water to reduce the possibility of dehydration as most neonate colubrid snakes are much more prone to dessication than the adults. Typically, leucistic specimens as hatchlings are pink and lack pigmentation on a portion of the top of the head. After several months a leucistic juvenile will become totally white in color.

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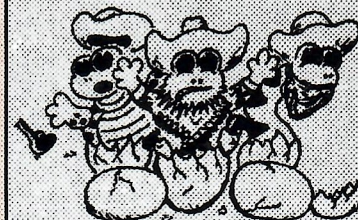
Tennant, A., 1984. The Snakes of Texas.

continued on the next page

the chances for successful insemination.

If, after mating, the female puts on mid-body weight and appears to be gravid, she should be set up separately. There is always the problem with this species that other

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Rat snakes may be encountered in barns or sheds as reflected in this exhibit design at the Houston Zoological Gardens. Photo by Paul Freed.



Normal and leucistic color phase hatchlings *Elaphe o. lindheimeri* in defensive posture. Photo by Jeff Early.

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AFH BUSINESS

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Notes on Three Species of Frogs of the Genus *Mantella*

by
Francois Le Berre

Frogs of the genus *Mantella* are among the most colorful and interesting of the anurans. Although once classified as dendrobatid frogs, *Mantellas* are currently considered members of the family Ranidae, subfamily Mantellinae. The genus *Mantella* is endemic to the large Indian Ocean island of Madagascar. During the past five years, considerable numbers of these frogs have been exported for the pet trade and made available to herpetoculturists in Europe and the United States. However, the habits and requirements of *Mantellas* are not well known to the average herpetoculturist. The purpose of this paper is to present information acquired by the author on the habits of three species of these brightly colored little frogs: *M. aurantiaca*, *M. "cowani,"* and *M. laevigata*.

Golden Mantella (*Mantella aurantiaca*)

Mantella aurantiaca is one of the better known species in this genus. Adults measure from 1/2 inch (1.3 cm) to nearly 1 inch (2.5 cm) in length, and there are four color forms of this species currently known. The color morphs include the typical bright orange form, a yellow form, and the less common red form. The most recent morph discovered is dark red with one black spot behind each eye. These colors and patterns vary, depending on the area of origin. Until recently, scientists considered this species to occur primarily in the region of Perinet. It is now known that *Mantella aurantiaca* is widespread throughout the southern half of eastern Madagascar, living near the ponds and in the understory of remaining patches of rainforests.

M. aurantiaca typically can be found in large colonies. They may be encountered nearby small, shallow pools and ponds. These primarily "pool edge" frogs do not swim well. It is not unusual to find an individual specimen drowned because the pond was too deep. When in proximity of *Mantella* inhabited ponds, it is not uncommon to hear males call. The soft chirping noise sounds like "teek-teek-teek." It is typical for the edges of the ponds to be fully covered with densely tangled brambles. These plants may afford the frogs some protection. Additionally, the vivid warning coloration of these anurans may also help protect against predators

THE VIVARIUM

although, as far as I know, research on the skin toxins in these frogs has received only limited study.

Mantella aurantiaca typically is only found in remaining undisturbed patches of rainforests, usually quite deep into the forest at lower elevations, generally below 2,600 feet (800 m). In the cool/dry season, which lasts from May to September in southeast Madagascar, golden mantellas undergo a resting period. During this time, they usually remain hidden under dead leaves and sometimes may even be partially buried underground to protect themselves from the relatively dry external environment.

As the cooler, dry season ends, warmer temperatures begin with the first storms. The first rains usually elicit reproductive behavior. Egg clutches typically consisting of 20-60 eggs, but sometimes up to 100 eggs, are laid under dead leaves or logs. Subsequent rain results in the eggs being washed into the pond. Tadpoles hatch 24 to 72 hours after the eggs are deposited in the water. Some herpetoculturists suggest that the whitish eggs are light sensitive and have advised that special efforts should be made to keep the eggs in complete darkness during embryogenesis, but the author has not been able to confirm this. Although several authors have stated that embryogenesis in this species lasts two weeks, this author has never witnessed such lengthy egg development in his own breeding programs. In the wild, the tadpoles feed on debris found in the water and fully develop in four to five weeks in water about 68°F (20°C). In some instances, in both the wild and in captivity, tadpoles may take up to eight weeks to metamorphose. Following metamorphosis, the surprisingly large froglets (1/3 - 1/2 inch (8 - 12.7 mm) in length) emerge from the water. Other than their smaller size, they are very similar to the adults. There are only minimal differences in coloration. Recently metamorphosed froglets may be a little more brown or yellow.

Determination of Sex

There is little sexual dimorphism. Male golden mantellas are typically smaller and less heavy bodied than females. Most smaller imported adults are usually males. The coloration of males tends to be darker and often a little more intense than that of females. It is typical for males to call when they are ready to breed.

Care in the Terrarium

All varieties of *M. aurantiaca* have to date proven relatively easy to maintain in a vivarium. *Mantella* are social anurans that can be kept in groups. The temperature in the vivarium should be maintained at 68 - 74°F (20 - 23°C). The terrarium should be landscaped to simulate a natural environment. The substrate, usually a soil mix, needs to be lightly acidic, which can be accomplished by using tree fern bark as a substrate with a layer of leaf litter consisting mainly of dry fern and oak leaves. A soil-sphagnum moss mix will also work.

A shallow water area should be created. It is important that the water is no deeper than the height of a frog when it is at rest or about 1/2 - 2/3 inch (1.3 - 1.7 cm). Dead leaves are useful. Shelters can be made from hollow coconut shells, or from the dark bases of 2 liter plastic soda bottles. These should be placed along the edge of the water. The temperature needs to be between 70 - 72°F (20 - 21°C). Too cool or warm water may lead to health problems for the frogs. As *Mantella* like to climb and move about, it is a good idea to include branches and plants such as pothos or bromeliads.

Breeding will not occur unless the animals are kept under very specific conditions. It is necessary to provide the animals with a rest period of two to three months, dropping temperatures and relative humidity. Following the return to normal conditions, to simulate the rainy season in order to initiate mating behavior, a rain chamber using a small water pump should be constructed. In their natural habitat, it typically rains mostly during midday for one to two hours and at least twice each night. This can be simulated through the use of multiple setting timers. The frogs will normally lay their eggs inside the shelters along the water's edge and, if the vivarium is well designed, the tadpoles will eventually fall into the water following a simulated rain. The tadpoles can be raised on tubifex worms and Tetra Min Five Star Formula® Vitamin Enriched Flakes.

Standard fluorescent bulbs can be used in the terrarium, as UV does not appear to be required by this species. In my experience, if tadpoles are not given enough iodine, they may suffer bone growth problems resulting in weakened adults.

As for diet, each adult frog requires three dozen or more fruit flies (*Drosophila*) or pin-

Mant



Mantella laevigata, a species with habits reminiscent of poison dart frogs (*Dendrobates*). Photo by Francois Le Berre.



The green mantella (*Mantella viridis*) is found in Northern Madagascar. Photo by Jim Bridges.



Mantella expectata. The habits of this recently described (1992) species are known at the present time. Photo by Dave Travis.



Red morph of the golden mantella (*Mantella aurantiaca*). Photo by Jim Bridges.



An unusually vivid golden mantella (*Mantella aurantiaca*). Photo by Francois Le Berre.

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Blue/black morph of the painted mantella (*Mantella cowani*). Photo by Francois Le Berre.

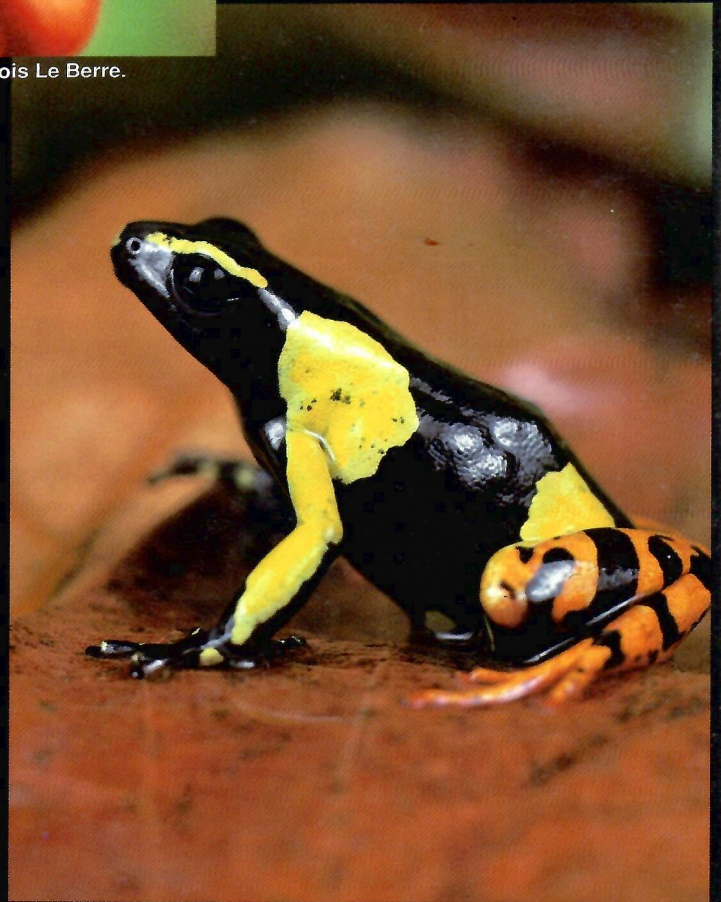


Green/black morph of the painted mantella (*Mantella cowani*). Photo by Francois Le Berre.

not



Orange morph of the golden mantella (*Mantella aurantiaca*). Photo by Francois Le Berre.



Yellow/black morph of the painted mantella (*Mantella cowani*). Photo by Jim Bridges.

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Painted Mantella (*Mantella "cowani"*)

Note: This so-called species and its several color morphs are currently considered by most Madagascar amphibian specialists to be morphs or possibly subspecies of *Mantella madagascariensis*. More work is needed and this is still under debate. The author has chosen to use the better-known term *Mantella "cowani"* to refer to individuals of this form.

How many varieties of *M. "cowani"* are there? AT this point, I don't think anyone yet knows. So many color morphs appear as *M. "cowani"*, varying from black and yellow to blue and black or black, red, green, blue, yellow and white, with or without the "black suit," that it is at the present time impossible to give a definitive answer.

In the wild, *M. "cowani"* is found under living conditions similar to *M. aurantiaca*, except that it is usually found higher up in the mountains, throughout the remaining portions of eastern mountainous coastal forests. In some parts of Madagascar, the two species *M. aurantiaca* and *M. "cowani"* are sympatric and interbreed. The hybrids remain fertile, resulting in populations with highly variable colors and patterns.

The biological cycle of the painted mantella is the same as for *M. aurantiaca*. If the males start to call when the rains begin, it may not necessarily because of the elevation of the rela-

tive humidity. It is possible the frogs are excited by the noise the raindrops make on the foliage, which is quite similar to the call of other males. If one plays a recording of rain dripping on leaves to *M. "cowani"* males, individuals will call loudly as if to challenge a possible rival. Breeding is similar to *M. aurantiaca*, except that clutches consist of 30-50 eggs.

M. "cowani", much like *M. aurantiaca*, prefers a damp and rather cool environment. This species is a better swimmer and climber than *M. aurantiaca*. Although not normally found high in trees, from time to time a group of several of these frogs can be seen crowded in a bow formed by an interjunction of branches.

While *M. "cowani"* are not typically considered very toxic, birds and lizards have been seen spitting them out after picking them up. Apparently, the frogs are not palatable, at least to some potential predators. In fact, little is known about the predators of mantellas. In the wild, individuals in some populations appear to be bolder than others, being more conspicuous among the dead leaves of the forest floor.

Care in the Terrarium

Manage this species as you would *M. aurantiaca*. A medium size terrarium is suitable. You can maintain a group of ten animals in a 28x28x18 inch (70x70x45 cm) enclosure. *M. "cowani"* can tolerate lower temperatures than *M. aurantiaca*, 65 - 74°F (18 - 23°C), but still needs a high relative humidity (85 to 100%). A cool/drier resting period of two to three months is necessary for them to remain healthy. They will feed on small invertebrates, including tiny crickets, fruit flies, and larvae of the wax moth.

Mantella laevisgata

Mantella laevisgata is one of the most beautiful frogs in all Madagascar. The entire body is velvet black. There is a large, bright green spot present on the back. The toes of the feet are sometimes spotted with light blue.

This frog lives in northeastern Madagascar, near Maroantsetra and Cape Masoala, where another species, *Mantella betsileo*, is also found. The author has never observed any interbreeding between these two species, as in *M. "cowani"* and *M. aurantiaca*. Like all painted frogs, *M. betsileo* lay eggs along the edges of small ponds created in sand depressions, always covered with a thick layer of dead leaves. *M. laevisgata*,

on the other hand, sticks its eggs one by one on the underside of leaves fallen onto the ground. One group of frogs, the author observed, were living on the slopes of a hill. Following strong rains, the dead leaves with eggs attached were washed to the bottom of the hill and into a pond. The author was once surprised to observe another colony of these frogs laying their eggs in the hollow stems of giant bamboo. The number of eggs per clutch was always less than ten. Compared to other mantellas, the eggs of this species are significantly larger. They are translucent with an initially dark nucleus in contrast to the whitish eggs of the two other species highlighted in this article. The tadpoles remained in the cavities and developed quickly and normally. In contrast to other painted frogs, *M. laevisgata* and *M. betsileo* are not only found in patches of remaining primary forests, but also in disturbed areas such as pineapple fields and degraded forests. *Mantella laevisgata* prefer hot climates and, depending on their localities, appreciate a high degree of relative humidity.

Upon close observation of this frog, the most striking aspects include their flat-ended "spatulated" toes which are directed away from the body, a long spinal column, and a unique body posture. Happening across them in the wild, their semi-arboreal habits quickly become apparent as they will climb easily on the bark of trees, on bamboo or onto rocks. The puzzling thing is that this climbing behavior and these physical characteristics are unknown among all other *Mantella*.

Care in the Terrarium

M. laevisgata does well in a relatively warm and humid terrarium, 31x20x20 inches (80x50x50 cm) managed in a group of up to ten individuals. The temperature should not drop under 70°F (21°C) and should not rise above 82°F (28°C). Relative humidity should be close to 90%, which can be maintained by installing a waterfall run by a pump. Design the terrarium with plants, cork bark and hollow bamboo stems as well as a shallow water container with a rock or a piece of sterile driftwood so that the frogs can easily climb out. The ground can be landscaped with moss and dead leaves, while light can be provided with fluorescent lamps, preferably full-spectrum bulbs.

If eggs are laid, the tadpoles will hatch at 75°F (24°C) within 24 hrs, if placed on a leaf just above or on the edge of a bowl of water. It generally takes two weeks before the tadpoles metamorphose, with froglets similar to, yet only one-third the size of, adults. *M. laevisgata* will mate and lay eggs several times per year during the warm rainy season from September to the end of April.

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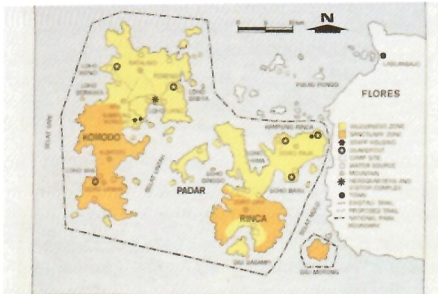
Special thanks to Philippe de Vosjoli for his extensive review of this article and for his editorial assistance.



Dragon Tales

The History, Husbandry, and Breeding of Komodo Monitors at the National Zoological Park

by
Trooper Walsh
Roger Rosscoe
Geoffrey F. Birchard



The range of the Komodo dragon includes the Indonesian Islands of Komodo, Rinca, Padar, and Western Flores. The Flores population is currently not a part of the Komodo National Park. Photo courtesy of Indonesian Embassy, Washington, D.C.

Introduction

Komodo dragons (*Varanus komodoensis*) are the world's heaviest living lizards. The longest specimen ever verified was a male, 10 ft 2 1/2 in (3.13 m) in total length, which weighed over 350 lbs (159 kg). Auffenberg (1981) states that the average length of approximately 100 animals observed and captured during his field study was 6 ft (1.8 m). Adult males generally grow larger than females and are commonly over 8 ft (2.4 m) in length and 200 lbs (91 kg). Females are usually under 8 ft (2.4 m) and weigh about 150 lbs (68 kg). Komodo monitors are predators as well as scavengers. They are at the top of their food chain. The dragons' keen sense of smell, if aided by favorable wind, enables them to seek out a rotting carrion from miles away (Auffenberg, 1981). The distribution of these lizards is restricted to a few volcanic Indonesian islands of the Lesser Sunda chain, including Komodo, Rintja, and the west coast of Flores. Reports of dragons on other nearby islets, including Padar, are probably based on records for transient animals. The total land area occupied by the dragons is approximately 390 sq miles (1000 sq km), or roughly one quarter the size of Rhode Island. Because of their remoteness, extremely small range, and isolation from human populations, these animals were not formally described by science until 1912 (Ouwens 1912).

The natural habitat of Komodo monitors is extremely harsh by human standards. There is very little available water during most of the year, although the monsoon season may produce local flooding. The average annual temperature at sea

level on Komodo island is 80° F (26.7° C). The hottest temperature recorded by Auffenberg (1981) was 110° F (43° C).

The History of Komodo Dragons at the National Zoo

The National Zoo has exhibited a total of seven adult dragons that have lived in captivity an average of five years. The first animal was obtained from the Griswold - Harkness expedition to Komodo island in 1934. This specimen was purchased for \$780 and it lived for 2 years. The second dragon was brought back by the National Geographic - Smithsonian expedition to Komodo island in 1937. This animal lived for 12 years. The third and fourth were gifts from Indonesia and arrived in 1964. One of these lizards died of amoebiasis after only three months. The other lizard, a female, lived for nine years. In 1970, she was provided with a male companion who lived five years. There were a number of instances of egg laying from dragon number four (Deprato, 1971). In January of 1967, eight eggs were laid. Twenty-seven eggs were laid in May of 1970 and 19 eggs were laid in October of the same year. An additional three eggs were found in September of 1971. In all cases the eggs were laid over a period of days and no nests were made. A few of the eggs were eaten by the female, most were desiccated when found, and the few that were incubated did not develop.

In our opinion, there are a number of reasons why dragons have done poorly in zoos and have



A park ranger arranges the bait. It has been noted that the feeding arena would be a bad place to slip and fall. Photo by Jon Coe. Coe, Lee, Robinson, Roesch Architectural Firm.

not bred. The animals that were exported were generally very large, older animals that were stressed by capture and shipment. The needs of the animals were not known and husbandry techniques were not optimal. For example, when the first animal arrived at NZP in 1934, there was some question as to proper diet. The zoo staff contacted Raymond Ditmars at the Bronx Zoo, who suggested feeding chicken, fresh beef, fresh lobster, ground round, squab, pheasants, and young pigs offered three times a day! Enclosures that held dragons were generally sterile, concrete exhibits without adequate heat. This was especially true in the winter when the dragons frequently stopped feeding and became inactive.

Our current dragons arrived at the National Zoo in May of 1988. These animals were a gift from the people of Indonesia and were offered to President



The pool at the NZP main exhibit serves as a retreat area and as a means of cooling off. Photo by Jessie Cohen, Graphics Department, National Zoological Park.

THE VIVARIUM



The dragons at NZP are fed mostly on rodents. Photo by Jessie Cohen.

Reagan in 1986 during a trip to Bali, and were presented to President Bush in 1988. Both animals were reported to be wild-caught from the island of Flores.

Housing and Husbandry

Upon arrival the animals were quarantined separately for 30 days in enclosures in the Reptile House basement. The male was 35 lbs (16 kg) and approximately 5 ft (152 cm) and the female weighed 20 lbs (9 kg) and was about 4 1/2 ft (137 cm). The light cycle was 12/12 (day/night). Supplemental heat was provided by quartz heaters which resulted in basking temperatures in excess of 100° F (38° C).

The exhibit currently housing our pair of Komodo monitors is L-shaped, and approximately 630 sq ft (58 sq m). The larger arm of the exhibit has plastic skylights over the entire top, and the short arm is an all glass greenhouse. The long and short arms are separated by shift doors. This allows the animals to be shifted for cleaning and separated for feeding and egg laying.

The exhibit has a dirt floor so the animals can dig freely. We feel this feature is very important to our success with this species for several reasons. First, our female is an extremely shy and nervous animal and although we have provided two artificial burrows, she almost always prefers to dig her own. Whenever we enter the enclosure she normally retreats to a burrow and stays there until everyone has left. Burrows do collapse on occasion but usually maintain their integrity. Second, the deep soil encourages the female to display

natural nesting behavior. When she is preparing to lay eggs she spends several days underground digging and tunneling, apparently looking for the right spot for the nest. The natural substrate also helps prevent foot injuries associated with the concrete floors of traditional dragon exhibits.

The larger wing of the exhibit has a three foot (0.9 meter) deep pool which is large enough to allow for the animals to swim. There are two large trees and a cycad in this enclosure. The short wing of the exhibit has a much smaller, shallower pool in which the animals can soak. There is a large banana tree on this side. Artificial burrows were provided in the form of two plastic 55 gal (208 l) drums with the tops removed. These are laid on their sides and covered with topsoil.

We maintain a daytime ambient temperature of 85 - 90° F (29 - 32° C). This is accomplished with forced air heaters. The nighttime lows vary with the seasons. During the summer the temperature gets down to 75° F (24° C) at night. In winter the temperature drops down to 60 - 65° F (16 - 18° C). Additional heat is provided 24 hours a day year round with three 1000 watt quartz heaters. During the summer months the ground temperature under these heaters can reach over 120+° F (49+° C). In our opinion, the opportunity to thermoregulate



A typical burrow entrance in the NZP greenhouse. Tail drags in the soil are swept clear daily by keepers during the egg-laying season to help establish activity patterns of the animals. Photo by Trooper Walsh, NZP.

and maintain high body temperatures has played an important role in our successful maintenance and breeding of Komodo dragons. The entire exhibit is hosed down every other day. There is no



The male dragon uses his rear leg to stimulate the female to lift her tail for breeding. Photo by Trooper Walsh, Department of Herpetology, NZP.

supplemental light, so the photoperiod of the exhibit is that of the Washington, D.C. area.

Diet

Our animals are fed whole, large rats once a week. The amount of food offered to each animal varies with the time of year and body condition. But we generally feed from 1 - 3 rats per animal. No vitamin supplements are used at present.

Courtship and Breeding

Since arriving at the National Zoo, our female has laid six clutches of eggs. We think that the first was laid in August of 1988, four months after arriving. Courtship behavior was noted, but egg laying was not observed. At the time we did not think that the female was old enough or large enough to breed and lay eggs. Although we searched for eggs they were not found until January of 1989 when the female dug up the eggshells from the rootball of the large cycad while looking for a place to lay her next clutch.

The first clutch was probably produced in August because the animals were still conditioned to a Southern hemisphere reproductive cycle. Since January of 1989 both animals have apparently adjusted to a Northern hemisphere light and breeding cycle and eggs have been produced January 1989, January 1990, December 1991, January 1992, and most recently in January 1993. We know that the female has eaten some of her eggs because we have egg fragments mixed in her feces. Early attempts at incubation of recovered eggs were not successful but we believe that the eggs were infertile.

In the wild, Komodo dragons are generally solitary animals. Our dragons normally paid little attention to one another although they used the same basking areas. Body contact was rare for most of the year. However, around the time that we thought the female was ovulating, contact became much more frequent. When actual copulation took place the animals were in physical contact all day. During this period the animals slept together in the open, and this was the only time the female did not retreat to a burrow at night. Similar constant contact began again on 7 December 1991. The male was in a state of constant attendance with the female at this time. He tongue flicked her feces, cloacal region, head, and neck. These tongue flicks were short and rapid as opposed to the long flicks of an alert or hungry animal. During the breeding season copulation took place almost daily. The male used one of his rear limbs to scratch the tail of the female.

At the time of the successful mating, the male was 7 1/2 ft in total length and 115 lbs (2.28 m and 52.21 kg). The female was 6 ft and 50 lbs (1.83 m and 22.67 kg).

The female accepted the male's constant atten-



A lizard with an attitude... "the world's cutest baby 1992." Photo by Jessie Cohen.

THE VIVARIUM



A clutch of 26 eggs was found on January 23, 1992 in the greenhouse under two feet of soil. Photo by Trooper Walsh, NZP.

dance for approximately three weeks. After this, she no longer tolerated the male and became quite aggressive towards him. This was the only time of year that she would not retreat to a burrow when keepers entered the exhibit and she would even charge the keepers.

In 1992, when we noticed the female rejecting the male we separated the animals. This was done to reduce stress on the female and to provide her with a place we thought was more suitable for egg laying and recovery. The ambient temperature in the greenhouse where the female was housed was lowered to 70° F (21° C) to encourage basking, and egg laying in the mound of topsoil under the hot spot. Soil temperatures directly under the heater were estimated to be around 90 - 95° F (32 - 35° C). The female ate sporadically for the next four weeks, and spent most of the daylight hours basking under the quartz heater. She spent every night in the artificial burrow. During the night of 17 January the female began digging burrows everywhere in the exhibit. From this time on she spent most of the days underground. On the morning of 23 January we noticed the female out basking and she was much slimmer. A mid-lateral fold of skin was evident along her belly. We decided to dig for eggs under the quartz heater hoping that our plan had worked. Using our hands, so as to not damage any eggs, we carefully excavated. At a depth of 24 in (61 cm), we uncovered the first egg. A clutch of 26 eggs was laid in the loose soil of a sealed nest chamber roughly the size of a basketball. The soil was moist but not wet and the temperature at the depth of the eggs was 77° F (25° C). The female remained in a new burrow at the opposite end of the greenhouse throughout recovery of the eggs.

The eggs were weighed and measured. The 26 eggs represented approximately 20% of the female's body weight. This ratio of clutch to female body weight is in line with figures given by Horn and Visser (1991) for other varanids. The average weight of the eggs was 5.85 oz (167.3 g) with a range of 5.5 - 6.3 oz (155.8 - 180.9 g). The eggs averaged 2 X 3 in (58.5 mm X 89.2 mm) in size. They were placed in sweater boxes in a medium of grade three vermiculite. The boxes were initially hydrated on a 1:1 ratio by weight as had been suggested by other herpetologists with experience in hatching monitors. Ten eggs were given to Dr. Geoff Birchard for incubation at George Mason University (GMU). Dr. Birchard was able to collect gas exchange data from the eggs during development. The GMU egg media were hydrated at two different concentrations: One was approximately 1:4 water to soil and the other 1:1. We switched our eggs to a compromise ratio of 1:2. The eggs at both sites were weighed

THE VIVARIUM

twice a week and at that time water was added to the medium to make up for evaporative loss. The boxes were rotated on the shelves in the incubators to compensate for different amounts of air movement from the incubator fans. Four different incubators were used at the two sites, and which were set between 81.5 - 84.2° F (27.5 and 29° C).

During the first two weeks of incubation, we determine by candling that all the eggs were fertile. However, eight of the embryos died for unknown reasons during the first two months. During the first 160 days, the eggs gained varying amounts of water, depending on the soil to water concentrations of the medium. The 1:1 medium produced a 65% weight increase while the 1:2 and 1:4 mediums resulted in 32% and 18% gains respectively. The eggs from all three concentrations lost weight in the weeks prior to hatching.

On 13 September 1992 the first eggs began to hatch at GMU. This was the 237th day of incubation. Over the next six weeks a total of 14 young dragons emerged at the two sites. One hatchling died within 24 hours and an additional four neonates died full term. Upon opening the full term eggs we noticed that the egg teeth were absent or greatly reduced on these babies. The time between pipping and leaving the eggs for



A Grade III vermiculite was used as incubation medium. The egg on the right has begun to pip. Photo by Jessie Cohen.

successful hatchlings varied from 3 to 24 hours. All of the young were attached to the yolk by a three inch stalk upon hatching. In most cases the yolk was absorbed and the stalk was broken off within the next 24 hours. In one instance a hatch-



Percival environmental chambers at NZP and GMU served as incubators for the eight and a half month incubation. Photo by Jessie Cohen.

ling was observed devouring its own afterbirth. The lizards remained stretched out quietly next to their eggs until removed from the vermiculite. Albumin samples were taken from all the eggs for a sexing study. The staggered hatch over six weeks was attributed in part to the different temperatures of the four incubators. The GMU incubator which averaged 84.2° F (29° C) resulted in seven young in one week. The three incubators at NZP ranged from 81.5 - 83.3° F (27.5 to 28.5° C) resulting in seven young over a six week period. Generally the lower incubator temperatures produced longer incubation times. Unexplainably the first NZP hatchling came from the 81.5° F (27.5° C) incubator on day 239. Successful hatchlings occurred on all three water to soil media and in all four incubators.

The hatchlings were initially placed in plastic shoe boxes with dry paper towels and left in the incubators for up to two days until the umbilical



Baby Komodos camouflage well against tree bark. It is speculated that young dragons may lead an arboreal life, avoiding the cannibalistic adults. Photo by Jessie Cohen.



Professor Geoff Birchard of GMU in Fairfax, Virginia, and "Kraken", the first Komodo dragon hatched outside of its Indonesian homeland. Dr. Birchard was instrumental in helping NZP staff determine optimal incubation conditions for the dragon eggs. Photo by Jessie Cohen.

sites closed over. Neonates had an average weight of 3.2 oz (91.8g) with a range of 2.5 - 3.6 oz (71.7 - 103 g). The average total length was 16.1 in (41 cm) with a range of 14.9 - 16.4 in (38-42 cm).

Hatchling Husbandry

From the incubators the young dragons were next housed in Rubbermaid® tubs with modified lids. The tubs measure 15 X 23 X 14 in (38 X 58 X 36 cm). A half round PVC hide box was placed in one corner. Opposite the hide box was a piece of cork bark that angled from the bottom to the top of the tub. Astroturf was used as a substrate. A water crock was placed in each tub. Heat was provided by a 75 watt lamp placed over the top of the cork bark. The temperature at the hot spot was 92 - 95° F (33 - 35° C). The hatchlings used this basking site daily for several hours every morning and early afternoon. At night the hatchlings slept under the PVC hide box.

The young Komodo dragons accepted their first meals within a week of hatching. We offered them young adult mice every five days. The feeding response of the baby dragons was enhanced when the bellies of the pre killed mice were opened.

At first, the monitors seemed to tolerate frequent handling and photographing, remaining placid and making little effort to escape when picked up. This behavior lasted for about a month when suddenly they became more active and aggressive. When disturbed, they exhibited a threat posture with head down, body raised, neck arched, throat inflated, and mouth agape. The threat was quickly followed by an attack that resulted in blood letting to the handler. This is an impressive

showing for a 3 oz (84 g) beast towards a 200 lb (91 kg) man.

In October of 1992 we discovered that four young had developed fractured femurs. We are not sure how these fractures happened because not all of the affected animals were handled daily. X-rays and blood work at two months of age showed their the skeletons were poorly mineralized and there were low levels of vitamin D-3 in the blood. It is possible that this is normal for hatchling monitors, but, as a precautionary measure, we began using UV lights over them. Ultraviolet light has been shown to be critical in vitamin D-3 production and calcification of bones in other lizards (Bernard et al., 1991). Follow up x-rays and blood work at four months revealed stronger bone densities and healing of the old fractures. No new fractures were observed. At six months the dragons are approximately 30 in (76 cm) long, weigh about 300 g (10.6 oz), and appear healthy.

Future Plans

An advertisement has been placed in the publication of the American Association of Zoological Parks and Aquariums (AAZPA) offering Komodo dragon hatchlings to other institutions. For ethical reasons, we decided not to sell the animals, but instead to offer them to approved institutions for a donation. This money will be used as a Komodo monitor Trust Fund for research on dragons in their native habitat as well as studies on captive animals.

Before our eggs hatched in 1992, plans were already being developed concerning the next reproductive season of our female. The Cincinnati Zoo is the only other institution in the United States that currently owns Komodo dragons, so a breeding loan to that zoo was written, and approved by both institutions. Cincinnati sent what they thought was a female (x-rays have since shown it to be a male) to the San Diego Zoo to make room for the NZP female. Using x-ray to visualize ossification of adult male hemipenile bones seem to be the best way to sex these animals (Shea and Reddacliff, 1986). The introduction of our female to the Cincinnati male went well and the animals quickly adjusted to each other. Behaviors similar to those observed at the National Zoo occurred and copulation soon followed. A clutch of 24 fertile eggs was recovered on the 19th of January 1993. This was one day short of a year since last year's clutch was laid. The eggs were

flown to Washington for incubation and have once again been divided between the National Zoo and George Mason University.

The San Diego Zoo has a permit filed with the U.S. Fish and Wildlife Service to import two female dragons. This would bring the U.S. population to 3.3 adult animals.

In the future, we hope to investigate the effects of warmer incubation temperatures on the eggs and the possible benefits of exposure to



Johnny Arnett and Robin Saunders of the Cincinnati zoo measure and set up Komodo eggs which resulted from a breeding of the NZP female and Cincinnati male in January of 1993. Delta Airlines donated two seats for the eggs as they were flown back to Washington for incubation. These eggs also appear fertile. Photo by David Jenike, Asst. Education Curator, Cincinnati Zoo.

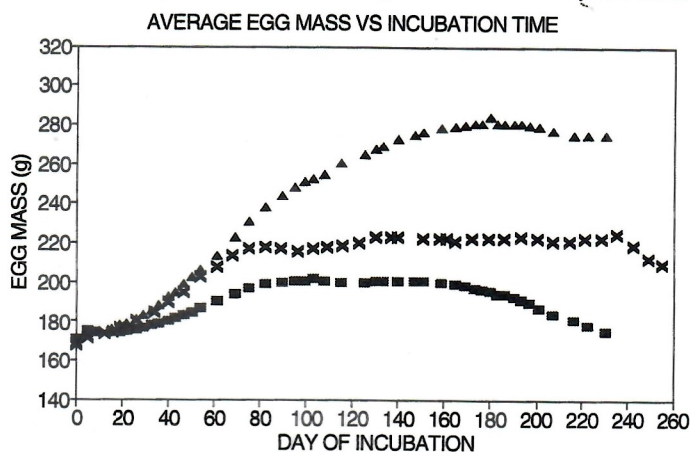
UV radiation on young and adult animals. In addition we plan to change management practices of hatchlings to allow them to be left alone for the first few weeks of life while their skeletal structures may still be fragile. Studies are also underway to determine the genetic variation of dragons in captive and wild populations. Because of the special management requirements and large size of these animals, a growing cooperative effort must be made by a number of people and institutions if we hope to establish and maintain a viable captive population of Komodo dragons.

Acknowledgments

The authors thank Dr. Geoff Birchard of George Mason University, Dr. Dale Marcellini, Curator of Herpetology at the National Zoo, and all NZP support staff for their contributions to this project. Additionally, we would like to acknowledge the timely cooperative efforts of Ed Maruska and Johnny Arnett of the Cincinnati Zoo, which have resulted in the 1993 clutch of dragon eggs. We also thank Ann Walsh for help in preparing this manuscript.

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Average Komodo dragon egg mass by incubation time in three different water to soil concentrations. The triangles are one to one water to soil, the crosses one to two, and the blocks one to four. Illustrated by Geoff Birchard, George Mason University.

Common Reptilian Bacteria: What Are They and What Is Their Significance?

by

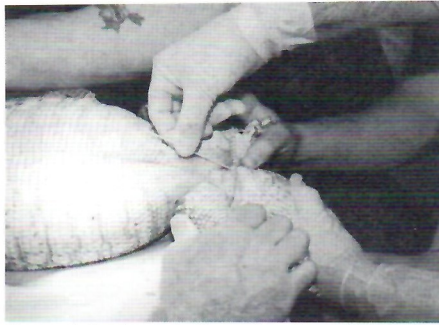
**Douglas R. Mader, D.V.M.,
A.B.V.P.**

Illness and disease are no stranger to any animal group, and reptiles are no exception. Perhaps, in many cases, reptiles are more susceptible to disease than their mammalian counterparts. A reptile's immune system is dependent on the environmental temperature. Unfortunately, reptiles are not always kept at their optimal temperature, and as a result they are more prone to disease. The underlying cause of this disease is usually some type of a bacterial infection. This often shows up as a respiratory illness. But, bacteria can also cause other problems as well, such as gastrointestinal disturbances and skin disease, just to name two.

An important point to mention here is that there are many types of bacteria which can cause disease in reptiles. Different bacteria can produce similar symptoms, and similar bacteria can produce different symptoms. To confuse matters further, some diseases which look like they are caused by bacteria may, in fact, be caused by something else such as a virus or a fungus. Because all bacteria don't respond to treatment the same way it is important to determine what bacteria, if any, are present and what would be the best method of treatment based on the bacterial organisms identified.

The bacteria in reptilian medicine are often referred to as belonging to either of one of two different groups, called the Gram positive [G(+)] or the Gram negative [G(-)] bacteria. The difference between these two groups is based on a test commonly utilized by reptile veterinarians called the Gram Stain. This laboratory test differentiates between the bacterial groups based on how the cellular components of the organisms absorb colored stains. There are many other differences between the two groups of bacteria, but a detailed discussion is beyond the scope of this article.

In addition to the G(-) and G(+) groups, there is another important classification which should be mentioned. Bacteria can be alternatively separated into types based on whether or not they utilize oxygen for growth and reproduction. Those bacteria which need oxygen to live are called *aero-*



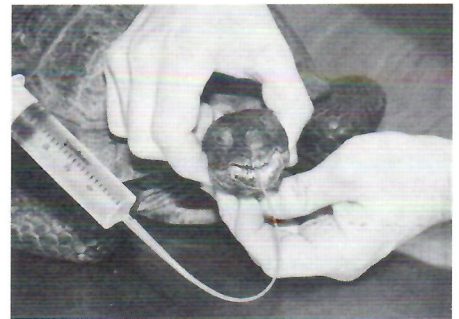
Bacterial culture being taken from the cloaca in a savannah monitor.

bic, and those which do not require oxygen are called *anaerobic*. Some bacteria can live in either environment; There is no connection between the G(-) and G(+) groups and the need for oxygen. That is, there are both aerobic and anaerobic bacteria in each group.

The majority of the significant bacterial pathogens, or those bacteria which cause disease, are in the G(-) group. Common examples include *Pseudomonas*, *E. coli*, *Salmonella* and *Klebsiella*. There are many different species and subspecies within each group.

It used to be believed that it was necessary to treat any G(-) bacteria found in reptiles. That practice of treating all gram negative isolates is no longer acceptable as it is now realized that many reptiles harbor some G(-) bacteria as part of their normal flora, and these can be either commensals or opportunists. This means that the bacteria can live in harmony with or actually benefit the reptile host in some way.

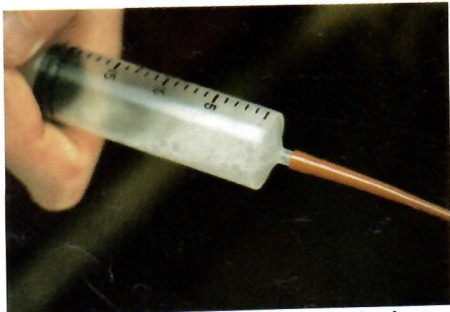
The decision to treat or not to treat depends on many factors: the source of the isolate, the type of animal patient, its physi-



This is a lung wash in a California desert tortoise. A sterile catheter is passed down the windpipe and into the lungs of the patient. Sterile saline is then flushed into the lungs.

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The saline is then retrieved from the lungs and can then be used for bacterial culture and sensitivity testing as well as for cytological analysis.

cal or clinical condition, the experience of the veterinarian, the drugs available to the veterinarian, the ability of the owner to assist with treatments, and of course, the type of bacteria itself.

The way that a veterinarian familiar with reptiles can determine what bacteria are present and possibly the cause of the disease problem is to perform a laboratory test called a bacterial culture. As an analogy, think back to when you were a small child and you had a sore throat. Your doctor had you say "Aaaaa," and he or she would then gag you with a cotton-tipped swab down the back of your throat. What they were doing was taking a sample, or a culture, of the bacteria from your tonsils in an attempt to determine the cause of your sore throat. Once the bacteria from the sample had been identified, or isolated, they could prescribe the best medication, usually an antibiotic, which would most efficiently treat your illness.

Proper sample collection for bacterial culture and antibiotic sensitivity testing is a critical step in initiating appropriate care for reptiles. It is often the practice for a veterinarian to collect bacterial culture samples, and then while waiting for the results, start the sick patient on an empirically selected antibiotic. This practice is wise as it gives the veterinarian a head start in treatment while waiting for laboratory results, which can take up to three or four days. Improperly collected samples will offer little information towards tailoring antibiotic therapy.

It has been a common practice in veterinary medicine to collect a combination bacterial culture from both the oral cavity and the cloaca in a sick reptile as a screen-



The red spots within the scutes of this boa are caused by a *Salmonella* bacterial infection in the blood.

ing tool. While this may be easy, it does not always give very specific information regarding bacterial pathogens, or disease causing organisms. The oral cavity contains a "garbage can" of bacteria from the reptile's environment. Although the actual bacterial pathogen might be included in the culture sample, it is often dwarfed by a myriad of other microorganisms. A similar problem is encountered when randomly culturing the cloacal region. It is clear, therefore, that site specific bacterial sampling is preferable to random sampling. Snakes presenting with infectious stomatitis, or mouth rot, will benefit from appropriate antimicrobial therapy based on proper bacterial isolation. However, as mentioned, a sample collected by swabbing a culturette over the affected gums will usually yield a mixture of oral cavity and environmental flora. A better technique involves sampling from within the infected gums by first making a small cut on the surface, and then taking a bacterial sample from within the tissue.

Cloacal cultures can be used in patients with diarrhea or other gastrointestinal dis-



The mouth rot in this red-tailed green rat snake is due to an infection by *Pseudomonas aeruginosa* bacteria.

turbances. Proper diagnostic tests and rule-outs of other more common causes of diarrhea, such as parasites, should be performed prior to the bacterial testing. Fecal sampling for ova and parasites, including protozoal pathogens, is a must. Interpretation of the culture results can be confusing because many different bacterial are normally present. However, certain isolates should be cause for immediate concern. These will be discussed later.

All patients displaying respiratory signs should be cultured. The best technique for sampling lung bacteria is to perform a tracheal wash. An appropriately sized sterile catheter is inserted down the wind pipe and directed into the lungs. Sterile saline is infused through the catheter. The patient is then gently inverted, rolled side to side, or in some way rocked to allow mixing and washing of the saline within the lung tissue. The fluid is retrieved and can then be used for both cytology, which is a microscopic examination for things like lung mites or lung worms, and bacterial culture and sensitivity testing.

If cost is a concern for the owner, an inexpensive, but medically reasonable alternative to performing a tracheal wash



The abscess in the foot of this lizard is caused by a bacterium called *Serratia*. This is a common finding in skin wounds.

with culture and cytology, would be to collect a simple bacterial culture from the choanal slit. Anatomically, this is the area where the glottis opens. Therefore, bacteria isolated from the choana are more likely to represent real pathogens.

Open abscesses should be debrided, and the cultures taken from deep within the lesions. Closed abscesses should be sampled directly from the pus within.

Bacterial cultures can also be taken from body fluids such as blood and urine using techniques commonly utilized in people. Properly collected samples yield invaluable diagnostic information for the veterinarian.

A recent study on the bacterial flora from sick reptiles revealed that approximately 50% of all bacterial cultures contained anaerobic bacteria. The test for anaerobic bacteria is difficult to perform and often quite costly. Hence, most veterinarians do not routinely perform anaerobic bacterial testing. However, keep this fact in mind when you have a sick animal that is not responding to routine antibiotic therapy. The sick reptile may actually be suffering from a bacterial infection which was not identified due to the method of testing.

As mentioned, the G(-) bacteria are most frequently implicated as pathogens. Deciding which bacteria to treat can often be confusing. Arbitrarily starting a patient on antibiotics just because gram negatives are present is not appropriate. A review of the more common bacteria will help the owner and veterinarian decide which isolates require treatment.

Salmonella/Arizona - Most of the *Salmonella* sp. and *Salmonella arizona* group (formerly *Arizona arizonae*) are considered



Klebsiella bacteria are responsible for the eye infection in this Burmese python. The pus is between the cornea and the spectacle.

THE VIVARIUM

pathogenic. Many reptiles harbor these organisms as part of their normal flora, and interpreting their presence can often be difficult. This group has public health significance because of their zoonotic potential, that is, these diseases can be transferred from animals to people.

Salmonellosis is not a disease to be taken lightly. It is very serious and can cause death in animals and, in certain situations, people. Because this is a zoonotic disease, and there are really no proven treatments in reptiles, our hospital usually suggests euthanizing the clinically affected animals. Although this may seem harsh, it is often a better alternative than potentially risking exposure of this disease to other animals in the household, or worse yet, to humans which come in contact with the infected pet. [When it comes to Salmonellosis, vets vary markedly in their opinions on whether to euthanize the animal or for the owner to continue to keep it under strict quarantine safeguards - Ed.]

The real dilemma of whether or not to treat for a bacterial disease arises when a clinically healthy animal tests positive on routine health screens. Because many reptiles can act as carriers, and treating these animals can often result in the production of resistant organisms, inapparent carriers and/or fulminant disease developing, I usually recommend not treating the positive animals. I do, however, recommend strict adherence to quarantine procedures, isolation of the positive animal and paying strict attention to proper hygiene.

Pseudomonas sp. - *Pseudomonas sp.*, such as *P. aeruginosa*, are commonly found as part of the normal flora in the oral cavity and intestinal tracts of reptiles. As such, it is often considered an opportunistic pathogen. Poor husbandry, such as sub-optimal environmental temperatures and malnutrition, can predispose to *Pseudomonas* infections. *Pseudomonas* has been isolated in cases of mouth rot, pneumonia, skin lesions and septicemias. *Pseudomonas* cultured in light numbers from the oral cavity or gastrointestinal tract in healthy patients probably need not be treated.

Aeromonas sp. - *Aeromonas* has been associated with pneumonias, oral cavity and skin lesions, and septicemias. The



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snake mite, *Ophionyssus natricis*, has been implicated as a common vector of this bacterium. *Aeromonas* isolated from healthy animals in light growth may be part of the normal flora. However, where there is significant growth, or in patients with questionable clinical health, treatment should be considered.

Serratia sp. - This bacterium is part of the normal flora of the oral cavity in reptiles. It is commonly isolated from skin lesions and appears to be introduced by traumatic causes, such as bite wounds. Skin infections with *Serratia* typically cause cheesy abscesses which require surgical curettage for appropriate treatment.

Mycobacteria sp. - *Mycobacteria* are common environmental bacteria. Of significance to reptile patients are *M. marinum*, *M. chelonae* and *M. thermophilus*. Although commonly isolated from skin lesions, *Mycobacteria* can also cause systemic illness with nonspecific signs such as decreased appetite, lethargy and wasting. Acid fast organisms are readily identified with either skin scrapings or biopsies. There are no reported successful treatments. This disease may also have some zoonotic potential.

Providencia sp. - Commonly isolated from the oral cavity of healthy snakes. This is believed to be an opportunistic pathogen. Treatment should be considered in view of the clinical status of the patient.

Klebsiella sp. - *K. pneumonia* is commonly associated with pneumonia and hypopyon, an infection in the anterior cham-

ber of the eye. These organisms are considered normal flora by some authors. When isolated from clinically ill reptiles, the organism should be treated. Doug Mader, M.S., D.V.M., Long Beach Animal Hospital, 3816 E. Anaheim St., Long Beach, CA 90804.

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Karl Patterson Schmidt

by
Roy Pinney

When snakebite puts an end to a human life, who is most likely to be the victim? The barefoot rural inhabitants of India or Africa, the careless camper, or an amateur collector? The answer is all of them, but must also include the professional herpetologists in museums and zoos who handle venomous snakes as part of their regular duties. Doesn't their expertise safeguard them against accidental bites? Usually, yes. But sometimes, no.

On September 26, 1957, the bite of a venomous snake tragically and suddenly ended the life of a highly gifted museum herpetologist. Though in good health and spirits, the sixty-seven year old Karl Patterson Schmidt became the victim of a boomslang envenomation.

Schmidt was born on 19 June 1890 at Lake Forest, Illinois, and attended the public schools, followed by Lake Forest Academy, and Lake Forest College. He won three freshman prizes for scholarship. However, he decided to spend the next six years as a farmer in northern Wisconsin.

Largely at the insistence of Professor James G. Needham, Schmidt returned to school at Cornell University, as a sophomore. At Cornell, his interests centered on invertebrate paleontology. As he said later, his final choice of a career was largely a matter of chance. He was returning from an expedition to Santo Domingo, when he visited New York's American Museum of Natural History. Mary C. Dickerson, then Curator of Herpetology at the museum, offered Schmidt a temporary job unpacking the huge Herbert Lang collection of amphibians and reptiles collected in the then-Belgian Congo. This was contingent upon an agreement that he finish his B. A. at Cornell, which he did in 1917. He published two reports on that collection, establishing him as a herpetologist and beginning a lifelong interest in zoogeography. Soon after, he co-authored *Ecological Animal Geography* with W. C. Allen. This work further enhanced his credentials as a naturalist. Shortly thereafter, he was promoted to Assistant Curator of Herpetology. Within a relatively short time, Schmidt left New York to become Curator



Karl P. Schmidt. Photo courtesy of the Field Museum of Natural History©.

of Herpetology at the Field Museum of Natural History in Chicago. In time, "K. P.," as he was called, became Chief Curator of Zoology, and he would establish a core of some of herpetology's most influential contributors, including Robert F. Inger and Clifford H. Pope (who also left New York for Chicago).

Schmidt's published contributions to herpetology were prodigious. He served as an editor of *Copeia*, *Biological Abstracts*, and *American Midland Naturalist*. He wrote for and edited zoological papers published by the Field Museum, contributed to *Encyclopaedia Britannica*, all while pursuing intensive studies on coral snakes, resulting in another 17 papers. In 1953, he prepared the sixth edition of the *Checklist of North American Amphibians and Reptiles*. To many herpetologists, Schmidt is best known for *Living Reptiles of the World*, published in 1957 and co-authored by Field Museum associate Robert F. Inger. As a wildlife photographer, I had been given the assignment of helping illustrate that volume. Schmidt never felt that the difficult task of popularizing science was inferior to research, a fact to which his bibliography

continued on page 32

Coming Events

July 10, 1993: H.O.T.S. Reptile Research's Second Annual Reptile Expo and Sale will be held in Rochester Michigan. For info, contact: H.O.T.S. Reptile Research, P. O. Box 12252, Hamtramck, MI 48212 or phone Dino (313) 375-5915 or Bill (313) 891-4461.

July 11-17, 1993: International Symposium on Turtles and Tortoises - Conservation, Restoration and Management will be held at the State University of New York. For info, contact: Craig Vitamenti, New York Turtle and Tortoise Society, 163 Amsterdam Avenue, Suite 365, New York, NY 10023; ph. (212) 459-4803.

August 13-15, 1993: 1993 National Reptile Breeder's Expo will be held in Orlando, Florida. For info, contact: Central Florida Herpetological Society, P. O. Box 3277, Winter Haven, FL 33885; ph. (813) 294-2235.

August 29, 1993: First Annual St. Louis Reptile Breeders Expo and Sale will be held in St. Louis, Missouri. For info, contact: James Burmley, 4341 Telegraph Rd., St. Louis, Mo 63129; ph. (314) 892-6605 or 845-2038.

September 4, 1993: Fourth Annual Eastern Herpetological Expo will be held in Pottstown, Pennsylvania. For info, contact: G. Leonard Knapp, 215 Lawn Ave., Sellersville, PA 18960; ph. (215) 257-6088.

September 10-12, 1993: East Texas Herpetological Society's Third Annual Herp Conference and Breeder's Expo will be held in Houston, Texas. For info, contact: ETHS, c/o Dr. David Doherty, 25206 Grogan's Mill Road, The Woodlands, TX 77380; ph. (713) 367-4963.

September 12-16, 1993: Annual Conference of the American Association of Zoological Parks and Aquariums will be held in Omaha, Nebraska. For info, contact: Randy Wisthoff, Henry Doorly Zoo, 3701 South 10th Street, Omaha, NE 68107; ph. (402) 733-8401.

September 25 & 26, 1993: Mid-Atlantic Reptile Show will be held near Baltimore, Maryland. For info, contact: Tim Hoen, Jenkins Hall/Biophysics, Johns Hopkins University, 34th and Charles St., Baltimore, MD 21218; ph. (410) 557-6879.

September 26, 1993: The Third Annual Heart of America Reptile Breeders Show will be held in Kansas City, Missouri. For info, contact: David Nieves, (816) 452-0875 or The Kansas City Herpetological Society, P. O. Box 118, Liberty, MO 64068.

October 2 & 3, 1993: Second Annual Reptile Breeder's Show and Sale will be held in San Diego. For info, contact: IRBA, P.O. Box 85152-279, San Diego, CA 92186; ph. (800) 497-3550; fax (619) 295-7129.

October 16, 1993: Staten Island Herp Meet will be held in Staten Island, New York. For info, contact: Al Swanson at (718) 317-8382 or Howard Fisher, 32 Milburn St., Staten Island, NY 10306; ph. (718) 987-6317.

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November 13 & 14, 1993: Sixth Annual San Diego Herpetological Society Exhibition and Sale will be held in Del Mar, California. For info, contact: SDHS, P.O. Box 4036, San Diego, CA 92164-4036; ph. (619) 689-2582.

December 12-18, 1993: Third Latin American Congress of Herpetology will be held in Campinas, Sao Paulo, Brazil. For info, contact: Comissao Organizadora 3 CLAH, Departamento de Zoologia, IB, Universidade Estadual de Campinas, 13081 - Campinas, SP Brazil

December 29, 1993 - January 5, 1994: Second World Congress of Herpetology will meet in Adelaide, South Australia. For info, contact: Dr. M. J. Taylor, University of Adelaide, Department of Zoology, Box 498, GPO, Adelaide, South Australia 5001, Australia.

March 5, 1994: 35th Annual Southern California Herpetologists' Herpfest will be held in San Diego, California. For info, contact San Diego Herpetological Society, P. O. Box 4036, San Diego, CA 92164; ph. (619) 689-2582.

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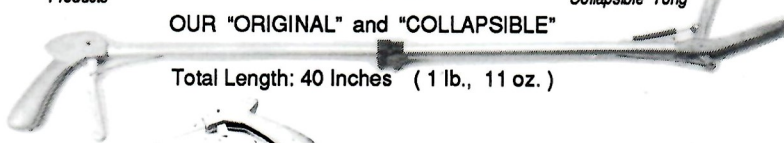
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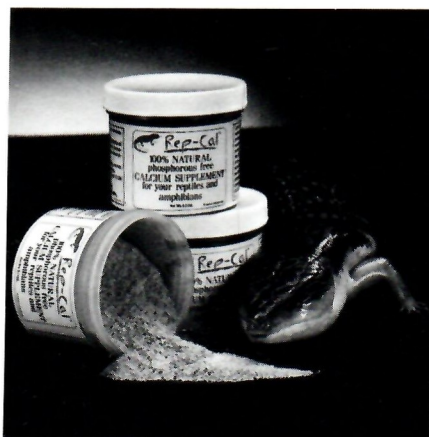
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will admirably attest.

Karl Schmidt was honored by many organizations for his work. A Guggenheim Fellowship in 1932 allowed him to make his first visit of the major European museums. He served as president of the American Society of Ichthyologists and Herpetologists (ASIH), publisher of the journal *Copeia*, from 1942-1946, and was president of the Society for the Study of Evolution in 1954. In 1952, Earlham College granted him the honorary degree of Doctor of Science, and in 1956, he was elected to the prestigious National Academy of Science.

On 25 September 1957, Schmidt was examining a live specimen of a central African rear-fanged snake, a boomslang (*Dispholidus typus*), not, at the time, generally regarded as particularly dangerous. Schmidt's own diary entries chronicle the account:

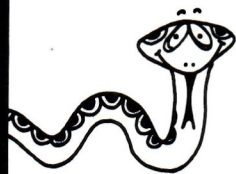
"A boomslang with undivided anal plate... A thirty-inch snake brought for identification to Chicago Natural History Museum by Mr. Truett of the Lincoln Park Zoo, proved to be uncommonly difficult to name. It was known to be an African snake, and with the characteristic head shape, oblique and keeled dorsal scales, and bright color pattern should have offered no difficulty. But no key for identification would make it a boomslang, for the anal plate was undivided. The fact that it was nevertheless a boomslang (*Dispholidus typus*) was dramatically attested by its behavior. Mr. Truett, Dr. Robert F. Inger, Hymen Marx, and I were discussing the possibility of its being a boomslang when I took it from Dr. Inger without thinking of any precaution, and it promptly bit me on the fleshy lateral aspect of the first joint of the left thumb. The mouth was widely opened and the bite was made with the rear fangs only, only the right fang entering to its full length of about 3 mm. Only one other tooth mark, from the penultimate tooth, appeared on the thumb when the snake was disengaged. The punctures bled freely, and I sucked them vigorously but did not think of..."

"September 25 (1957). 4:30 PM - 5:30 PM. Strong nausea, but without vomiting, during trip to Homewood on suburban train."

"5:30PM - 6:30PM. Strong chill and shaking, followed by fever of 101.7F (38.7C), which did not persist (blankets and heating pad). Bleeding of mucous membranes in the mouth began about 5:30 PM apparently most from gums."

"8:30 PM. Ate 2 pieces milk toast...9:00 PM - 12:20 AM Slept well. No blood in urine before going to sleep, but very small amount of urine. Urination at 12:20 AM, mostly blood, but small in amount. Mouth had bled steadily as shown by dried blood at both angles of mouth... A good deal of abdominal pain, mainly from gas, continuing to 1:00 AM, only inadequately relieved by belching."

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"A little fitful sleep until 4 AM when I took an enema (bowels having failed the previous day)...Took a glass of water at 4:30 AM, followed by violent nausea and vomiting, the contents of the stomach being undigested supper. Felt much better and slept until 6:30 AM September 26."

"6:30 AM Temperature 98.2F (36.8C). Ate cereal and poached egg on toast & applesauce & coffee for breakfast at 7... Slight bleeding is now going on in the bowels, with frequent irritation at the anus. No urine, with an ounce or so of blood about every three hours (instead of several ounces of urine to be expected). Mouth and nose continuing to bleed, not excessively."

Those were the last written words of Dr. Karl Schmidt. After breakfast, he was up and active. By 10:00 AM, he felt so well that he telephoned the museum, telling them to expect him back at work the next day. He got up from bed to have lunch, but began vomiting after lunch and soon had difficulty breathing. With the onset of these alarming symptoms, his wife, Margaret Schmidt, called the inhaler squad and the family physician. Initial resuscitation efforts restored warmth to Schmidt's hand and color to his face, but his condition quickly deteriorated. He was transported to the hospital at about 3:00 PM on 26 September and was promptly pronounced dead from respiratory paralysis. Karl P.

Schmidt died at his home, less than 24 hours after being bitten by what was then thought to be among the most mild tempered of venomous snakes.

The autopsy, performed on 27 September, revealed extensive internal bleeding. Death was ascribed to cerebral hemorrhages caused by "venom from the snake bite."

Schmidt's unwarranted optimism was extremely unfortunate, but had some justification. The snake was very young, and only one fang had penetrated deeply. Alas, nearly two decades earlier, careful experiments by Grasset and Schaafsma (South African Medical Journal, 1940, 14:236-41) demonstrated that boomslang venom has an extraordinarily high toxicity, even higher than that of such notorious snakes as cobras, kraits, and mambas. Unfortunately, this information which dictated exercising extreme caution when handling a boomslang, would have been more obscure in the pre-computerized age of the late 1950s.

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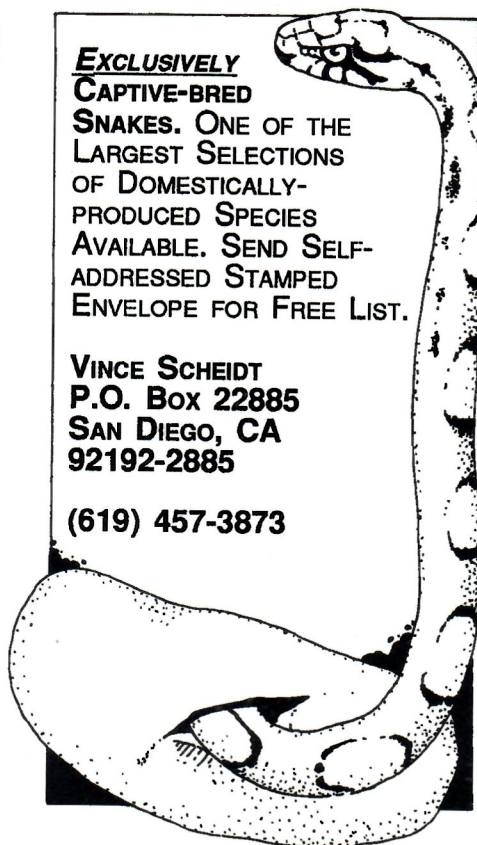
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THE VIVARIUM MAILBAG

Dear AFH,

After reading Drew Newman's letter in the Vol. 4, No. 4 issue of *The Vivarium*, I must disagree. While I am saddened by the loss of anyone, particularly a fellow herpetoculturist, I do believe that our herptiles are, indeed, pets. Those who keep and handle animals, at least those potentially dangerous species, must accept that there is a certain modicum of risk inherent. While this does not take away from the tragedy of a person's death, neither does it lessen what our herptiles mean to us.

A pet is, by my definition, an animal that we keep in our homes. In my opinion, it does not, as Mr. Newman seems to believe, require that said animal be one that you can play with or take with you as a companion. If this were true, then fish would not be pets, nor would many birds. Hamsters and other rodents may be infrequently handled, but this fact does not mean they are not pets.

I will grant you that all animals are different and each warrants different care and handling. I have been, on occasion, clawed by my green iguanas and bitten by my tokay geckos, but by the same token, I have been bitten and scratched by dogs, cats and birds.

I agree that herpetoculture is a discipline in its infancy. The only way we will grow is to encourage people to engage in it. While an Egyptian cobra, or to a much lesser extent, a reticulated python or a crocodile monitor may not be a suitable pet for the general public, other herptiles certainly are. After all, just as some breeds of dogs are probably unsuitable for the general public, they are not banned. The public perceiving herpetoculturists as people who regularly handle potentially dangerous animals, may lead to stricter regulations. If we want to survive, we must educate the public.

Brian Henderson, Corona, CA

Dear Brian:

The editor believes both writers make useful points. A pet might best be defined as any non-human animal kept purely for aesthetic reasons, not for food. However, a herptile pet typically has care requirements that are more specialized or at least different from those of a dog, cat, or goldfish.

Reptiles and amphibians do need specialized care. Ask anyone who has worked in a zoo, nature center or as the adoption chairman for a regional herpetological society about the numbers of herptiles which owners, especially "impulse buy" owners, wish to abandon. Virtually all were purchased as "pets" to be kept in a "cage," and the owner had been told the animal required "little or no special care."

Reptiles and amphibians are, in the broad sense to some people, pets. It is important, however, that herptiles are sold as animals that require specialized care in an "enclosure" with necessary "habitat." Most new owners need to be informed that they should purchase an "Advanced Vivarium Systems" care book or other well written care sheet.

Drew Newman makes an excellent point by

emphasizing that when making presentations to the public about reptiles and amphibians, it is very important to highlight their beneficial role in nature, and their specialized needs in captivity.

In Defense of Ebenezer

This is in response to the flurry of misinformation surrounding the circumstances of the death of my friend, Bill Bassett, who died at his home in Harahan, LA at the age of 47 on Saturday, May 15, 1993. I met Bill through a mutual friend last summer in New Orleans, and although had not known him long, had been a guest at his home, and had spent time on several occasions with the now infamous 16 ft. reticulated python, Ebenezer, who was blamed by the press for Bill's death.

Bill Bassett, known as "Snake" to his friends, was a meticulous and knowledgeable herp owner. He was a Gulf Coast Herpetological Society member, and at the time of his death, had ten snakes in his collection, including a variety of boas, two albino corn snakes, and Ebenezer. Bill took great pride that all of his herps had affectionate dispositions. This was especially true for Ebenezer, for whom Bill had a special affinity. Bill had had Ebenezer for about four years, handled him constantly, and was even known to take him over to friends' houses for visits.

As of this writing, the coroner's report still lists the cause of Bill's death as "unknown," until all the toxicology tests are in. But according to Donna Lewis, Office Manager of Bill's company American Crane Rentals, Captain Langford of the Harahan police department told her as early as Monday, May 17th, the results of the autopsy lead the police to believe that Bill had died of natural causes, probably a heart attack.

Why wasn't the press privy to this information? As late as Wednesday, May 17th, Reuters reports in national newspapers speculated that the snake attacked Bill, that he may have died of suffocation and so on. Other local newspaper reports, based on more misinformation than facts preached on the dangers of keeping herps in captivity as pets, and used Bill's reported means of death as an object lesson. The real tragedy here is that newspapers insist on sensationalizing snake-related deaths, without even the benefit of the most basic facts to substantiate their conclusions.

According to Donna Lewis, as of this writing, the Harahan Police Department investigation of the case is still on-going. Any speculation on the actual cause of Bill's death is premature, but to hold Ebenezer responsible in any way is irresponsible and just plain destructive. Ebenezer suffered 100 stitches, extreme loss of blood and can't eat due to the multiple stab wounds around his neck. He's currently under the care of a specialist for a second attempt at surgery, and the Jefferson Parish Animal Shelter council will meet Wednesday, June 9th to decide what happens to him next.

Bill's friends will miss him, but among us, we all agree on who the real victim is.

We sympathize, but please refer to the AFH Perspective in this issue -Ed.

Kristin Armstrong

THE VIVARIUM

1993 NATIONAL REPTILE BREEDER'S EXPO

The Central Florida Herpetological Society announces the 1993 Reptile Breeder's Expo, to be held August 13-15, 1993 at the Twin-Towers Hotel and Convention Center in Orlando, Florida. Last year's Expo was the largest gathering of reptile and amphibian enthusiasts in the world! This year's show will feature over 300 displayers of captive born animals and related paraphernalia, such as books, art jewelry, and equipment.

SCHEDULE

Friday, August 13 Registration and Exhibit Set-Up
12 Noon - 5:00 P. M.

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Q. What treatment do you recommend for mites on snakes?
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A. Every week, one or two people contact us looking for the silver bullet that will stop the horde of tiny bloodsuckers that have invaded their collection and are feeding on their snakes. Few topics on snake maintenance come up with such regularity, a consequence of the nearly supernatural ability of mites to reappear after apparent local extinction. Mites are the gift that keeps on giving. In this column, our recommended treatment for infestations of the snake mite, genus *Ophionyssus*, the most common ectoparasite of captive snakes, is outlined.

In the way of an introduction, we advocate a reverse Golden Rule when considering treatment that might best be used to accomplish a desired result. Simply stated, we always attempt to not do something to our snakes that we would not do to ourselves. For example: we wouldn't want to have even minor surgery without suitable anesthesia, and we see to it that our snakes get the same; we wouldn't want to eat decomposed food, and so we would never feed bloated mice to snakes (even though snakes can usually digest such without problems); we wouldn't want to sit in toxic dust for hours and we wouldn't advocate the insecticide dust method to rid snakes of mites (even though we are told that, properly done, it does not apparently harm the snakes.) For mite problems, we feel there is a better way. Years ago, before the invention of no-pest strips, even before the invention of the not recommended Dri-Di@ silica gel, captive snakes used to get mites and, even way back then, keepers had a tried and true method to successfully get rid of them. Snakes with mites were soaked in lukewarm water. Most snakes like a nice soak, especially snakes with uncomfortable mite infestations. While it's rumored that super-mites today are being bred with some resistance to no-pest strip fumes, mites still drown. Here's how to incorporate soaking into a successful treatment for mite infestations.

Have you ever noticed how water beads up on the surfaces of snake scales, like water drops on a finely waxed table? When snakes are placed underwater this property of snake skin can cause small air bubbles to form around and under scale margins all over the snake. Water on the surface of a mite does a similar thing; water at first

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doesn't soak a mite, instead the external surface of the mite repels the water and causes an air bubble to form around the mite. With all these little underwater air supplies, a mite on a submerged snake can take a long time to drown. As a solution to this problem, soak mite-infested snakes in soapy water. Eight hours is long enough. The water should be just deep enough to cover the snake and not unnecessarily deep. Add about a half to a whole teaspoon of mild dishwashing detergent per gallon to get the desired soapiness. The soap reduces the surface tension of the water and this reduces or eliminates the little underwater air bubbles and causes the mites to drown faster. The water should be neither hot nor cold; usually the same temperature as the ambient temperature of the cage of the snake is best (use a thermometer, don't trust your feel.) Don't allow the water to heat or cool more than a few degrees during the duration of the soak. Snakes with a high risk of drowning, such as very sick or uncoordinated individuals, should not be soaked.

Getting mites off a snake is relatively easy. But it requires some effort to exterminate the mites in the cage of the snake. It is necessary to consider two points to successfully get rid of mites from an infested enclosure. First, mites almost never lay their eggs on a snake. Mites roam around on snakes, hiding under scales, around the eyes or around the cloacal opening under the anal scale. Mites take nourishment from snakes in the form of blood meals. But mites usually hop off a snake and go walking around to find some suitable other place to lay eggs. Often, mites climb up the cage sides, stopping at the first corner, knothole or seam to deposit eggs. The second point to consider is that mite eggs are much more difficult to kill than mites. In fact, when battling mites it's best to assume that some eggs will survive all your efforts and hatch out. The published incubation time for mite eggs varies from source to source. Probably the duration of the incubation time is affected by temperature and humidity. Most authorities agree on 21 days as the maximum duration of incubation for mite eggs. It wouldn't hurt to assume it's a little longer.

While the snake is soaking, wash out its enclosure with a strong disinfectant solution; most good disinfectants regularly used in cage maintenance will kill hatched mites of any age on contact. Then, while the enclosure is still wet, take a soft bristled brush and scrub the inside and the outside. Carefully scrub the corners and seams and other possible egg laying sites. On a light-colored surface, the eggs of one female mite will appear as a tiny, tan smudge. The first wash may not dislodge the eggs, and the disinfectant will likely not kill the eggs, but the eggs are easily scrubbed free with some elbow grease and a brush. They can then be washed out of the cage.

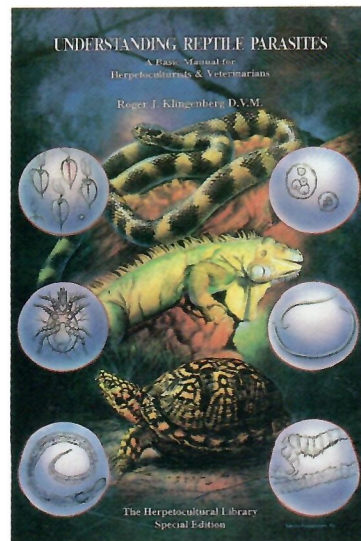
Rinse thoroughly with water and dry the

enclosure. No adult mites should be present in your enclosure or on your snake at this point in your treatment. But, making the conservative assumption that, no matter what, a few mite eggs may remain behind, place the appropriate amount of no-pest strip in the cage for at least 22 days. No-pest strips are very effective against hatching mites, so use a very small amount. Snakes exposed to too high concentrations of no-pest strips will suffer a variety of problems, including anorexia, convulsions and death. Snakes should not be allowed in contact with no-pest strips. We have found two pieces of no-pest strip, each 3/8" x 2 1/4", to be effective in cages with 24 cubic feet of interior. We use empty film canisters that have holes punched in them as containers for pieces of no-pest strips. No-pest strips can be difficult to work with; it's recommended that you not touch the yellow plastic strips with bare skin, and no-pest strips are very difficult to cut, so be careful! [Editor's note: no-pest strips can be toxic to small, fine scaled lizards such as geckos. These should be put in quarantine in a separate room while snake demiting is in progress].

There will be other mites that you will need to eradicate. If your snake has mites, then your snake room probably has mites also. Mites, even pregnant female mites, sometimes leave a snake enclosure and walk around. We once measured mite speed at one inch per minute. That's five feet per hour. At that rate, a mite can probably walk clear around your snake room in one night. They're certainly capable of changing enclosures on their own power. Here are some suggestions for treating a mite problem in your snake room: Be on the lookout for mites cropping up in other enclosures. Carefully check your other snakes' water bowls, looking for that single little fleck of "black pepper" that tells you the enemy is there. If they are present, you will almost always find a mite or two drowned in a snake's water bowl, before you see them on the snake. Lightly spray 1.5% Neguvon® around the floor and around all enclosures in the room every four days, for a period of at least 22 days. Do not spray any into the snake enclosure. Neguvon® is an insecticide designed to kill ticks on cattle; it can be purchased at farm and ranch stores. Neguvon® is serious stuff -- follow the instructions on the label and do not let it in contact with your skin, especially when you are mixing the concentrate with water. Place a couple of moth balls in your vacuum cleaner bag and vacuum your snake room daily. The moth balls will kill any mites that end up in the bag. Empty your snake room trash container daily.

We have heard that on the horizon there is a new miracle mite treatment, Ivermectin® spray. This stuff is apparently being tested in a few places and is said to be quite effective. We certainly look forward to it. In the meantime, getting

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rid of mites can be done, which is not to say that it's fun or quick. It takes some work and some disciplined follow-through. Anyone who's had mites in their collection knows it's best to quarantine new animals and not let mites in to begin with. And anyone who knows their captive snakes have mites and doesn't try to control the problem should be tied down in some tall grass full of chiggers.

Editor's note: Whether or not to use a pest strip, as well as the length of time to leave a piece of strip in, varies markedly among experts. In addition, the state of California now requires that pest strips carry a warning label about the cancer risk they pose to humans.



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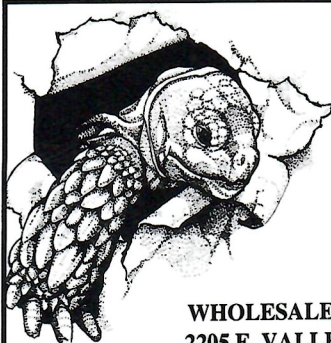
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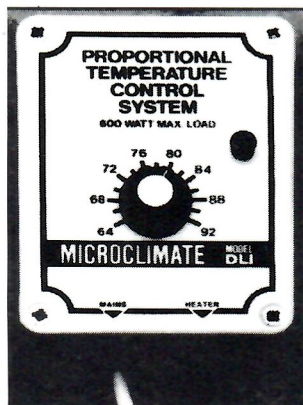
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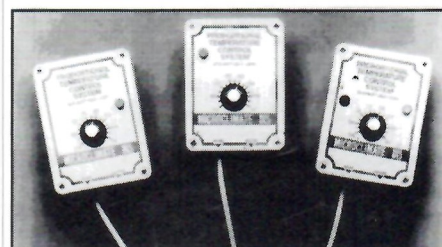
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