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HUMAN/REPTILE INTERFACE AT THE EDGE OF THE THIRD MILLENNIUM

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VOLUME 11 NUMBER 1

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THE VIVARIUM

VOLUME 11 NUMBER 1

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Cover: The "mint" phase of *P. terribilis* is highly sought after by collectors. Image by Danté Fenolio courtesy of Charles Powell and the American Dendrobatid Group.

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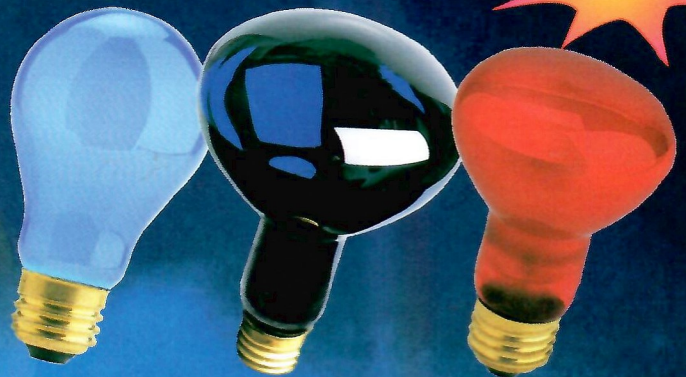
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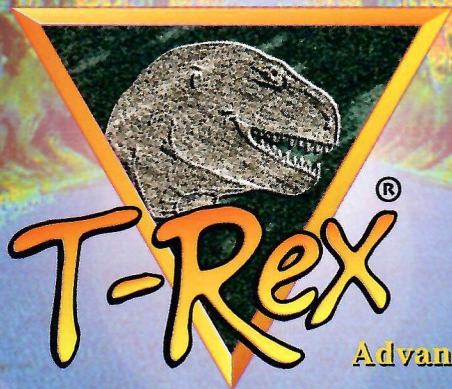
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Spirulina for herps: Vita-Rep- M and Vita-Rep-C

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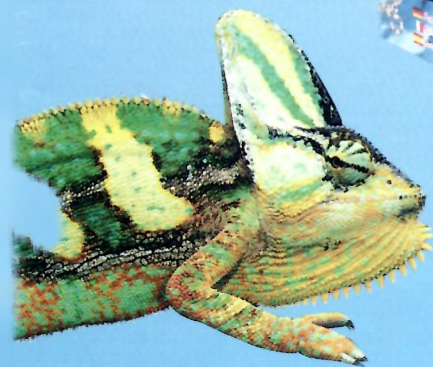
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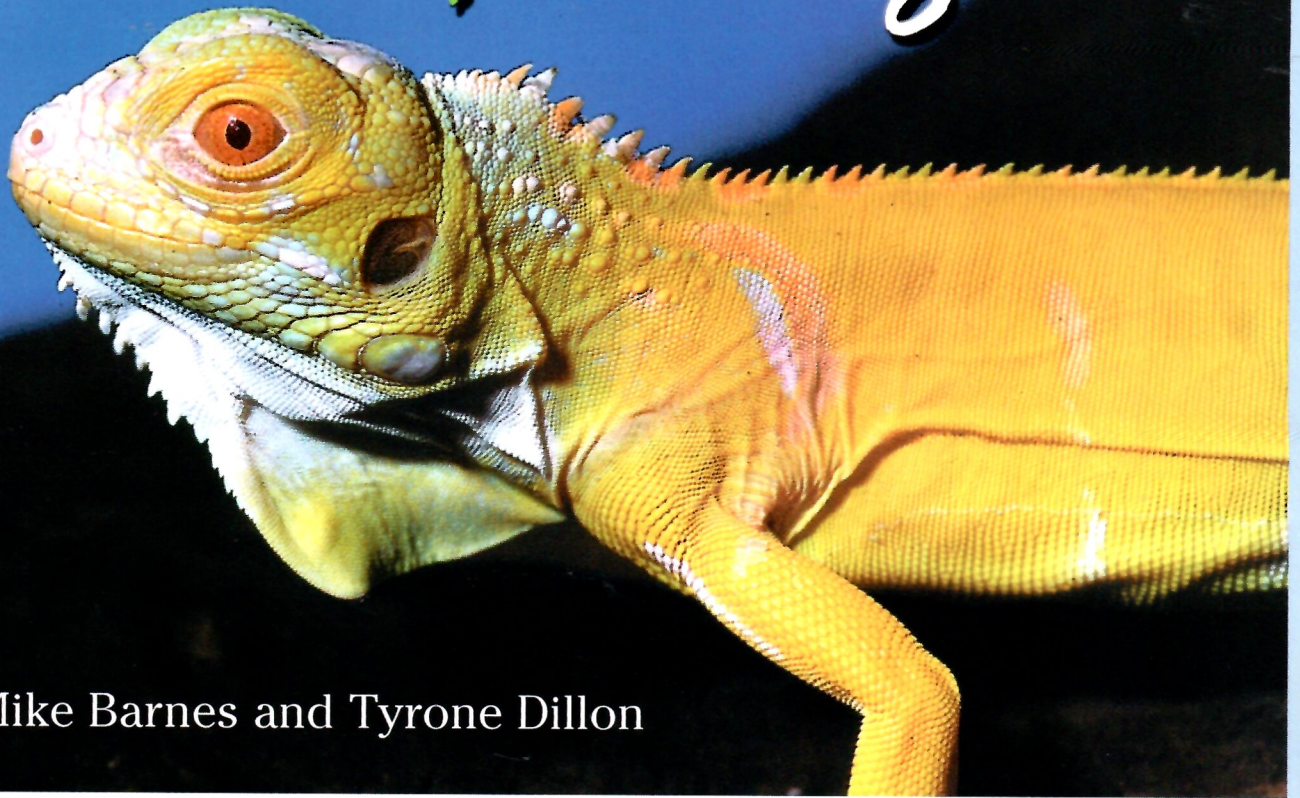
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Albino Green Iguana



by Mike Barnes and Tyrone Dillon

This magnificent green iguana, *Iguana iguana*, is by far the finest example of an albino green iguana yet known. The pure yellow of its body is second to none. Notice the wide range of pastels around the shoulders. Nowhere else will one find a better representation of an albino green iguana.

This specimen was hatched in Central America in February 1999, and was soon thereafter acquired by California Zoological Supply. At the time of writing, the iguana is 20 inches (51 cm) long. Due to its voracious appetite, the lizard will soon surpass this length.

Housed in a 20-gallon (76 l) terrarium under a Zoo Med 5.0 Repti-Iguana® light, this saffron beauty is fed a wide variety of fruits and vegetables including banana, squash, carrot, zucchini, and red and green leaf lettuce, all supplemented with Zoo Med Canned Iguana Food® and Zoo Med Reptivite.®

Although the iguana is too young to sex accurately, early appearances suggest that it may be a male.

This specimen is a one-of-a-kind find, an absolutely incredible iguana. It will make a great display animal and a big attendance draw for a public or private zoo, animal park, or public aquarium. The iguana could make you the envy of all of your reptile-loving friends if you were to add this beauty to your reptile collection.

*About the authors: Mike Barnes is Assistant Managing Director and Tyrone Dillon is Managing Director of California Zoological Supply.
(See ad on page 49)*



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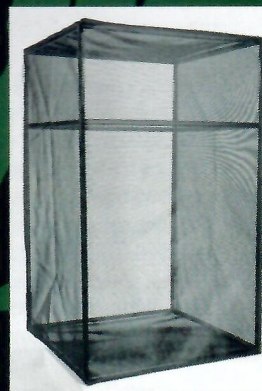
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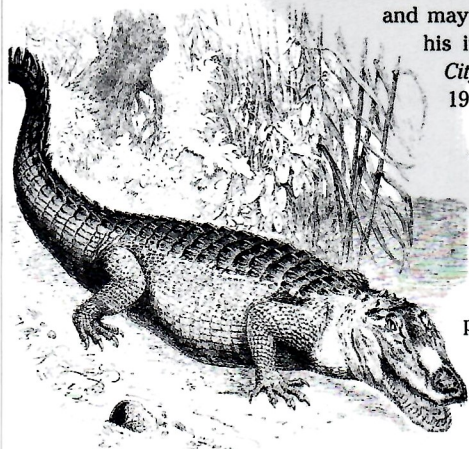
Herp News from

Oh no!

"Carlyle, Illinois - The parents of a 3-year-old boy squeezed to death by a pet python were charged... with endangering the life of a child and possession of a dangerous animal. [The 26-year-old father said]... he didn't know the snake was vicious enough to kill his son... who was asleep on the living room floor of the family's mobile home... 'I wouldn't have had a snake in my house if I'd thought it was going to kill my son, [he said] that boy was everything in my world.' The endangerment charge carries a maximum penalty of 10 years in prison." [Associated Press from *The Tacoma, Washington News-Tribune*, September 2, 1999 from Marty Marcus].

Gators, gators everywhere

• A member of the "Kachunga and the Alligator" show lost the tip of his finger during a performance in Sedalia, Missouri. He was showing the crowd the inside of the alligator's mouth, then pushed it shut. Unfortunately, his finger was in the gator's mouth and 2,000 pounds per square inch of gator jaw strength sheared off the tip. He said, "I never lost anything like this [before], it was just a clean bite." The man will remain as an announcer with the show and may return to performing after his injury heals. [*The Jefferson City Post-Tribune*, August 19, 1999 from Vicky Elwood].



• The deaths of more than 100 alligators in Lake Griffin, Florida have been attributed to a rare algae called *Cylindrospermopsis*. It may look like harmless pond scum, but it can release deadly toxins, and now covers almost all of Lake Griffin. It has also been found in other lakes and the St. Johns River in

Florida. Getting rid of the algae is a nasty job, too. Scientists in Queensland, Australia tried to get it out of the Solomon Dam lake in 1979. They used copper sulfate, which did kill the algae, but the dying algae released a toxin which caused gastrointestinal, liver and kidney damage in 150 people who drank the water. The algae has also been found in Kansas, Minnesota and Texas, but those cases do not seem to have included toxic releases. [*Naples, Florida Daily News*, July 23, 1999 from Kim and Wes von Papineau and Alan Rigerman].

• Meanwhile, in the Savanna River site owned by the U.S. Department of Energy, wildlife is flourishing. While most people think of this area as a nuclear site, both for bomb manufacture and the final clean up from the Cold War, the animals and plants seem to regard it as a human-free zone and grow bigger and live longer than they do elsewhere. And they don't glow in the dark. Indeed, tests show no more radiation in Savanna River critters than elsewhere. The DOE transferred 10,000 acres to the South Carolina Natural Resource Department which was thrilled to get the land. There are more than 100 species of reptiles and amphibians on the site including several hundred alligators and rare and endangered species. [*The Miami Herald*, July 4, 1999 from Alan Rigerman].

• An alligator handler was bitten during filming of a scary video presentation called "When Animals Attack." In a case of life imitating video, the handler was bitten by an 8.5-foot alligator who had managed to free

its mouth of duct tape while waiting for his turn in the footlights. The animal was killed. The handler went to a hospital. [*The Miami Herald*, July 27, 1999 from Alan Rigerman]. This prompted an angry letter to the editor from a woman who felt that "there is no excuse for the way we treat animals in the name of entertainment... [this] hokey production ... portrays animals as evil killers... A man ended up in the hospital, an alligator was killed needlessly and the fates of the remaining two reptiles are unknown, all for a marginal tabloid TV show. It makes you wonder what kind of person finds this scenario of fear, injury, torment and death to be entertaining." [*The Miami Herald*, August 21, 1999 from Alan Rigerman].

• On a happier note, the August 17, 1999 *Miami Herald* shows a wildlife biologist holding an albino alligator at an attraction in South Miami. The albino was the first such captured in south Florida, and one of only 17 known albino alligators in the U.S. Albino alligators have no skin pigment and this one has red eyes. [From Alan Rigerman]. And officials are planning to restore Florida's Everglades. The new Army Corps of Engineers plan would restore the water flow to millions of acres of southern Florida and provide access under Route 41 for water and wildlife. If approved, this project will be the largest environmental restoration project ever undertaken anywhere in the world. [*USA Today*, July 1, 1999 from Gary Kettring].

Can you have an urban legend in Africa?

The Herald from Harare, Zimbabwe reports that "Police have dismissed as untrue and unfounded allegations that a number of women have died countrywide after being forced to breastfeed frogs [for allegedly ritual purposes]... The story of a girl who was forced to breastfeed a large frog after being offered a lift by a businessman driving a posh Mercedes-Benz has spread far and wide. It now has numerous versions, each one more sensational than the previous one... making it appear as if the number of victims is increasing by the day." The senior police officer in Harare said, "We have investigated the case and found it to be totally false. There is no such case and the nation should not panic." [August 16, 1999 from Nathan Tenny. Read all about it at <<http://www.zimpapers.co.zw/theherald>>].

Really, don't kiss that toad

Florida officials are warning residents not to kiss, lick, smooch or let their children play with *Bufo marinus*, the cane toad. The amphibians were introduced to the sunshine state from South America in the 1930's in the mistaken belief that they would eat destructive beetles off the state's sugar cane crop. Owners of dogs and cats are warned not to let these pets out of sight, particularly at night when the toads are most active. If a dog bites a *Bufo*, the dog will foam at the mouth, its gums will become bright red and the dog will act drunk. While cats do not usually put toads in their mouths, they can get toad toxins on their paws and irritate their mouths and eyes indirectly. Pet owners are advised to seek veterinary help immediately. [*The Miami Herald*, July 8, 1999 from Alan Rigerman].

And don't eat frogs with too many legs

Stanley Sessions was right. Many amphibian deformities are caused by trematodes, parasites which infest the hind limb buds of tadpoles. You may have dissected flatworms in school. That seems to be what is causing duplicate limb deformities in amphibians all over the U.S. The trematode carries out one stage of its life in predatory birds which eat amphibians and release trematodes in the ponds whilst feeding. Scientists speculate that deformed amphibians may be easier for the

Around the World

by Ellin Beltz



birds to catch, leading to a spiraling cycle of frog deformities. [*The San Francisco Chronicle*, April 10, 1999 from Matthew Aikawa].

Settle all bar bets now

How do you tell an American crocodile from an alligator? *The Miami Herald* reports that crocs are usually green-gray or olive with a long and slender snout. The fourth tooth on the lower jaw is exposed even when the mouth is closed and the whole animal is from seven to 15 feet long. Alligators are usually dark gray or black with a rounded and broad snout. No teeth are visible when the mouth is closed (I guess this is why alligator show-men always open gators' jaws). Gators grow from six to 19 feet long. Both crocodilians occur in south Florida. While experts consider the American crocodile more docile than the alligator, crocodile warning signs are being installed in all the places where they may interact with humans. [August 11, 1999 from Alan Rigerman]. There are about 600 American crocodiles in south Florida compared with 1.5 million alligators in the same area. [*The San Francisco Chronicle*, July 10, 1999 from Matthew Aikawa].

You cute ol' things

Veterinarians at the National Zoo are beginning to develop a geriatric medicine practice for the aging animals in their care. Some of their oldest animals are tortoises: two Aldabras were born in 1956 and their African pancake tortoise hatched in 1965. Other long-lived animals are elephants, hippos, gorillas, crocodiles and cranes. [*The Washington Post*, August 1, 1999 from Andy Via].

Watch for these guys on Nasdaq

Two children who live in South America read about a contest in *Young Entrepreneur* magazine to develop the best small business plan. They have founded "Pipa Shippa International," an exotic-animal export company which specializes in shipping South American toads to North American pet shops. *Pipa pipa* is everywhere in Venezuela; they sell for \$1.50 retail in the pet shops there. So the kids wrote the award-winning plan to buy cheap, ship cheap and sell high. They estimate their first year profits at about \$13,000. They received a \$1,200 award from the magazine and the business is taking off by leaps and bounds! [*The Orlando Sentinel*, August 14, 1999 from Alan Rigerman].

Speakers support salamanders

More than 30 residents who spoke at a public hearing about a new roadway through a Mabee's salamander breeding pond in Hampton, Virginia "preferred protecting the salamander or not building the road at all," according to *The Richmond Times-Dispatch*. A contractor had started work on the road without an environmental permit; work was stopped and wetland mitigation for the damages will now be required. But the state still wants the road through the last remaining natural area near Hampton. Current plans are for two spans to cross the pond, supposedly keeping the salamanders' breeding pond clear and open. What is not addressed in the article is the influence of volatile organic chemical (VOC) and salt runoff from the bridge, VOCs as airborne emissions, salt as airborne emissions and vibrations from the bridges interfering with salamander breeding. [August 15, 1999 from Andy Via].

Iguana come into your neighborhood

Residents of Dania Beach, Florida often stand around with their arms straight out from the sides. Not because they are a huggy community; usually they are showing visitors just how big the loose iguanas in their neighborhood grow. The area east of I-95 and south of Griffin Road is an odd place to have a wild population of iguanas and other lizards; resi-

dents speculate that construction of an "outdoor park" may have displaced the critters into their area. Several residents report loose six foot iguanas disrupting their patio furniture and harassing pets. But iguanas are not the only lacertan residents; also found are water monitors, Cuban anoles and the so-called "Jesus lizard" which walks on water. One biologist said that it is as if the neighborhood got a shipment from some tropical island. Others speculate the animals may all be released pets. [*City Link*, August 4, 1999 from Alan Rigerman].

Snakes alive catch a thief

An alert Panama City, Florida pet shop clerk noticed live snakes swirling out of a customer's shirt and jeans. She noticed that the critters looked a lot like animals belonging to the store — which were now missing from their cages. So she called 911. A 46-year-old man was caught and pleaded no contest to grand theft of snakes from the shop. He was sentenced to two years of community control (house arrest) and three years of probation. He was also ordered to stay away from the pet shop. The clerk said, "It was hilarious. He kept saying he wasn't taking anything, but those snakes were just moving around and one was under his shirt and he was doing all kinds of strange things and trying to keep it in there." [*Citrus County Chronicle*, August 21, 1999 from Alan Rigerman].

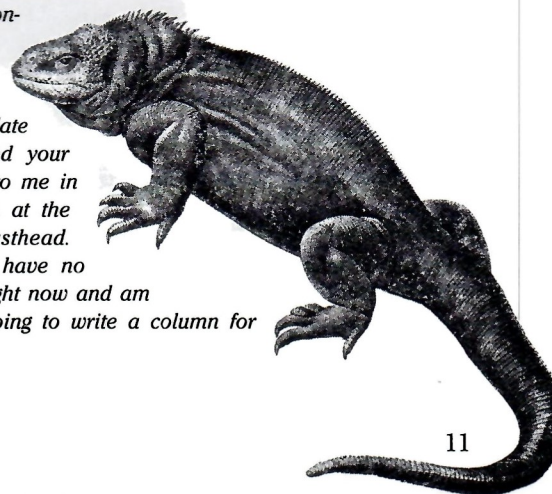
Feds plan to replace snakes

"The U.S. Fish and Wildlife Service is considering reintroducing the giant garter snake to the San Joaquin Valley as part of a larger program covering the Central Valley... the estimated cost... is \$70 million, and it is expected to take nearly 30 years to complete... [in] the Sacramento Valley... rice farmers are already working to assist in the snake's recovery... Areas of central Bakersfield, California where water is now controlled by canals were once fertile ground for the giant garter snake." [*The San Francisco Chronicle*, July 13, 1999 from Matthew Aikawa].

Woman glad her dog survived

In a sight rather unusual in Montgomery County (near Washington, DC) a woman saw her dog nearly strangled by a giant snake. The dog had been outside when it was grabbed. The woman's 18-year-old daughter tried to pull the 12-foot snake off the small dog, but was unable to make it stop constricting. Finally the husband attacked the snake with a surfboard and a shovel, and it released the dog which was not breathing. The family revived the dog and rushed it to the vet. The snake was killed by a neighbor with a .22 rifle. No one positively identified the snake; nor did anyone know where it came from. [*The Washington Post*, July 28 from Any Via and *The Erie, Pennsylvania Morning News*, July 29, 1999 from Brian Wettekin].

Thanks to every contributor this month! You can contribute too! Send the whole page of newspaper or magazine with the publication/date slug still attached and your name on each piece to me in care of The Vivarium at the address on the masthead. Please don't delay! I have no backlog of material right now and am wondering how I'm going to write a column for 11(2).



A REVOLUTION IN THE 1999 IRBA AND VIVARIUM

by Vivarium Staff

For the 1999 San Diego IRBA Show held at the San Diego Concourse on October 9th and 10th, IRBA and the *Vivarium* magazine brainstormed to develop a radically different herp event that fused herpetoculture, education, technology and art. The result was an 80,000 square foot multi-event show, the likes of which have never been seen in the history of herpetoculture. This great herp happening will set the standard for herp shows for years to come. As could be expected, once the word got out the public came, with a record 6200 attending and the highest international attendance ever. This was not a show most people would easily forget.

The events were distributed in three areas. Two show rooms featured sales booths with one holding workshops and another the shows and awards. In the carpeted lobby, a herp art show featured the paintings of Karel Brest Van Kampen, Margaret Hawley, Gamini Ratnavira, Marty Capron, and other wildlife artists. David Northcott, Danté Fenolio and Philippe de Vosjoli displayed their photographs. Highlights of this art show will be presented in the January (11.2) *Vivarium* issue.

On Saturday morning a juried **Herp Show and Awards** took place with five judges evaluating and rating herps in the following categories: Honduran milksnakes, *Pituophis*, corn snakes, dwarf monitors, inland bearded dragons, crested geckos and panther chameleons. Participation in the juried animal awards was high, with many entries in each category. The winners will be presented in the January *Vivarium*.

One of the highlights of the show was the juried **1999 Vivarium Show and Awards**, an event that had the public excited, gawking and pointing at the 24 entries, several of which raised vivarium design to a higher form of art and technology.



The 1999 Vivarium Show and Awards was a great hit.



Best of Show and First Place in the large **Tropical Vivarium** category went to the Amphibia Research Group. This mind-boggling display included fog rolling out of a hollow log, moonlight setting, gradual light increase, lightning simulator, rain drippers, misters, and various sounds to accompany the electronically controlled settings. For example, booming thunder accompanied the simulated lightning. A great variety of plants decorated this cork-backed display, including bromeliads, vines, mosses and fern. This amazing vivarium housed frogs and phantasmal leaf-tailed geckos. As the **Best of Show** winner, the Amphibia Research Group was awarded \$1000.

HERPETO CULTURE: CUTTING EDGE REPTILE SHOW



Danny Salzhandler, vivarati extraordinaire once again blew away the audience with his fusion space-age/post-apocalyptic Biosculpts, winning the **First** and **Second Place** in the **Vivart** category. Oriental fire-bellied toads, Jamaican anoles and an emerald tree boa were on display.



This five foot Biosculpt won **Second Place** in the **Vivart** category.



Sherman Nursery won **First Place** in the small **Aquatic Vivarium** category for a system combining wood, Java moss and emersed *Anubias*. The water portion contained several cryptocorynes. It housed dyeing poison frogs.



Jerry Hodge, master carpenter and vivarati, exhibited a beautiful hand-carved, wood-framed vivarium with waterfall and a unique easy-maintenance water changing system. This striking piece displayed an emerald tree boa and red-eyed treefrogs. He won **Third Place** in the **Vivart** category.



Live Cargo won **First Place** in the large **Aquatic Vivarium** category with a rock background drip waterfall, Anubias plants, fish and frogs.



Vivarium Research Group won **Second Place** in the small **Tropical Vivarium** category with a blue anodized sliding front VRG enclosure highlighting a "Visiscape" designed by Patrick Huddleson and displaying *Dendrobates leucomelas*.



Reptile Depot won **Third Place** in the large **Tropical Vivarium** category with this beautiful moss covered display.



Black Jungle Terrarium Supplies won **First Place** in the small **Tropical Vivarium** category with a hexagon setup backed with cork and housing a great variety of epiphytes, including bromeliads, orchids and an unusual Dischidia. This eye-catching setup was inhabited by yellow-backed *Dendrobates tinctorius* and *Dendrobates pumilio*. The *tinctorius* were so comfortable that they bred during the show.



LLL Reptiles won **Third Place** in the small **Tropical Vivarium** category with an original display using a hollow log as a waterfall. Hydroponic clay pellets formed the base substrate. A variety of plants decorated the interior. Designed by Crystal Humphreys.



Penn Plax assembled a colorful aquatic vivarium with synthetic water lilies and vivarium plants, and some of their new plastic resin imitation wood and vivarium products. They won **Third Place** in the small **Aquatic Vivarium** category.



Reptile Haven won **Second Place** in the large **Desert Vivarium** category with a Foam Homes set up housing bearded dragons and designed by Tom McDonnell.



T-Rex won **First Place** in the small **Desert Vivarium** category with a dramatic surrealistic design by Jon Coote using a blend of Calci-Sand and concrete structures to feature colored lizards.



Advanced Vivarium Systems won **Second Place** in the small **Aquatic Vivarium** category. The display housed small turtles and several species of fish.



Sherman Nursery also won **Second Place** for their large **Tropical Vivarium**, using a very "Zen" approach to design with large areas of open space planted with low ground covers including mosses, azolla and liverwort. This vivarium housed several unusual plants including a caudexed *Plectranthus* (Swedish ivy genus) and a purple-leaved passion vine. It housed a variety of colorful poison frogs. A BioVine® Water Log was integrated in the design.

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Natural History, Captive Husbandry and Breeding of the New Caledonian Crested Gecko, *Rhacodactylus ciliatus*

Part 2: Husbandry and Propagation

by Philippe de Vosjoli and Frank Fast

All photos by the authors

Part 1 covered natural history and appeared in issue 10(6) of The Vivarium. Part 3 will conclude this series on *Rhacodactylus ciliatus* with details on disorders and diseases, and will appear in 11(2).

Crested geckos, much to everyone's surprise, have turned out to be the easiest to keep of any reptile. They are docile and amenable to moderate handling. From a breeder's standpoint, they are a gold mine because of a short generation time, a high reproductive rate, and because they are naturally polymorphic, existing in nature in several color and pattern morphs. This means that over the next few years, as a result of selective breeding, outrageously beautiful crested geckos will become available, elevating them to living art and becoming a reptilian analog of koi carp. Simply said, crested geckos are one of the most exciting things to have happened in herpetoculture in the last five years.

Captive Husbandry

Selection - Crested geckos are now readily available as young captive bred specimens. Larger animals, mostly males, are also occasionally offered for sale. In general, your best bet is to start with immature animals (you'll know their approximate age).

Quarantine - Because of the ever-increasing risks of disease in herpetoculture, any newly purchased specimen should be quarantined in a separate enclosure for at least 30 days prior to introduction into a group. It should be evaluated and monitored for weight, appetite, growth, condition of feces, health and behaviors.

Housing - The minimum size enclosure for up to four crested geckos is a 20-gallon (76 l) high, screen top vivarium, with larger sizes being even more desirable. As mentioned in Part 1, crested geckos have a daily behavior pattern of hiding during the day at ground level and emerging at night to climb up shrubs and other vegetation to feed and socialize. If you want to

simulate nature, you will need a tall vivarium with small trees or shrubs, four to six feet (1.2-1.8 m) tall.

Babies can be raised for the first six months in larger plastic terraria which are practical and inexpensive for housing large numbers of small crested geckos.

Substrate - During quarantine and for housing large numbers of crested geckos, the substrate which is easiest to use and replace is newspaper or newsprint. For display purposes and for housing breeding groups, we prefer a 50/50 mixture of a peat moss based potting soil with no perlite and a small-to medium-grade orchid bark. The mix is lightly and thoroughly moistened initially. To observe more natural behaviors, a layer of leaf litter can be placed on top of the substrate.

Landscaping - Enclosures should have slabs of cork bark on the ground to serve as shelters and running diagonally across the tank to serve as climbing areas. Other commercially produced reptile shelters will also be effective for this species. Wood branches with a diameter about the girth of a crested gecko body can be used for climbing sites. In tall enclosures which will allow more natural behaviors, trees and shrubs can be used for climbing — umbrella trees (*Schefflera arboricola*) and dracaenas work well. Provision of sites for climbing can help prevent floppy tail syndrome.

Lighting - Crested geckos can be raised and maintained in low light if they are given a dietary source of vitamin D₃. Most of our specimens receive only indirect light from windows or nearby light fixtures. Hobbyists who wish to use a light source for vitamin D₃ synthesis can either place reptile UV-B fluorescent bulbs (Zoomed ReptiSun 5.0 is highly rated) over their enclosures or expose their animals to sunlight in outdoor screen cages with



Harlequin morph of the crested gecko.

shelters during mild weather, for four to five hours a week. Although crested geckos are primarily nocturnal, they will sometimes emerge in early mornings to bask or expose sections of their body to sunlight for brief periods.

Red light/reverse light systems - When they are out at night, crested geckos can be quite entertaining to watch. The best way to do this is to turn off the lights in a room except for red 25 watt incandescent bulb(s) placed above the enclosure. These will also be used as a primary heat source. In zoos, a reverse light system will prove ideal for displaying this nocturnal species.

Heating - During the warmer eight to nine months of the year, crested geckos should be kept at daytime temperatures of 76–82°F (24–28°C). They will safely tolerate temperatures up to 85°F (29°C). At night the temperature can be allowed to drop to the mid 70's (about 24°C). For two to four months during the winter, crested geckos should be given a rest and kept at temperatures five to seven degrees cooler than the above mentioned range [about 68°F (20°C) nighttime low and 74°F (23°C) daytime high]. This will cause crested geckos to be less active, feed less and cease breeding.

In southern California, we keep crested geckos indoors at room temperatures naturally within the right range for this species. If you need to heat crested gecko vivaria, use either incandescent red lights in reflector type fixtures (covering no more than a third of the floor surface area) or use a subtank

heating pad or heat strip on a rheostat or thermostat. Heating pads and heat strips should cover no more than 25% of the floor area and be adjusted so that their surface temperature is 78°F (25°C). During the winter rest period, the heating pad should be turned off or adjusted to 74°F (23°C). In hot climates, crested geckos should be maintained in air-conditioned rooms to meet their temperature requirements.

Numbers per enclosure

Crested geckos have a high level of social tolerance but nonetheless follow a classic gecko pattern whereby males tend to be aggressive to each other. In some cases we have kept crested geckos in groups consisting of two males and several females with minimal aggression between males. In other cases, males have fought, resulting in lacerations on the head and loss of tail. In general, keeping only one male per enclosure is recommended for small vivaria.

Aggressive displays and interactions between males and females may also occur but tend to be brief and of little consequence. Because these geckos are normally sold in pairs, keeping them in pairs is an effective method for housing and breeding this species. However, many breeders, in order to minimize the number of enclosures and individuals they maintain, will choose to keep their animals in breeding groups of one male and five or six females. Enclosure size and shelter availability will be a key factors when keeping large groups. If too crowded, then signs of stress may become apparent, e.g. some individuals will remain thin and breed poorly.

Babies can be safely housed in groups for up to six months, longer if they are kept in large enclosures. They should be segregated by size to reduce stress.

Water and Relative Humidity

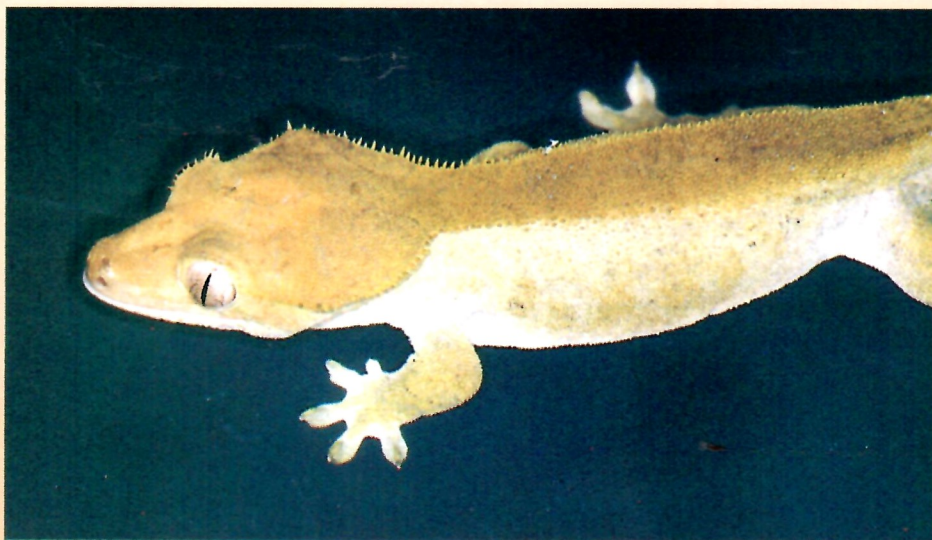
We've noticed that crested geckos in the wild tend to be more active after rains, so we mist the sides of their enclosures lightly every evening during the warmer months. To prevent the build up of mineral stains on the sides of an enclosure, we recommend purified or reverse osmosis (R.O.) water. Nightly misting also helps to raise the relative humidity within an enclosure.

We also make available at all times high quality drinking water provided in

(Continued on page 20)



Black spotted unicolor morph of the crested gecko. The black spots are an independent trait that can be found in other morphs including the flame morph.



A bicolor morph of the crested gecko.



Yellow tiger morph of the crested gecko.

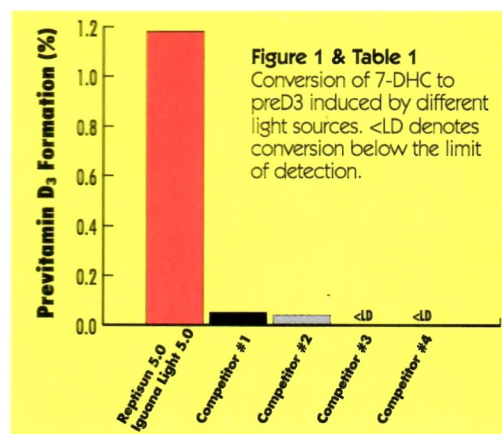
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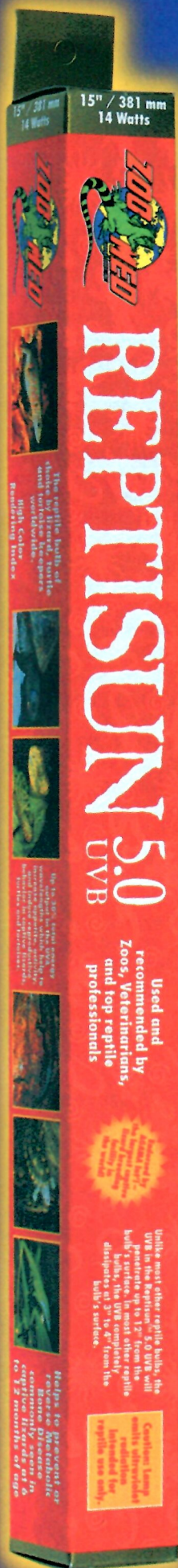
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(Continued from page 18)

a shallow container. Other herpetoculturists use misting of enclosure sides as the source of water and have had good results.

Diet - Crested geckos have thin and relatively weak jaws. Unlike the larger *Rhacodactylus*, their bites are brief and of little consequence. They are incapable of killing large prey or biting chunks out of fruit. This has implications in terms of their feeding. They must be fed small prey and fruit in a form that can be easily swallowed whole.

In the wild, *ciliatus* are often found at night climbing up flowering shrubs and herbaceous plants, presumably to access nectar from flower parts, small

soft fruit and small insects. The ground where they occur can at certain times of the year be littered with small ripe fruits, such as tiny figs. They also capture and feed on various small arthropods.

In captivity, crested geckos are fed insects, particularly supplemented crickets, and purées of fruit and cooked meat or simply puréed baby foods. A good feeding regimen is to offer crickets twice weekly (50% of diet) and puréed foods twice weekly. To estimate the right size cricket to offer crested geckos, figure that the length of cricket should be about the width of a gecko's head.

For the purée, we use nine parts fruit baby foods (e.g. Gerber® in jars) to one part meat baby food. For fruit, we

use fruit medley — apricot, peach, banana, strawberry. Some breeders blend their own formulas, using various fruits and some vegetables. We'll occasionally replace 10% of the mix with puréed vegetable. Use less than 50% banana or the mix will quickly turn dark and may be refused. For the meat portion, we use veal or chicken baby foods.

Some breeders will maintain crested geckos on a diet of primarily puréed food and seldom offer crickets. We feel that diversifying the diet can result in better long-term health and egg production.

Vitamin/Mineral Supplementation

Because insects and most fruit tend to have a high phosphorus-to-calcium ratio, it is important to supplement the diet with calcium. Two methods of supplementation are used by breeders. One method uses a source of calcium with no vitamin D₃ but also exposes crested geckos to a source of UV-B such as reptile high UV-B bulbs or sunlight in screen cages. Alan Repashy uses two tablespoons of Miner-All®-O (without D₃) per 1000 g (2.2 lb) of puréed foods, but exposes animals to sunlight in screen cages with shelters during mild weather for four to five hours weekly.

The other widely used method is to mix in one heaping tablespoon of calcium carbonate and one teaspoon of a multivitamin/mineral supplement with vitamin D₃ per 1000 g (2.2 lb) of puréed foods. Several breeders use a tablespoon of calcium/D₃ supplement and a teaspoon of a reptile multivitamin/mineral supplement per 1000 g of puréed mix.

Crickets are lightly coated with calcium carbonate or a calcium/D₃ supplement at each feeding.

Feeding babies - For baby *ciliatus*, only offer food in small containers such as baby food jar lids and don't use too much food. If the container is too large or contains too much food, babies may run through the mix, which can then dry and cause the toes to stick together. These "stuck" babies can't perform natural activities, such as climbing walls and structures, and can die if they aren't treated.

Assessing calcium storage - Adult crested geckos store calcium in endolymphatic sacs, visible in their open mouths at the back of the upper



Notice the well defined white edge along the fringe of the hind leg. The extent of white correlates with the extent of white in raised scales along the sides of the body.



This is a dark unicolored morph that the authors are working with. Note the uniformly dark belly.

roof (palate) of the oral cavity. Gentle tapping of the snout or stroking the sides of the snout will encourage a gecko to open its mouth and allow you to observe the whitish calcium sacs and assess the amount of calcium stored.

In a gravid female, the amount of stored calcium will visibly decrease following passage of the eggs through the shell gland. If too much calcium and D₃ are provided, the calcium sacs can become so enlarged that feeding may become difficult. In rare cases, so much calcium will be accumulated that the calcium sac will rupture (Alan Repashy, personal communication). Monitoring the amount of stored calcium can allow you to assess the effects of calcium/D₃ supplementation.

Breeding

Sexing - Mature males have enlarged hemipenial bulges and preanal pores. To see the preanal pores, however, requires a strong magnifying glass or pocket microscope and good eyesight. Unlike with *R. leachianus*, we have not been able to use the viewing of preanal pores as a method to determine the sex of small crested geckos although this may be possible with a pocket microscope. Males have larger whitish cloacal spurs than females and this can be used for a more educated guess when trying to sex baby crested geckos.

Sexual Maturity - Under optimal rearing conditions, crested geckos can reach sexual maturity at between six and eight months of age. Males around six months of age show an almost overnight hemipenial bulge when they reach sexual maturity. With tailed females, we consider a body weight of 26 grams (0.9 oz) as the *minimum* weight for considering breeding. We prefer keeping females separate from mature males until they are 28-30 grams.

Breeding Patterns - Simply keeping crested geckos in pairs or groups of similar size will result in breeding. As a rule, crested geckos will breed for seven to eight months and then rest for four to five months during cooler periods, but different temperature and dietary regimes can affect this pattern.

If kept at temperatures in the upper 70's (about 25°C) year-round, given plenty of food and calcium/D₃ supplementation, up to eleven clutches of eggs can be laid but females will not

Examples of egg production in *Rhacodactylus ciliatus*.

Female 1. The records here show the first two years of breeding for this young female.

Date	Number of Eggs	Days Between Laying
7/11/97	2	
8/17/97	2	37
9/11/97	2	24
10/10/97	2	29
11/17/97	2	28
12/15/97	2	28
Total:	12 eggs	
REST 12/97-5/98		
5/21/98	2	
6/24/98	2	33
7/21/98	2	27
8/18/98	2	28
9/14/98	2	26
10/14/98	2	30
11/30/98	2	44
Total 1998:	14 eggs	

Female 2. This wild-caught female was collected in 1995.

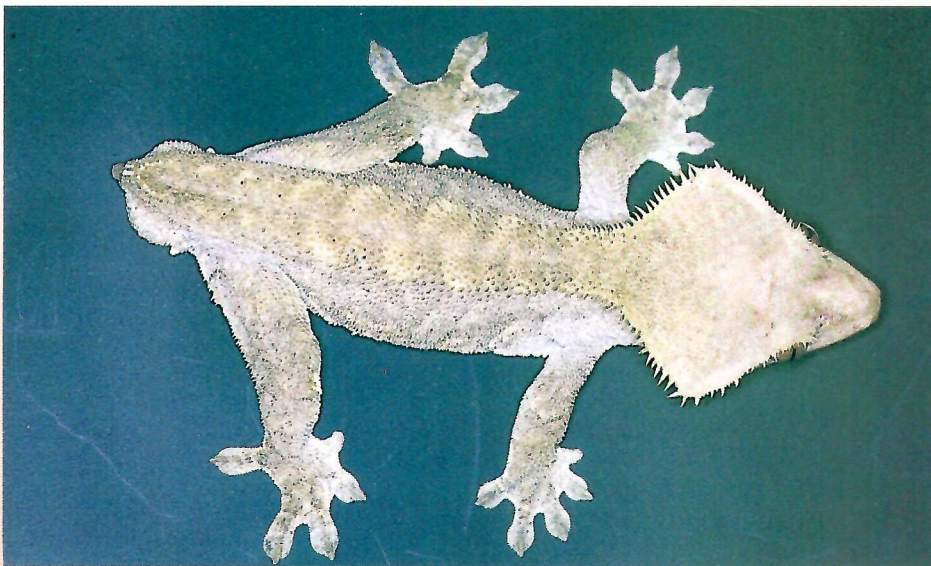
Date	Number of Eggs	Days Between Laying
3/21/97	2	
4/28/97	2	37
5/27/97	2	29
7/8/97	2	44
8/19/97	2	42
10/22/97	2	63
Total 1997:	12 eggs	
REST 10/97-4/98		
4/15/98	2	
5/26/98	2	51
6/29/98	2	33
7/28/98	2	29
8/28/98	2	31
Total 1998:	10 eggs	

Female 3. These records are for a young, second-year female.

Date	Number of Eggs	Days Between Laying
12/17/97	2	
REST 12/97-3/98		
3/17/98	2	
5/4/98	2	48
6/8/98	2	35
7/9/98	2	29
8/7/98	2	29
9/10 calcium crash		
9/31/98	2	54
10/26/98	2	26
Total 1998:	16 eggs	

survive long-term under this regime. We recommend limiting feeding to one puréed meal and one insect meal per week during the cool/rest period. Depending on where our groups are located, fall/winter temperatures will drop to 65-68°F (18-20°C) at night and range between 70-74°F (21-23°C) during the day.

Nest Boxes - When these geckos are kept on newspaper, a container with moistened soil or vermiculite over which a section of curled cork bark is placed will serve well for egg-laying. If kept on a soil/bark mix, a shelter or coiled cork bark should be placed over an area of substrate that is moistened through nightly misting. The best way



Broad head is a trait that can be selected for in this species.



The desirable 'Flame' or 'Fire' morph of the crested gecko.



Vent of male crested gecko. Note the large hemipenile bulges.



Vent of female crested gecko.



Note the calcium storage sacs on the roof of the mouth.



Eggs of crested geckos incubating in a perlite/vermiculite mix. Note the granular, under-calcified eggs on the bottom left.



Baby crested geckos vary in size at hatching. This can be the result of either genetics, the condition of the female or incubating conditions.

not to miss eggs is to keep careful records and check for eggs daily, beginning 23 days after the last egg clutch.

Eggs - Healthy eggs are white with a relatively thick leathery shell. Undercalcified eggs have a semi-translucent shell with scattered granular calcium deposits. Within 12 hours, eggs exposed to air will dessicate and not be recoverable, so daily checking of egg-laying containers is required for geckos kept in groups. If the geckos are kept in single pairs, breeding records and observation of the girth of females should give you a good idea when the next clutch is due. Check for eggs beginning 23 days after the last clutch. This will allow you to limit the time spent checking for eggs.

Reproductive Pattern - Many lizards (leopard geckos, bearded dragons, various chameleons) show a high reproductive rate for the first two to three years, producing large and/or frequent clutches; this pattern subsequently declines. After a few more years, old females may no longer be reproductive. We currently don't have enough data to present a reproductive profile of crested geckos. Young animals which are a year or two old tend to have the highest reproductive rates, and older females tend to breed less frequently, with varying and increasing intervals between clutches. However, even a five year old female can still produce five good clutches of eggs per year.

Egg Incubation - After finding eggs, we remove them and place them in plastic storage containers of sweater box size which have been filled with 1.5 inch (3.8 cm) of damp substrate

[approximately 3 parts water to 4 parts (by weight) substrate]. The substrate is a mix of 50% perlite and 50% coarse vermiculite.

Eggs are placed on their sides and half buried in the mix. A lid is used, and the container is kept at room temperature.

We inspect the eggs several times a week, lifting the lid to allow air flow and to monitor the substrate moisture. We have incubated eggs at 76-80°F (24-27°C) and at 68-74°F (20-23°C). These ranges have had no effect on sex ratios, but has impacted incubation time, being about 90 days at the higher temperatures and up to 121 days at the cooler temperature range. In crested geckos, sex is not determined by incubation temperature and over time about equal numbers of males and females will be produced.

Morphs

We are currently working on identifying the genetics of various morphs, a project which will require several years. A preliminary categorization of crested gecko morphs follows.

Unicolored - Single uniform color. Belly is a single color but can be lightly mottled. The color can be shades of tan, yellow, dark brown, dark reds, and bright orange. Some colors such as reds are commonly associated with a pale lower jaw.

Bicolored - Two colored. The area between the lateral crests is one shade of color and the rest of the body a different shade. In bicolored *ciliatus* it is not uncommon to have lateral tiger stripes of a lighter color patterning the mid-dorsal area. The belly is a single color but may be lightly mottled.

Tiger/Marbled - A single ground color marbled with thin lateral tiger stripes of another color. The belly usually has a marbled pattern formed by the two colors.

Fire/Flame - The lateral areas are mostly single colored and the mid-dorsal area is bicolored with broad tiger stripes, usually a shade of yellow or orange. Both the limbs and the digits may have yellow or orange blotches of the same color as in the mid-dorsal area. Bellies are mostly the same dark color as the sides with some light blotches.

Harlequin - This crested gecko has a dark gray background and bright cream yellow slashes in both the lateral and middorsal areas. Limbs and digits may also be blotched, and the belly is bicolored.

Black Spotted - *Ciliatus* with the independent trait of black spotting can be from several of the above morph categories.

Painted Thigh - This morph has a thick creamy white to yellow-white line along the fringe edge of the hind legs. The trait is associated with small numbers of enlarged white to yellow/white scales along the sides of the body distributed in lateral rows. The amount of white on the thighs correlates with the amount of white on the lateral scales. This appears to be an independent trait.

Other morphs - Little effort has yet been directed in developing morphs related to form and scalation but this is bound to happen in the course of domestication of this species. For example, enlarged scales forming the various crests could be selected for, so that they are even larger. We have had one F1 specimen with no ciliary crests but doubt that this is a trait that would be of great appeal. Greater width of head could also be selected for in this species, as could greater size.

Other traits could lead to domesticated forms which personally we believe would turn crested geckos into something rather grotesque, like some of the fancy goldfish breeds. For example, we have noticed some specimens with slightly shortened snouts and slightly enlarged eyes, a trait that could be taken to greater extremes but that hopefully will be selected against in the course of herpetoculture. The fact is, herpetoculture has in the crested gecko found its koi carp.

Acknowledgment: Special thanks to Alan Repashy for supplying invaluable information on husbandry and breeding, and to Kyle Billuni, research assistant, for additional data.

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Scenting Eggs and Embryonic Learning

A new technique to increase herpetocultural success

by Jon Coote

Herpetoculture has advanced mainly by steady evolutionary developments and less commonly by quantum leaps of combinations of radical new ideas and discoveries. Examples of these quantum leaps are our abilities to now accurately determine the sex of reptiles and our learning that varying environmental conditions, particularly temperature, encourages successful reproduction. Our increasing knowledge of nutritional requirements, and especially of the vital requirements for adequate levels of vitamin D₃ and calcium, are more evolutionary, and have contributed particularly to the success of lizard husbandry. These evolutionary developments are made because our understanding of herpetocultural nutrition can be initially extrapolated from research on other captive vertebrate species.

The Sense of Smell

Perhaps the main sense that reptiles employ in their daily interactions with each other and their environment is their sense of smell. The essential structure of the nasal cavity of all reptiles is similar, with shape and proportion being the main differences.

Sensory epithelium, lined with cilia which vary between species, are found at the back of the nasal cavity. These cilia are generally thought to contain receptor proteins, either on or within them, that can detect the shape of molecules of volatile scents. New thoughts now favor the theory that these receptor proteins measure molecular vibration rather than shape. This new theory more accurately explains how the sense of smell can detect odors that have never occurred in the world before, one newly discovered by a chemist for example. The sense of smell is the only one that is not pre-programmed to detect a finite range of stimuli. How can it be possible for receptor proteins to be available in an infinite number of shapes to fit molecules of scents as yet unknown?

For most reptiles, their nasal sense of smell is superseded by their far more sensitive vomeronasal organs, the twin organs of Jacobson. These organs are located in the roof of the

mouth and separated from the nose by an extension of the primary palate. Molecules of scent, both volatile and non-volatile, are transferred from the environment by the tips of the forked tongue to these twin organs for subsequent analysis and interpretation. The vomeronasal system is most highly developed in snakes, particularly aquatic species. It is less developed in some lizard groups such as anoles, chameleons and most agamids, and in arboreal species in general. Those with the most advanced vomeronasal development usually show a marked reduction in their nasal sense of smell. Crocodilians retain vomeronasal organs as juveniles but lose them as adults.

The importance of these senses of smell cannot be underestimated in their abilities to allow the reptile to detect what it perceives as edible. Perception of food can be problematic in herpetoculture, effectively limiting the species that we can successfully maintain and reproduce. Many species have particular food preferences as juveniles which are not shared by the adults. So it may be possible for us to successfully keep the adults, but then find that it's impossible to get subsequent hatchlings to feed voluntarily. A good example is the African tiger

snake, *Telescopus semiannulatus*. Adults have been persuaded to initially take small mice, using T-Rex Lizard Maker® scent, and then to take unscented small mice without further problem. Captive-bred hatchlings, however, have proved to be more intractable in their feeding response, although the Lizard Maker® scent hasn't yet been tried with them.

If there was a reliable new technique to encourage hatchling reptiles to take foods that are easily available, and as nutritious and digestible as that which they would typically eat in the wild, it could increase the number of species in mainstream herpetoculture. It would have to be a technique that could utilize easily available manufactured scents or flavors that are currently available, and preferably those flavors would be of prey species that are typically fed to captive reptiles, (such as the range of products from T-Rex which includes scents for lizards, mice, and crickets). These manufactured scents and flavors would also need to be readily marketable.

(Continued on page 41)



Baby corn snakes and other colubrids could be conditioned to more readily accept standard prey items or manufactured diets during incubation. Photo by Bill Love.

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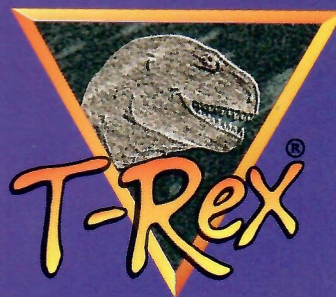
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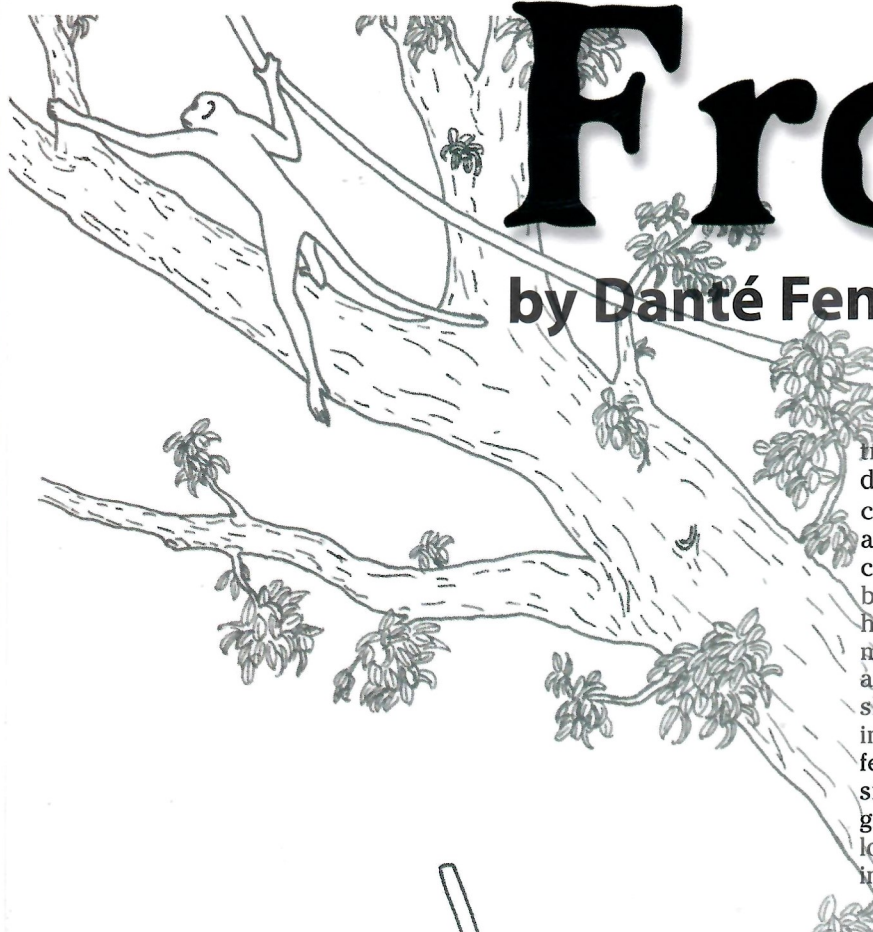
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Frogs

by Danté Fenolio

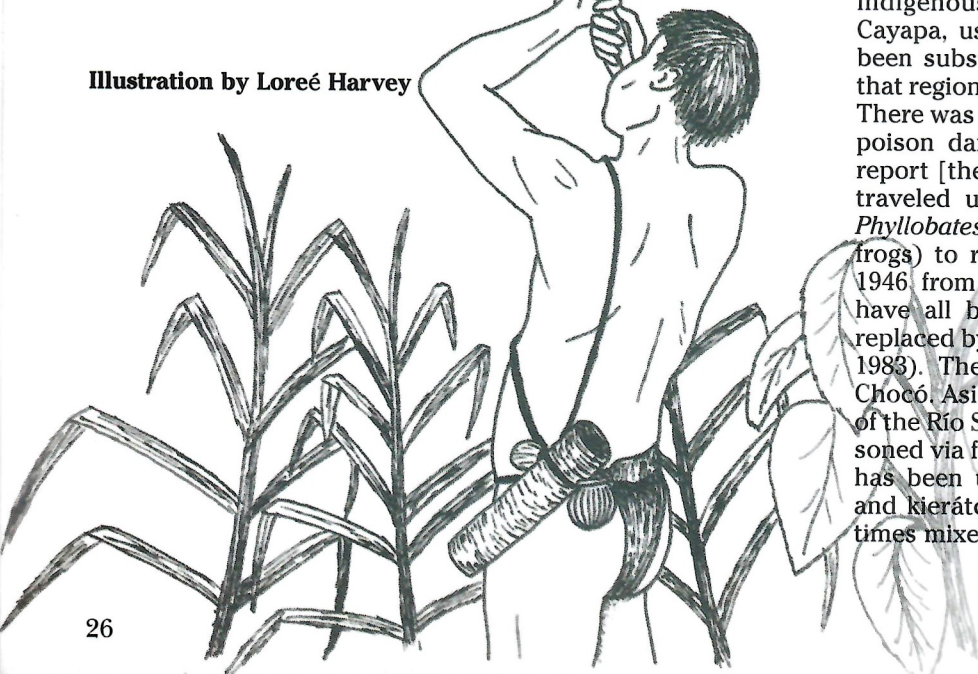


Daybreak over the Pacific lowland rainforests of Colombia, dawn's faint light reveals mist wafting aimlessly through tangles of vegetation. The tranquility of the scene comforts a troop of monkeys, dozing in the forest's canopy. The morning is cool and crisp, the smell of damp humus heavy in the air. Silently, a silhouette stealthily passes by tree trunks, through creepers stretching down to the forest floor and over bundles of roots. Undetected, it moves closer to the tree harboring the unsuspecting monkeys. With fluid-like motion, a dark pole is hoisted to the air and skillfully aimed. Finalizing minute calculations of distance and slope, an abrupt bellow finalizes the procedure. In an instant, one of the slumbering monkeys shrieks, takes a few steps forward but continues no further. In confusion, the animal loses muscular control and releases its grip of the branch. Falling to the forest floor, it thuds loudly as it hits the ground. The Emberá hunter moves in to claim his prize.

Blowguns have been utilized by indigenous groups in Latin America for centuries. Only two related Colombian groups have been confirmed to use, or have used, darts tipped with frog toxins. Myers et al. (1978) includes a detailed description of the history, usage and construction of blowguns, quivers and darts in relation to poison frog usage. The following information is derived from that outstanding paper, unless indicated otherwise (if interested in this topic, I recommend you read the paper).

Indigenous groups that have traditionally used blowguns, and poison them with frog secretions, are the Emberá Chocó and the Noanamá Chocó. A report of indigenous peoples of northwestern Ecuador, the Cayapa, using frog toxins on darts exists but has not been substantiated (there is no known poison frog in that region with toxins virulent enough to poison darts). There was a report of *Dendrobates auratus* being used to poison darts in Panama but much doubt lies in the report [the Choco informant from the region may have traveled up from Colombia and assumed toxicity of *Phyllobates* (the genus containing the dangerously toxic frogs) to reside in a lesser toxic poison frog (Breder, 1946 from Myers et al., 1978)]. Apparently, blowguns have all but disappeared from the Noanamá Chocó, replaced by firearms (Myers et al., 1978; Myers and Daly, 1983). The tradition is declining among the Emberá Chocó. Aside from a group of Emberá at the headwaters of the Río San Juan, darts have not been exclusively poisoned via frog toxins. A plant poison, collected as a sap, has been used, deemed pakurú-neará by the Emberá and kieratchi by the Naonamá. Frog toxins are sometimes mixed with plant toxins to poison darts.

Illustration by Loreé Harvey



That Kill

The fabrication of a blowgun is an involved task. The blowgun is made of palm wood, roughly 9–11 feet (2.7–3.4 m) in length, and may take months to complete. It can be fitted with a sight. The quiver may be made of bamboo and the darts of palm wood. Characteristically for the Chocó, the darts have a corkscrew carving pattern for about an inch after the tip; a deep break point is made above the screw carvings. The fine thread of the screw pattern holds the toxins. Wadding for the darts is made of a cotton-like fiber from a plant. Seedpods are hollowed and attached to the quiver to hold the wadding.

The primary role for the blowgun has been as a hunting tool. It seems that the majority of South American indigenous groups have cultural morals against the usage of blowguns in warfare. Many believe bad luck will follow if the weapon is used outside of its hunting role but the Chocó don't share in the belief. Myers et al. (1978) indicated that it is likely the Chocó used darts laden with frog toxins against the Spaniard soldiers during the period of Spanish domination. The Chocó's resistance of Spanish domination lasted more than a century. There was also mention of a situation in modern times where an Indian was held on suspicion of using a frog toxin-coated dart in a murder. As well, another Indian had made mention in an interview with Colombian government officials that a man shot with a dart could only run for several hundred meters before dropping dead — experience usually leads to such knowledge.

Meet the Makers

The frogs used for dart poisoning are exclusively species from the family Dendrobatidae, within the genus *Phyllobates*. This genus is inclusive of all of the highly toxic species of poison frogs, which dendrobatid frogs as a whole are referred to. The bright coloration of many poison frogs is thought to be a condition known as *aposematism*. Vivid colors are recognizable and serve to warn potential predators of the toxicity in the bearer. Likely, the value of recognizing the bright colors as warning signs needs to be learned by predators, first by making the mistake at least once and surviving. This being the case, the aposematic coloration is not foolproof. All species of *Phyllobates* display vivid coloration in pattern or the entirety of their bodies.



Of the three highly toxic *Phyllobates*, *P. aurotaenia* is the newest upstart in the poison frog keeping hobby. Image by Danté Fenolio - courtesy of the Amphibia Research Group.



This *Phyllobates lugubris* was encountered in the Caribbean, southern coastal forests of Costa Rica. Image by Danté Fenolio - courtesy of the Amphibia Research Group.



A well fed "mint" phase *P. terribilis* stares into the lens. Image by Danté Fenolio - courtesy of Charles Powell and the American Dendrobatid Group.

Contrary to popular lore, arrows have not been poisoned by these indigenous groups; thus, the popular name "poison arrow frog" is not an accurate title. Myers et al. (1978) pointed out that the confusion may have been brought about by the Spanish word "flecha", meaning arrow or dart; arrow being the more popular usage of the word. Since Spaniards were busy occupying much of Latin America at the time many of the first European accounts about peoples of Latin America were made, there could be a correlation (the accounts would have been in Spanish). Additionally, the names "dart-poison frog" or "poison dart frog" are equally inaccurate. As of 1993 (with an update by Duellman to *Amphibian Species of the World* by Frost) there are nine genera of poison frogs containing 159 species (Duellman 1993) (the species count has increased since that update). To date, only three species have been confirmed to have been used to poison darts. Owing to this (1.9% or less of the total poison frog species have been used to poison darts), a reference to darts in the name for the entire group seems inappropriate.

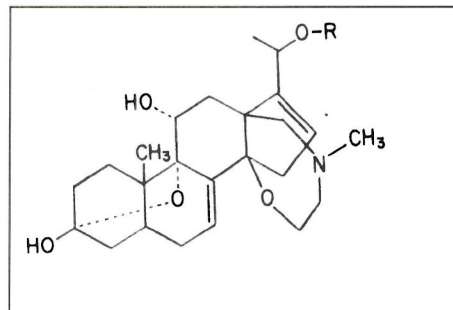
The three poison frogs that are true "dart-poison frogs" are *Phylllobates aurotaenia*, *P. bicolor* and *P. terribilis*, all having ranges in the Pacific forests of Colombia. The genus in entirety only consists of two additional, less toxic species from Central America — *P. lugubris* and *P. vittatus*.

The following information was derived from Frost (1985) and Duellman (1993). In 1913, Boulenger first described *P. aurotaenia* as *Dendrobates aurotaenia*. The species ranges through the Atrato and San Juan drainages of the Choco region of Colombia. Daly and Myers (1978) indicated the possibility of *P. aurotaenia*'s range extending into extreme southwestern Panama along the western foot of the Serranía del Sapo. The species is a mid-sized poison frog with a striped pattern very reminiscent of its northern, Central American relatives. Bibron described *P. bicolor* in 1841. That species ranges through the western foothills of the Andes in Colombia. The species is a larger poison frog that passes through an ontogenetic color change from a distinct juvenile pattern with stripes to the adult pattern and coloration, as does *P. terribilis*. The two are thought to be sister taxon.

In 1978, Myers, Daly and Malkin described *P. terribilis*. Frost (1985) lists its range as lowland rainforests around Quebrada Guanguí, in the upper Río Saija drainage, Department of Cauca, Colombia. A Mr. Jorgens has made three trips to Colombia in search of *P. terribilis* (Jorgens 1997). He found a population of the frogs closer to the coast than Quebrada Guanguí by a good distance, indicating the range for the species is larger than once thought. The frogs are different in color than the Quebrada Guanguí population; they are greenish-blue rather than orange with a "black snout



A close up of the skin of *Phylllobates terribilis*. Granular glands in the skin release a combination of various batrachotoxins, one of the world's most potent antipredator toxins. Image by Danté Fenolio - courtesy of the Amphibia Research Group.



This is the chemical structure of batrachotoxin. From *Albumin Evolution in Tropical Poison Frogs* (Dendrobatidae): A Preliminary Report.

stripe". Jorgens also found a light, bright yellow population a few kilometers from Quebrada Guanguí. In relation to color morphs, *P. terribilis* ranges from yellow to orange to lime green to greenish-blue to a silvery color the author has seen in captive specimens — and possibly more.

The calls from the five species of *Phylllobates* are variations in frequency of a trill where a uniform note is repeated at a speed greater than ten notes per second (Myers et al. 1978). The call is clearly audible; the author had a pair of *P. terribilis* for years and could hear the male call regularly from across the house. Captive *P. aurotaenia* and *P. terribilis* have been observed to perform cephalic amplexus during their mating ritual (the male is positioned on the female's back, his hands are wrapped around the female's neck with the tops of the hands to her throat) (Myers et al. 1978). Zimmerman (1983) indicates that in captive animals, *P. lugubris*, *P.*

vittatus, *P. terribilis* and *P. bicolor* courtship can last several days. In *P. terribilis*, clutches in captivity have ranged from eleven to 17 eggs (Myers et al. 1978). The clutch might not be guarded, but kept moist via return visits by the male to excrete water onto the egg mass. Eggs are deposited terrestrially, usually in leaf litter. The male transports tadpoles to a water source on his back after they hatch. Several trips may be made to transport the entire clutch. Jorgens (1997) observed a male transporting eight tadpoles at one time. Myers et al. (1978) found three males carrying tadpoles: one male had one tadpole on its back, the others had nine tadpoles each.

Zimmerman (1983) notes the tadpoles of *Phyllobates* to be herbivorous as well as carnivorous. She indicated that eggs hatch after 9–14 days and larval development time is about 1.5–2 months. Sexual maturity is attained ten months from metamorphosis for *P. lugubris* and *P. vittatus* in captivity. She reported that *P. terribilis* eggs hatch after 11–12 days, the tadpoles need about two months to develop. Sexual maturity is attained after 1.5 years. Myers et al. (1978) reported two captive clutches of *P. terribilis* eggs beginning to hatch after 11 days and larvae taking about 55 days to metamorphose.

In the wild, *P. terribilis* do not appear to aggregate and are well dispersed throughout the forest (Myers et al. 1978; Jorgens 1997). The author has found *P. vittatus* and *P. lugubris* in the wild where they were also well dispersed. Myers et al. (1978) mentioned a presumed long lifespan for *P. terribilis* as they had captive animals still alive at the time of their publication



The more common gold form of *Phyllobates terribilis*.

(5+ years). The author also had a pair for five years. Other species in the genus have reported captive longevities around this amount of time and slightly longer.

It has been found that the toxicity of wild caught frogs decreases over time in captivity (Myers et al. 1978). It has long been suspected that components of the frogs' diet in the wild allow for full production of the alkaloid toxins; likely, ants play an important role. Captive frogs fed on fruit flies and pinhead crickets seem to have little if any toxins.

The Fine Print

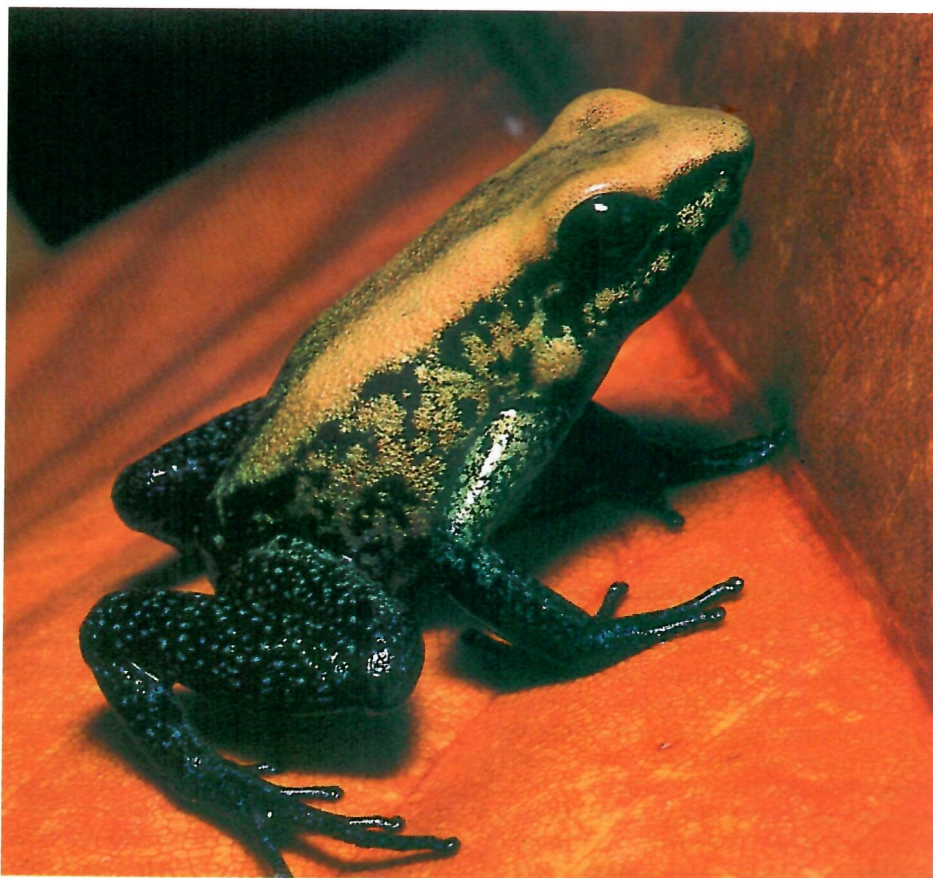
If the toxins from *P. terribilis* were packaged somehow, the disclaimer would be impressive... **Do not allow direct contact with skin, eyes, mouth, or any mucous membrane...just don't touch it; keep out of reach of children, pets or anything else you'd like to keep alive; if accidentally ingested or entered into the bloodstream, don't bother calling a doctor (or us for that matter), death is certain.**

Poison frog toxins are not few in number nor are the same compounds

found within each variety of frog. There are over 200 compounds that have been identified from various species (Daly et al. 1987). The frogs of the genus *Phyllobates*, specifically the three dart-poisoning species, are endowed with steroidal alkaloids that bear no biosynthetic relationship to alkaloids found within the closely related genus, *Dendrobates* (Daly et al. 1987). All three highly toxic frogs secrete the same toxins from special glands spread in the skin, called granular glands; the alkaloids are secondary metabolites (Myers and Daly, 1983; Neuwirth et al. 1979; Daly et al. 1987).

Of the three really toxic species, *P. terribilis* is twentyfold more toxic than the other two, due to a greater production of batrachotoxins (Myers et al. 1978). These toxins are so virulent that after collecting *P. terribilis*, Myers and Daly discarded some garbage contaminated with the frog's toxins. Domestic animals got into the garbage and were subsequently found dead (Myers et al. 1978). Dogs had also been mentioned as casualties from mouthing frogs

(Continued on page 50)



Well established in the poison frog hobby, *Phyllobates bicolor* is a larger frog usually with dark colored legs. Image by Danté Fenolio - courtesy of the Arizona Dendrobatid Ranch.

The Interactive Multifactorial Model of Herpetoculture

Part 1: Introduction and Ontogeny

by Philippe de Vosjoli, Susan Donoghue, VMD and Roger Klingenberg DVM

Note: The introduction section presents a theoretical foundation for the model. From a practical standpoint, herpetoculturists may want to skip this section and move on to sections A, B, and C which have more direct applications and are invaluable for anyone serious about herpetoculture.

In recent years certain herpetocultural dogmas and in some cases myths (e.g. feeding insects to young iguanas is harmful) have become increasingly widespread through dissemination in articles, books and internet web sites. Although the authors may have good intentions, the end results are narrow, simplistic models that do not accurately represent either an animal's ontogenetic adaptive capabilities or how one can adjust husbandry conditions to meet particular needs. As the saying goes, there's more than one way to skin a cat, and more than one way to raise an amphibian or reptile.

How we choose to raise an amphibian or reptile has both practical and ethical implications. We know that unlike most pet owners, nature selects for reproductive success rather than longevity. Conversely, commercial breeders will be more interested in how quickly an animal can begin to breed and how productive it will be, rather than how long it will live. For individuals wanting to farm crocodiles or large pythons as a source of leather and meat, rapid growth at low cost will be economically advantageous. On the other hand, for pet owners of large snakes, such as boa constrictors, it may be desirable to establish methods for growing snakes slowly or limiting their adult size. This may benefit both man and animal as their partnership is likely to be more extended if a snake remains manageable and relatively safe. The same principles may be successfully applied to raising African spurred tortoises or green iguanas. For the dedicated pet owner, long term health and longevity of their special amphibian or reptile will usually be a primary concern, more important than

achieving a large size or reproductive success.

Our Interactive Multifactorial Model provides a framework for understanding the effects of various husbandry factors and for developing applications to meet various needs related to the herpetoculture of species, whether it be for production of meat or leather, large-scale operations specializing in breeding for the pet trade, or achieving longevity and health as a valued pet.

Introduction

The first step toward a multifactorial model is to recognize that an amphibian or reptile is an autopoietic (self-producing and self-organizing) unity; that is, you or outside factors do not create it or organize its structure (Maturana and Varela, 1973, 1980, Varela, 1979). The animal produces and develops itself if placed in a suitable environment. Because an amphibian or reptile is not created whole by its mother and father, it must generate itself cell by cell, starting when an egg is fertilized by a sperm. From that point, an amphibian or reptile undergoes structural/developmental changes over time in the process of becoming an adult capable of reproduction. This developmental process is called *ontogeny*. As herpetoculturists, all we can do currently is create the conditions leading to the autopoiesis of desirable amphibians and reptiles (captive breeding) and control how the components of an environmental medium (husbandry conditions) influence the ontogeny of an amphibian or reptile. How various factors interact to influence the ontogeny of an individual amphibian or reptile is the conceptual framework of the Interactive Multifactorial Model of Herpetoculture. For more information on the autopoiesis and autonomy of biological unities see:

H.R. Maturana and F.J. Varela 1973. *De Maquinas y seres vivos: Una teoria de la Organizacion Biologica* Editorial Universitaria, Santiago, Chile.



Veiled chameleon (*Chamaeleo calyptratus*). Thinking in terms of the effects of husbandry on life stages is critical with most lizards. For example, juvenile veiled chameleons grow rapidly and have relatively high calcium requirements, and failure to provide adequate calcium and a source of vitamin D₃ can result in metabolic bone disease with deformed limbs or casque. Other aspects of diet as well as temperature can also affect casque structure. Adult veiled chameleons will fare better long-term if part of their diet consists of plant matter. Older veiled chameleons will require a less rich diet.

H. Maturana and F. Varela. 1980. *Autopoiesis and Cognition: The Realization of the Living*. Deidel. Boston.

F.J. Varela. 1979. *Principles of Biological Autonomy*. North Holland. New York.

Endogenous Factors - Factors related to the autonomous (specified by an organism's own laws of organization) aspects of an amphibian's or reptile's

autopoiesis, we call *endogenous*, meaning that they do not originate outside of the organism. These endogenous factors include in a broad sense genetics and ontogeny. The ontogeny of an animal has biological/physiological and cognitive/behavioral components.

One of the best known examples of ontogeny is the developmental stages in frogs, e.g. embryo, tadpole, froglet, adult frog. Associated with these stages are physical/physiological and behavioral/cognitive components. The stages can have respective dietary adaptations, e.g. tadpoles may be vegetarian, froglets may be insect-eating or cannibalistic, and adult frogs vertebrate-eating. Cognitive abilities may also be significantly different. For example, an aquatic tadpole experiences the world and reacts to the world differently than a terrestrial adult frog.

Exogenous Factors - Factors that influence the ontogeny of an amphibian or reptile we call *exogenous* factors. These include the variables of herpetoculture: temperature, diet, water, environmental topography, social factors, and disease. It is these factors that act on the autopoiesis of an organism and influence its ontogeny. Thus, if you keep a baby Burmese python at its optimum preferred temperature and feed it twice weekly you can grow it to be an unusually large specimen, attaining ten feet in 18 months. However, by simply manipulating diet and temperature, you could also in the same period of time have a Burmese python only six feet long. Similarly, a regime that may on one hand result in the rapid growth of a panther chameleon can also result in high egg production that may contribute to the risk of dystocia once a female reaches sexual maturity. With adult chameleons, heavy feeding year-round can result in obesity and shortened life span. Likewise, a diet that initially results in high growth in baby green iguanas may increase the risk of kidney disease once it becomes adult and cause its early death.

Developing a model for understanding how these factors interact is the goal of the Interactive Multifactorial Model.

A. A Life Stages Model of Ontogeny Endogenous Factors :

For a variety of reasons (including that there is little known about the genetics of most amphibians and reptiles and the relationship of genetics to

phenotypical characteristics), we will not address genetics, although this is an area which generally deserves more consideration by herpetoculturists. Already we are seeing the effects of inbreeding in certain species — microcephalic snakes, bug-eyed snakes and leopard geckos, lizards or frogs with shortened limbs, and failure of F4 and F5 generations to thrive or survive. We are also seeing a failure to cull animals that lack vigor or health and those herps having undesirable traits such as a propensity for aggressive behavior.

The Life Stages Model - Ontogeny, the structural/developmental changes that an organism undergoes from embryo to old age, is a concept that is critical, not only to successfully keeping amphibians and reptiles but in virtually every aspect of trying to understand a life form, including a human life. We apply the idea of ontogeny, even if unconsciously, on a regular basis in day-to-day life. For example, we recognize the changes in our bodies as we grow from child to adult to senior citizen. We know that children have different needs than adults and experience and interpret the world differently than adults. We recognize that adolescence places a high emphasis on sexuality and social

A Six Stage Life Stage Model of Ontogeny

Stage I: Embryonic. Spent within the egg boundaries. Influenced by genetics, diet of mother, temperature, and the composition of incubation environment including gases.

Stage II: Hatchling/neonate/juvenile. Growth and form may be influenced by diet, temperature, activity levels, landscape factors and social stresses. Primary drives are to eat, grow and avoid predation. High shed rates.

Stage III: Subadult. A transitional stage to Stage IV. Characterized by same factors as in stage II but often increased social components. Transition to stage IV is under the influence of sex hormones which can have drastic behavioral aspects.

Stage IV: Young sexually mature adults. Sexual, competitive, and territorial behaviors. Growth rate tapers markedly. High reproductive rate. Females will show nesting and/or egg-laying behaviors.

Stage V: Mature adults. Little to no growth. Declining reproductive rates.

Stage VI: Old Age. No growth. Extended shed intervals. Scale wear. Decreased activity and feeding. Little to no reproduction.



Young leopard tortoise (*Geochelone pardalis*). The growth rate, size and form of tortoises will be greatly influenced by exogenous factors such as diet, temperature, and available space for exercise. Landscape factors will determine shell and nail wear. Pyramiding of the shell is caused by a combination of dietary factors and low temperatures. A diet that will make baby tortoises grow quickly may be harmful to adults.

relationships and that the psychological crises of this age differ from those of older adults. We eventually realize that a diet that kept us slim and healthy as growing adolescents will make us fat when we get older. We acknowledge that environment plays a critical role in the development of a human being.

Anyone who has experience raising amphibians and reptiles also applies ontogenetic knowledge. Diet and supplementation schedules of juveniles will be different than for adults. Animals can be "power-fed" when young to reach large size and or early

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sexual maturity. Conditioning for breeding will be applied to mature animals but not necessarily to juveniles. Behaviors of animals will also be expected to change, depending on age and time of year. Temperature, diet, water, and social factors will directly act on the ontogeny of an amphibian or reptile, affecting its growth, size, appearance, health, reproductive potential and lifespan.

From a practical standpoint, we choose to apply what we call a life history model of ontogeny associated and punctuated by certain characteristics of growth, behavior and reproduction. Our life history model has six stages as follows:

Stage I. Prebirth/embryonic - Autopoiesis begins the moment an egg is fertilized by a sperm. The embryo constructs itself cell by cell following a program in its genetic code. The embryo's only interface is with the environmental medium within the egg which in its turn interfaces with the rest of the world only through the selective boundary of an egg shell or egg membranes. This stage is affected by genetics, nutrient intake of the mother prior to and/or after fertilization of the egg, and health of the mother. After an egg is laid, the environment of the embryo will be affected by substrate moisture, water quality, dissolved or dissolvable substances in the incubation substrate (reptiles) or water (amphibians), gases in the air or in water, and by temperature.

In reptile species with temperature dependent sex determination, the sex of an individual will be determined by temperature in the first few weeks of incubation. Within critical parameters, the length of this stage in several reptile and amphibian species is influenced by temperature and this can also affect size and health. Relatively little research has been done on how various factors affect this ontogenetic stage in amphibians and reptiles.

Stage II. Hatchling/juvenile - Following birth, a hatchling is propelled into the external world. Continued autopoietic existence will be dependent on activity to obtain the energy resources for growth, activity and reproduction. It will also be dependent on cognitive abilities and behaviors. The primary drive of juvenile herps is to eat, grow and not be eaten.

High growth rate is the most noticeable characteristic of this stage which is why nutritional deficiencies are common causes of disease in immature herps. Body surface to body volume ratios are at their highest at birth and gradually decline as an animal grows. The high surface-to-volume ratios make small herps more susceptible to evaporative water loss, and more able to heat and cool rapidly. Shedding rates are at their highest during this high growth stage.

This stage is initially characterized by a high level of social tolerance in many species. For example, baby flap-necked chameleons can be raised together in a large tank but cannot be kept together by the time they reach sexual maturity. In contrast, we find that juvenile bearded dragons may mutilate each other when hungry, but stop this behavior by the time they reach about eight inches (20 cm) snout-vent length (SVL), corresponding to the onset of Stage III.

Stage III. Subadult: This stage is not well defined in many amphibians and reptiles and is mostly characterized by shifts in behavior. For example bearded dragons at a length of eight inches will stop mutilating each other when hungry. Argentine horned frogs once they reach three inches will lose their cannibalistic tendencies and can be kept with other horned frogs in the same size range. Other species such as flap-necked and other chameleons will show increased aggression will have to be kept individually. In terms of herpetoculture, with some species adjustments may be necessary at this stage to reduce competition or aggression. With others, a greater level of social tolerance may allow you to keep individuals together that previously had to be segregated. A rise in sex hormones will transit this stage to Stage IV.

Stage IV. Sexual onset/Peak reproduction: Once an amphibian or reptile reaches a certain size and/or age, sex-

ual maturity is achieved, with a shift in physiology and metabolism. Growth rate, which was rapid in Stages II and III now will taper drastically in both sexes.

Animals at this stage exhibit adult sexual behaviors. In many herps there is an annual or seasonal cycle associated with this stage characterized by increases and declines in sex hormones and energy reserves. Under the influence of testosterone, males of many species develop secondary characteristics including, depending on species, larger heads, enlarged jowls, crests, horns, pre-anal and femoral pore secretions, shell processes, and nuptial pads in anurans. With the males of many species, sexual, territorial, competitive and aggressive behaviors characterize this stage, at least during the breeding season. In several herps including many geckos, tortoises and all anurans, the onset of vocal behaviors will also characterize this stage. In female herps, the major physiological shift is that excess energy resources will be diverted toward the production of eggs. A wide range of sexual behaviors will also become evident including receptivity to males,



In green iguanas, sexual onset behaviors may occur as early as two years but usually around two and a half to three years of age in captivity. Male green iguanas have proportionately some of the largest testes of any vertebrate and when adolescence kicks in, it hits hard with a surge of testosterone that drastically alters a male iguana's cognitive landscape. This initial testosterone surge is accompanied often by high levels of aggressive, territorial, competitive and sexual behaviors. From the point of view of the new iguana owner who has been exposed only to Stage I and II behaviors, Stage IV aggressive behaviors often come as a surprise, sometimes with serious consequences. Owners have reported being terrified as their male iguanas charged and chased them in their homes with intent to bite.

lack of receptivity once gravid, nest digging, egg-laying, and varying degrees of aggressive and maternal behaviors. The age of reptiles and amphibians at the onset of Stage IV and the duration of Stage IV will vary with species and with environmental/husbandry conditions. In bearded dragons, the onset may be as early as six months or require nine or more months with two to three peak breeding years, followed by a gradual decline in reproductive rate. In boa constrictors sexual maturity can be reached by as early as early eighteen months or can require three or more years. In several lizard species there will be two or three years of peak egg production followed by declining reproductive rates.

Stage V. Maturity/Reproductive

Decline: Most herps in the wild will not survive to this stage. There will be few reproductive old timers compared to young sexual onset breeders. Because large size typically characterizes this stage, animals that have achieved this status can hold a unique place in terms of both ecological and social niches. This stage is characterized in many species by reduced activity, in others by reduction/resolution of social/sexual conflicts. In most herps, reproduction declines in Stage V. For example, blue-tongue skinks will breed every two or three years instead of annually. Bearded dragons by three to four years produce fewer and fewer eggs. By seven to eight years of age, bearded dragon females are non-reproductive. Leopard geckos show a similar pattern. Snakes in general follow a pattern of reproductive decline in stage V, either skipping years and/or producing fewer eggs.

Stage VI. Old Age - In most amphibians and reptiles, old age is characterized by absence of growth and slight weight loss as less energy is expended on feeding. Activity levels are reduced. Reproduction rate is intermittent, reduced or absent. In reptiles, shedding is less frequent. In many reptile species, scales appear more raised and or show signs of damage or wear. Old age is more likely to be reached in captivity than in the wild. This stage lasts until death.

The Life Stage Model of ontogeny provides us with a framework which, applied on a species by species basis, gives us a life history profile as well as

guidelines for herpetoculture, veterinary assessment and care.

B. Ontogeny and Its Integration with Nutrition:

Influences endogenous factors in ontogeny, whereas husbandry addresses the exogenous factors. Nutrition attempts to meet endogenous demand with appropriate exogenous supply by feeding. A common example of ontogeny interacting with nutrition is the concept that requirements for calories and nutrients change with life stage. Juveniles, for example, tend to require more calories, pound for pound, than sedentary adults, and geriatrics require fewer calories. These ontogenetic characteristics reflect the interacting of multiple endogenous and exogenous factors.

Stage I - In the prebirth stage, embryos utilize yolk sac contents for most of their nutritional needs, with gas and water exchanges across the egg shell playing a substantive role. Yolk sac contents provide fuels (calories) for body functions, especially growth, as well as essential nutrients. The fuels in yolk sacs are fat (lipids, fatty acids) and protein (peptides, amino acids). Even reptiles which live their entire adult lives as herbivores, consuming fiber-rich, carbohydrate-based vegetarian diets, begin life as carnivores nourished by the high-fat, high-protein food of the yolk sac. Indeed, field studies of green iguanas show that the intestinal milieu of microbes, enzymes and metabolites (such as short-chain fatty acids) necessary for and specific to a vegetarian diet takes about four weeks (after hatching) to establish. For the first four weeks out of the egg, the neonatal green iguana is transitioning physiologically and biochemically from a high-fat, zero-carbohydrate diet to a low-fat, carbohydrate-based diet. This nutritional ontogeny is common in the animal kingdom, and parallels can be drawn between the transitioning juvenile green iguana and the foal or calf, for example, weaning from a diet of its dam's milk (fat and protein based) to one of grass (carbohydrate and fiber based).

Nutrient partitioning refers to the preferential uptake of nutrients and calories by specific organ systems. The concept of nutrient partitioning began with a paper by Child in 1920 in which he reported that nutrients were distributed differently to different organs,

according to each organ's or tissue's specific metabolic rate. Two decades later, studies showed that embryos as a whole have first priority because of their high metabolic rates.

Stages I and II - Within embryos (and young juveniles), the nervous system receives highest priority. Brains and nerves are growing at enormous rates during this time, and the nervous system is critical to the future survival of the organism. The brain remains a major consumer of calories throughout life. Possibly, reptiles with high cognitive function, such as monitors, continue to partition a higher proportion of nutrients to the brain through all of their life stages.

Certain specific nutrients are essential to development of the brain. These include specific fatty acids such as arachidonic acid, phospholipids such as phosphatidylcholine, and amino acids such as taurine. All of these nutrients are found in high concentration in vertebrate prey, and in eggs (no surprise, as all embryos require these nutrients for brain development), but in lower concentrations in plant matter. Whether carnivores became smarter from eating meat, or they were smarter to begin and thus learned to eat meat, is a lively debate among nutritional anthropologists.

Embryos in Stage I and juveniles in Stage II are characterized by rapid growth. While as herpetoculturists we note the growth and development of morphologically obvious features such as bone and muscle, it is other systems and organs, such as brain and liver,



Tadpoles of *Rana schmackeri* from China. Because amphibians have a tadpole or larval stage, an additional stage needs to be added when applying a life stages model to amphibians. Tadpoles, because they are aquatic, will be sensitive to different factors than adult frogs. The diet of most tadpoles will be markedly different than that of adult frogs.

which are a higher priority during this time.

Stages III, IV, and V - Adult life stages are characterized by high nutritional demands in actively reproducing females, and variable demands for males depending on their activity level. Males that roam large territories need fuels to sustain their physical activity. Although nutrients may be partitioned differently during this time in order to support sperm production, total nutrient requirements typically don't change much. In contrast, females can become drained nutritionally if reproductive rates are high. Nutrients are partitioned for production of ova and support of embryos, often at the expense of the dam. Thus diet and feeding management during adulthood vary considerably, depending on the goals for the animal.

Stage VI - Old age is characterized by reduction of muscle and progressive decline in organ function, but the degree of decline and specific organs involved vary by species and, within species, by individual. Most species (including humans) experience a decline in kidney function with old age. Loss of kidney function may be accelerated in those individuals subjected to chronic dehydration in adult life, such as mature green iguanas maintained as pets in typical (<75% humidity) households.

The thread of stress and disease runs through all the life stages. Both impact food preferences and intakes as well as metabolism, including nutrient partitioning. Ontogenetic influences cannot be separated from the patient, nor can the influences of stress and disease be disregarded when feeding reptiles at different life stages.

C. Ontogeny and Its Integration With Disease:

Veterinarians that treat reptiles and amphibians consider the ontogenetic development of each individual patient as part of the animal's evaluation. A detailed history, for example, may recall the patient's progression from birth to the present, noting growth, appetite, diseases, and so on. Diseases which are prevalent when an animal is young may be rare when the patient is older, so early in the exam of a patient, its stage of development is assessed. Moreover, disease prevention efforts are typically based in part on a patient's ontogeny for the same reasons, because different diseases are

prevalent at different stages of development, but also because an animal's immunity and responses to disease differ with ontogenetic stage.

Certain factors affecting the ontogenetic development of a reptile or amphibian can be manipulated, and these have the potential to be used positively. Temperatures at which reptiles and amphibians are raised, for example, is a factor that critically affects development and one which is considered daily in reptile practice. Moreover, diseases affecting ontogenetic progression can be either endogenous or exogenous in origin. Husbandry affects both endogenous and exogenous diseases, with a huge impact on disease pathogenesis in all reptiles.

Endogenous disorders -

Developmental disorders can lead to either immediate or delayed health problems. For example, an embryonic snake with no functional lung tissue due to a congenital, inherited defect, will have immediate problems when moving from Stage I (embryonic) to Stage II (hatchling/juvenile). This is in contrast to a tortoise embryo with hypoplastic (insufficiently developed) kidney tissue that can easily move from Stage I to Stage II and even further. The delayed effect of this disorder will express itself only when the size of the developing juvenile exceeds the ability of the reduced kidney mass to adequately cleanse the blood. This tortoise will die as an older juvenile or maybe even a young adult, but the disease originated much earlier in its development.

Exogenous disorders -

Not all developmental disorders are inherited. For example, the incubating reptile egg is affected by such exogenous factors as too much or too little heat, moisture, and oxygen. Such acquired damage is manifest in hatchlings as kinked tails, malformed body parts, or abnormal patterns. Damage from exogenous factors may be compatible with life, but often is not.

One area of concern in disease prevention is the transfer of infectious agents from the mother to the developing embryo. Whether these are classified as endogenous (originating from the mother-embryo unit) or exogenous [acquired from outside the unit (embryo)] is open to debate, but all can agree on the serious impact of bacterial, parasitic, and viral agents

passed from the mother to the egg. For instance, a gravid snake infected with *Salmonella* might inadvertently expose her eggs to the pathogen as each moves through the infected oviduct. Bacteria-laden eggs often succumb when the pathogens invade and grow within the egg itself. However, in the majority of cases, if the maternal snake's immune system had been supported by good husbandry practices, the odds of pathogens passing from mother to the egg would have been decidedly less. Immune suppression brought about by poor husbandry is the single most important factor in the development of disease in reptiles.

Ontogeny of Immunity - In reptiles, more so than any other group of animals, the key to the suppression of disease is maintaining and supporting an active and viable immune system. While many factors go into maintenance of the immune system of reptiles (humidity, light cycles, space, and more), the single most important factor is heat. The provision of an appropriate (for that species) and usable thermal gradient promotes proper metabolism, cell proliferation, antibody production, and immune function. Other factors under our control are involved, too, such as nutrition and parasite control. In addition, the animal's ontogenetic stage must be considered, for such factors as active reproduction affect immunity.

The immune system is best developed in the adult stages (III, IV, and V). In these stages, immunity can

(Continued on page 39)



Premetamorphic Budgett's frog (*Lepidobatrachus laevis*). In this species tadpoles feed on other tadpoles, small fish and aquatic invertebrates. A favorite food are brothers and sisters, engulfed whole and allowing phenomenal overnight growth. Adults of this species relish other frogs but are not usually cannibalistic. They will spend more than half the year in an epithelial cocoon while buried in dried mud.

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testudo kleinmanni at 10 days old

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— Best of Show — AMPHIBIA RESEARCH GROUP

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Welcome to the Amphibia Research Group's "application specific" terrarium. This unit was specifically designed to accommodate the captive reproduction of a number of microhabitat specialist frogs. In fact, the pitcher plants were added to the enclosure to furnish reproductive sites for a microhylid frog that occasionally uses *Nepenthes*' pitchers for reproductive purposes in the wild – the Sticky Frog, *Kalophrynus pleurostigma*. Additionally, the hollow half-log attached to the left side of the terrarium has an access port to the water dish behind it through the left wall. This design is intended to replicate a tree hollow with a water filled basin...cleanable water in this case! Also, the glass door of the access port allows for observations of animals during reproduction, photography, etc. The mask has been placed on hinges in front of the port so as to hide the movement of human traffic to the terrarium's occupants utilizing the hideout. Coconut hideouts, seed pods and hollow bamboo segments abound throughout the enclosure to provide a wide variety of living and reproductive sites.

Systems Working in Unison to Maintain an Ideal Environment

This unit features a variety of systems that facilitate the long-term maintenance of a tropical environment when combined. Normally, the entire unit is run by a 16 function, dimable timing device. For purposes of the show, the various mechanisms have been placed on toggle switches and a control box to demonstrate the terrarium's features. As water circulates through the vivarium, it passes through a wet/dry filtration system (located below in the stand), biologically filtering the water. Ammonia and nitrite levels are naturally kept in check by two distinct groups of nitrogen cycle bacteria living within the filter's biomed. exactly the same thing that takes place in an aquarium's filter. This unit circulates water 24hrs a day with the pump returning the water from the filter to the top of the two waterfalls. A submersible heater is also located in the filter's sump to maintain a minimum desired water temperature. A misting system is operated by a timer to water the enclosure's plants two times a day (early morning and early evening). The misting system is plumbed in behind the cork bark via "PVC - with extra-fine spray nozzles creating a light drizzle when in operation. This system draws its distilled water directly from the five-gal-

lon storage unit in the stand. By using distilled water, the spray nozzles will not clog with hard-water deposits. Also operated by a timer, an ultrasonic humidifier is plumbed into the system to enhance the two rain showers daily and create two extended daily peaks in moisture. These two peak humidity times are designed to emulate the early morning and early evening showers of tropical wet forests around the world during their rainy seasons (of course, these peaks can be lengthened or reduced with this system). With the ability to produce so much in the way of humidity, we wanted to also include a lower humidity point close to mid-day and early afternoon (like those of many tropical wet-forests worldwide). Small computer fans controlled by timers turn on for a short period of midday to facilitate a daily lower point in humidity. The fans can be dimmed to increase or decrease airflow. Ventilation ports at the front of the terrarium allow for air passage into the terrarium where the current continues to flow upward through the enclosure and out the two rear fan controlled ports. In less than a minute, the fans turned on full can defog the front of the terrarium should there be a humidity buildup on the viewing windows. Diurnal lighting is

full spectrum complements of Vita-Lite technology. Four 48" fluorescent tubes and a reflector plate more than provide for the needs of the plants and animals. A low wattage halide light is controlled by a timer and a dimmer working in unison to bring the bulbs through a "sunrise" in the morning and a "sunset" in the evening...thus at dawn the halides are the first on and they take a half hour to reach full output. The fluorescent lights turn on at that point. The fluorescent lights are the first to turn off in the evening and the halides dim until the terrarium is dark. A night light is also controlled by a timer, where blue light is utilized since herptiles don't detect it under most circumstances yet nocturnal viewing can still be facilitated for onlookers. A computer fan in the stand keeps air flowing throughout and the water pumps cool. A screen placed below the lighting system keeps inhabitants from close encounters with bulbs, fans, etc. The entire lid swings open like a piano top for maintenance that can not be done through the front of the terrarium. Incidentally, the two panes of glass in the front of the unit slide from side to side like shower doors to accommodate maintenance, feeding of the animals or photography. Each red light on the control panel indicates that water levels are low in either the filter's sump or the misting system's reservoir. An audible warning siren attached to a water detection pad in the stand will indicate that water is leaking should there be a problem. Ambient air and water temperatures are available from the control panel (all electronics by Elliot Jonasson). All of the plumbing can be easily manipulated or repaired with unions on either side of each water pump and ball valves inline.

More Bells and Whistles

Several more features are included in this unit to help simulate dynamic natural conditions. A strobe light has been programmed to randomly pulse and create artificial flashes of lightening when the "storm" switch is thrown. A continuous loop cassette and tape recorder provide thunder from a 12" sub-woofer. Depress one more switch on the control panel and the misting system initiates a rainstorm. Yet another switch can activate the ultrasonic humidifier

and foggy conditions prevail. Bad weather (or good in our case) at your fingertips! There is also a special effects light located beneath the log where the ultrasonic humidifier exhausts its fog. With all of the other lights out in the unit and this special effect light in operation, the fog seeping from the end of the hollow log glows green! The entire exterior of the terrarium is finished with a sand/granite paint matching the colors of the oak stand supporting it. While in construction, every attempt was made to avoid the use of any metals that would corrode over time. This enclosure has been created with the expressed intent of long-term maintenance for microhabitat reproducing amphibians and had been up and running for several months prior to the show.

The enclosure will be on display through December at:
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Multifactorial Model

(Continued from page 38)

be weakened by reproduction, stress, disease, and husbandry errors.

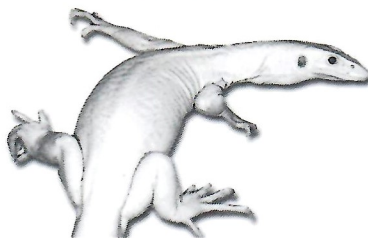
In contrast, young and old animals have weak immune systems (for differing reasons) because of the natural ontogenetic development of immune function. Thus reptiles and amphibians in stages I, II, and VI are at greater risk for developing disease. We can help, through preventive medicine practices, to support the young or old patient's immunity, but we must remain cognizant that immune function at these stages often remains sub-optimal.

Our model of ontogeny provides a framework to build life history profiles for each species and to guide our care of these animals. Through this model we can better understand the effects of husbandry practices, disease treatment, and preventive health management.

We can thus better meet the herpetocultural needs of each species in our care. Part 2 of this series will appear in *Vivarium* 11(2).

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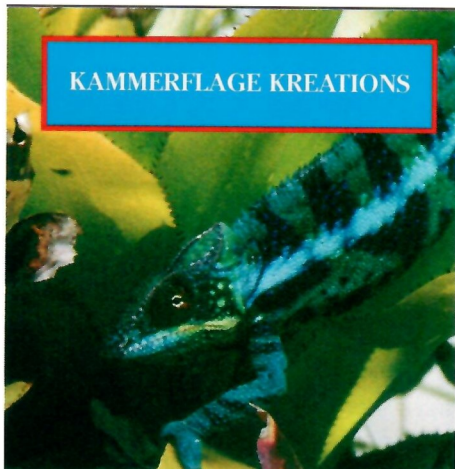
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IRBA Sets High Standards for the Herp Industry

Under the leadership of Ray Busby and David Masur, IRBA was the first to establish the same standards as professional trade shows. At IRBA shows, tables are draped and booths have draped backs. Ample room for movement and viewing is allowed between booths. A professional staff organizes and assists with efficient loading and unloading of displays. The show rooms are well lit and air-conditioned to a temperature comfortable for both humans and herps. Security is provided. Because IRBA shows offer both captive-bred and quality wild-caught herps, they have been the source of many new species in herpetoculture. Besides the many snake species now bred by hobbyists, a great variety of treefrogs, poison frogs, chameleons, monitors, turtles and tortoises are offered for sale. A wide selection of herp products, novel vivarium technology and vivarium plants are standard fare at the IRBA shows. IRBA has also been one of the strongest advocates of the rights of herpers to practice their avocation, donating part of its proceeds to PIJAC (Pet Industry Joint Advisory Commission) and using its many shows to rally support in legislative battles.



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Scenting Eggs

(Continued from page 24)

New Research

The unpublished work of a PhD student, Helga Sneddon, and other members of a team under the supervision of Professor Peter Hepper, in the School of Psychology, Queen's University, Belfast, UK, may have established just such a technique during their research into embryonic learning. They have discovered that they can influence the feeding response of hatchling crocodiles by exposing them to manufactured food smells *prior to hatching*. The project was in part designed to help the captive reproduction of endangered crocodilians by encouraging an active feeding response in hatchlings, who are frequently less than enthusiastic about available foods.

The decision was made, for research purposes, to experiment with a flavor which would be entirely unnatural to a crocodile. For this reason the flavor chosen was strawberry as it was assumed to be an abhorrent flavor for confirmed carnivores such as crocodiles. Fruit-eating crocodiles are unrecorded, other than where incidental or accidental ingestion has taken place.

The artificial strawberry flavor was painted onto the incubating crocodile eggs for an exposure period of 16 days prior to hatching. Ten days after hatching, the baby crocodiles were offered two dishes of the same food, but with one flavored by the artificial strawberry substance. More than 60% of the baby crocodiles voluntarily opted for the dish of food flavored with strawberry. These baby crocodiles had already developed a taste and acceptance for strawberry flavor before they had ever eaten for the first time.

Professor Hepper said: "There is a conservation interest with crocodiles in this work. To conserve the species it may well be that, if you can get them to eat more readily after hatching, there is a greater chance of survival. If we can add something to the food that they have been exposed to in the egg we may be able to get them to eat more."

The same research team has employed this embryonic learning technique in chickens. Exposed to strawberry flavor while still in the egg, chicks showed a marked preference for strawberry flavored food.

The team also studied similar effects in human babies. Twelve babies were exposed to garlic flavor while still fetuses in the womb. Garlic was chosen because it is a sensory stimulus that can cross the placenta and reach the fetus. Babies normally demonstrate marked avoidance of anything flavored with garlic. Those 12 babies were subsequently far more tolerant of the smell when exposed to it on a cotton ball.

Professor Hepper's research team is interested in all aspects of early learning. They aim to investigate all animal groups to see if the same effects of pre-hatch or embryonic learning are present. To date all vertebrate species investigated appear to show the same effect.

Conclusions

This truly quantum-leap technique promises to ease the captive raising of problematic captive bred species, while opening the door to new species previously considered practically impossible to feed as hatchlings. Already, similar experiments with corn snake eggs and T-Rex's Mouse Maker® are encouraging, with feeding respons-

es to pinkies by subsequently-hatched corn snakes from parents that previously produced difficult feeders. I await the future with interest to see how effective and wide ranging this revolutionary technique will prove to be in successful herpetoculture.

About the author: Jon Coote is T-Rex's Director of Research & Development and is responsible for the introduction of the current T-Rex Products Inc. range of artificial flavors for captive reptiles.

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Radical Ideas For 21st Century Herpetoculture

Part 1

by Vivarium Staff

Here we are right at the edge of that infamous Y2K. We've been asked what the *Vivarium* is doing in celebration of this supposed turning point. After all, end of the world loonies are preparing for alien lift off, and others terrified by the prospective cyberparalysis of society are getting armed and stocking up on goods in preparation for the coming shortages, chaos and decadence. We, at the *Vivarium*, have thought about it and decided we'll join in the fun, pull all the plugs and give our readers some mental fireworks — 21 radical and controversial ideas certain to excite the sleepy, offend the stuffy, and challenge some of the unspoken myths of the late twentieth century. Above all we are offering plenty of food for thought. As it turns out, this is also the issue which highlights the second annual Third Wave Vivarium Show and Awards sponsored by International Reptile Breeders' Association and the *Vivarium* magazine which was held October 9 and 10 at the mega IRBA San Diego Show. Welcome to the *Vivarium* Y2K!

Millenium Headline: Four-Inch Rule Goes the Way of Asian Turtles

The regulation itself is a mouthful. Intended to prevent kids from placing *Salmonella*-carrying aquatic turtles into their mouths, the law has killed more than the deadly disease. It's the unintended consequences that have impacted the chelonian world. And the unintended consequences are the reasons this law should go the way of the 20th century and fade out of existence.

This federal law limits the sale of chelonians to specimens greater than four inches long, unless sold for scientific or educational reasons. Its purpose was to reduce exposure of young children to *Salmonella* carried and transmitted by aquatic turtles, especially farmed red-eared sliders. The thinking was that children couldn't place larger turtles in their mouths. It presumes a threshold relationship between mouth size and prudence. Although this reg's one exception (scientific and educational reasons) has been a loophole employed by many, the longterm consequences of the regulation are felt today.

Has the rule reduced turtle-associated salmonellosis in children? There have been no discrete comparative trials that we know of, and changing numbers over the years reflect many causative factors. Certainly, in the decades since this law was enacted, the main risk has been identified as *Salmonella* in our food sources. Bacterial contamination of poultry meat and eggs, fish, and meat livestock has become commonplace. If we were talking chelonians, bacteria from our food would be a huge space-filling Galapagos tortoise, and *Salmonella* from turtles would be, well, just a small turtle.

What's the unintended consequences of this reg? For starters, those collecting turtles and tortoises from the wild select specimens over four inches long. This reduces proportionally more of the adult breeding stock — exactly those animals which should remain in the wild. Moreover, the rule discourages the captive breeding of chelonians. What other animal breeder is forced to withhold offspring from the pet trade for years?

The four-inch rule discourages chelonian breeding as an economically viable enterprise. Without an active chelonian breeding network in the US, the four-inch regulation further encourages collection from the wild.

Are there other unintended consequences? Probably. Once sales of hatchlings were eliminated in the US, those breeding aquatic turtles for the pet trade looked overseas. One only needs to visit waterways in Europe and elsewhere and observe the resilient red-ear slider thriving to know how well exportation succeeded, and failed.

Here's a thought for the new millenium: let's get rid of the four-inch rule.



Red-eared slider, the beast that catalyzed the four-inch turtle law. Unintended consequences of the four inch law has been collecting pressure on adult turtles such as box turtles and discouraging the development of turtle herpetoculture for the U.S. market on a commercial scale. We recommend ending the four-inch law but making the sales of turtles to minors illegal.

Global Warning

Have you been to the big herp shows in San Diego, Las Vegas, and Orlando? If not, do so! Besides the incredible number of vendors selling almost everything you could imagine, you'll meet more people, make more herp friends, than could otherwise be accomplished in a year's worth of visits to small local shows. Where else can you meet breeders from Germany, Netherlands and the UK? At San Diego and Las Vegas, you'll find all the best hard-to-find herps imported from all over the world. These opportunities were unheard of 20 years ago, and we can only guess what the next 20 or 1000 years will bring to herpetoculture.

One guess we've made, however, is a grim thought. The global travel which is now so prevalent in herps will bring with it global transmission of diseases. At the shows, herps just imported from the other side of the earth are tabled next to the guy who breeds bearded dragons just down the road. Attendees handle many animals as they walk the aisles, travelling from vendor to vendor.

The potential for spread of disease at shows is real, but probably not as large as the risks once the travelled herps are purchased and brought home. We've already noticed a trend since the arrival of fast global travel for herps. Recommendations for post-purchase quarantine for most herps under most circumstances are now often increased to 90 days (instead of 60). And with good reason. Some diseases take longer than 60 days to manifest. Others may be harder to recognize and diagnose, because they haven't been seen before in this country. How much time do you think it will take before the bugs causing pneumonia in *Testudo* species in their native lands show up in pet tortoises in the US? The same can be said for viruses in pythons from Asia, and bacteria in geckos from northern Africa.

This wariness is not meant to throw cold water on the hot new trend of superb herp shows that are true international events. Indeed, our mission is quite the opposite. These shows are unique opportunities for most of us, and to make the best of them, we should perhaps consider that some of the features that make them unique also make for considered changes in herpetocultural techniques.

The new millenium brings herps to our doorsteps that spent yesterday in Asia, tomorrow in Canada. We need to mold our herp hygiene and preventive medicine accordingly.

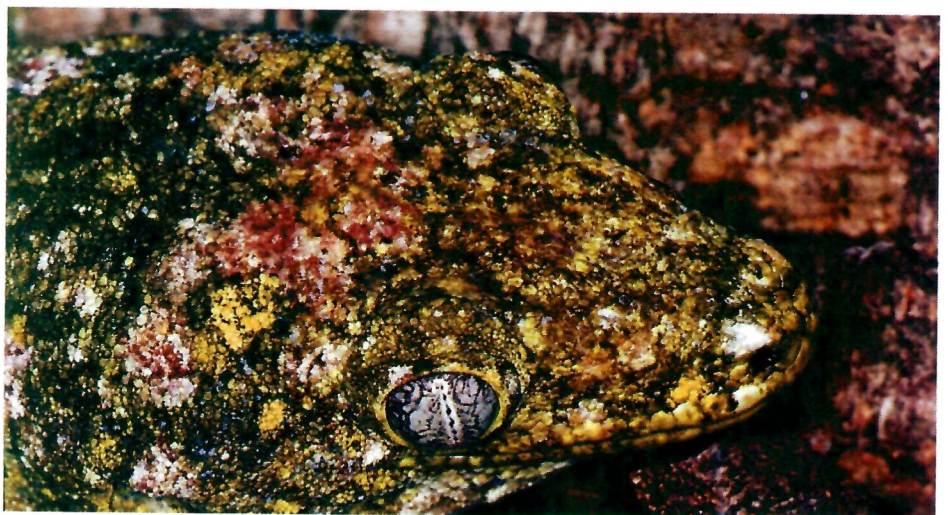
One last thought: the door swings both ways. How much longer will it be before we in the US are shipping herps carrying Baytril®-resistant bacteria all over the world? Global transit will require us to think expansively. And quarantine carefully.

Cybertechnology Will Connect Nature to Culture

A recent report on privacy indicated that increased miniaturization of digital video and audio equipment threatens the rights of privacy. Cameras have been found embedded in the walls of bathrooms, bedrooms, offices and meeting rooms. The concern was spying and the appearance of voyeuristic images on the Internet.

The very same technology can radically change our relationships with nature and with animals kept in vivaria. Want to do field work? Then install miniature solar powered digital video cameras at various levels of a forest with transmission by satellite to your research computers. As our technology becomes smaller we can have eyes everywhere and can have round-the-clock surveying of natural habitats or our collections.

Cameras can be placed in vivaria giving close-up images of what your poison frogs are doing inside that shelter. A video tape played at high speed can reveal the weekly patterns of behavior of your snake. Sensors connected to your computer will tell you about the microclimatic shifts in your vivarium. Miniature microphones can record the underwater sounds of your axolotls or nightly communications between your giant geckos. The new technology will become an extension of your senses. At its extreme, you might have goggles or lenses that reveal the mind of another as never seen before, perhaps allowing you to see shifts in body surface temperatures which have been converted to a visual image. Our future is to become cyborgs.



Microphones placed in the enclosures of New Caledonian giant geckos (*Rhacodactylus leachianus*) would reveal the vocal repertoire of this communicative reptile.

Functional Foods

Let's say it's 20 years into the future. You're ordering the most outrageously cool prehensile-tailed skink, a high-yellow and lime green morph from a breeder who lives a thousand miles from you. It arrives on your doorstep the next day, along with packets of powdery stuff you're to sprinkle on its salads. The powder is specially formulated to counter the untoward effects of stress from shipping and a new environment. This supplement is part of the wildly growing realm of functional foods, and in the 21st century we'll see functional foods brought to herpetoculture.

The term, *functional foods*, is an umbrella, encompassing a wide variety of diet ingredients and supplements that do more than simply nourish. They can change body composition, alter moods and temperament, enhance athletic performance, reduce stress, and lower the incidence of certain diseases. In human nutrition, examples of functional foods include creatine for improved muscle function, a variety of cholesterol-lowering ingredients such as garlic and special fatty acids, and the fat substitute Olestra®.

Examples of functional food categories used today in herpetoculture are probiotics and prebiotics. These promote health by helping to restore or maintain good microbes in the gastrointestinal tract by supplying the fermentation products of good microbes (probiotics) or supplying the ingredients upon which the good microbes thrive (prebiotics). Both have been used in herbivorous and omnivorous reptiles such as tortoises, green iguanas, prehensile-tailed skinks and bearded dragons in the rehabilitation of sick patients.

The future for functional foods in herpetoculture is limitless and likely to move far beyond good microbes. Muscle enhancers for monitors, tegus, and other herps we want to appear (not necessarily act) masculine and aggressive, as well as for alligators raised for meat. Mood alterers for male iguanas and large snakes — anger management in a shaker vial. Kidney boosters for lizards prone to renal failure. Immunity and stress supplements for convalescents and travellers. Neurotransmitters for herps — perhaps bearded dragons and uromastyx, maybe monitors — to enable higher cognitive levels of interaction with people. These products will give a whole new meaning to that tired 20th century phrase, *food for thought*.

A Shocking Idea

Let's say you have an outstanding leucistic specimen of herp, and your friend living at the other end of the country has its perfect mate. What do you do? Usually, one of the animals is shipped to the other, a period of time elapses while the transported animal settles in, then everyone holds their collective breath, waiting for mating to occur. Is this what all animal breeders go through? Not hardly.

For dairy cattle and most breeds of horses, for long distance breeding of many domestic animals, and for difficult to breed individuals (including humans), artificial insemination is the method of choice — sometimes the only viable method — for successful propagation.

Here's what's involved. Sperm is collected from the donor male. A variety of methods can be employed (use your imagination) but what may work best for many herps is a technique termed electroejaculation, where an intermittent pulse from a harmless electric current administered by a probe positioned within the rectum (cloaca, for herps) is used to cause ejaculation of semen. [No one ever said theriogenology — the branch of veterinary medicine dealing with reproduction — was boring.]

Parameters for successful sperm storage vary with different species, and close attention must be given to temperature and solutions, termed extenders, which dilute the concentration of sperm. For storage beyond 24 hours, semen is frozen, using CO₂ pellets and liquid nitrogen. For this phase, research will be needed to learn the best extenders for stored semen from various species of reptiles.

Once semen is stored successfully so that sperm remain viable, it can be transported anywhere in the world for introduction into receptive females. Determining optimal times for sperm



This odd chameleon from Madagascar in the *Furcifer* group may be a new species. Reproductive technologies such as artificial insemination of reptiles may allow captive breeding between individuals of rare species kept in different parts of the world.

introduction into females will also take some study, but the phenomenon of sperm storage in many reptiles may facilitate this step.

With artificial insemination, males and females can remain in their respective homes, reducing stress in the animals and risks of disease transmission. Moreover, one male can inseminate many females from many areas, allowing expansion of gene pools from outstanding specimens.

Maybe your turquoise Nosy Be male chameleon is the finest specimen ever seen. Why not breed him to 50 females instead of five? Worried about inbreeding in your group of radiated tortoises? No problem. Sperm could be collected from wild males in Madagascar and shipped to your doorstep in East Podunk. Want to breed your female corn to Bill Love's outstanding, one of a kind, designer corn? Piece of cake. Snake breeders could sell ampules of frozen semen from their best males.

Electroejaculation has been tried in tortoises, and the science is in place to develop the techniques in reptiles. If we were asked to name the one change that could revolutionize future herpetoculture, it might just be artificial insemination.

Y2K Bugs

We were at a pet fair last month, talking herps with everyone who stopped to look at our tortoises lounging on the grass, the Ambanja blue male chameleon warily eyeing the crowd from his potted ficus, the requisite bearded dragon and White's treefrog — two of the best pets one could have... and a spray bottle of disinfecting cleanser. What? It's a liability issue, even though disease risks from handling any of these herps are likely to be small.

The risks aren't zero, especially in herps stressed from public exposure. And the risks loom much larger in other herps, such as green iguanas which are known to be frequent carriers of *Salmonella*. As herpetoculturists, our primary Y2K bug might just be *Salmonella*. Yet it appears as if the means for reducing or maybe even eliminating this pathogen from herp collections is just around the millennial corner.

Hundreds of *Salmonella* serotypes have been isolated, and many of those found in reptiles aren't proven to be pathogenic (disease-causing) to humans. Yet there are too many documented cases of reptile-to-human transmission of pathogenic *Salmonella*, and there's too much at stake regarding liability, to ignore public health concerns. The issue isn't restricted to herps. Many veterinary hospitals treating horses and cows have to deal with patients who suddenly begin shedding *Salmonella* when stressed from transportation, illness, and surgery. Similarly, *Salmonella* contamination is ubiquitous in waterfowl and poultry. In the last couple of years, *Salmonella* has been looked at in new ways, and novel techniques are helping to reduce the problem in some of these other species.

What has science come up with? Oral inoculations with good bugs that drive bad bugs out of the intestine. Special ingredients that make good bugs prosper, and bad bugs fail. Probiotics and prebiotics promise to boost the immunity of gut-lining cells so that bad bacteria do not stick. With advances in the chemical engineering of genes, some day there may be strains of animals resistant to *Salmonella* colonization. There will first be the band-wagon effect, with entrepreneurs trying to capitalize on the developments for other species by marketing products for herps, which may or may not be efficacious or safe. Eventually, science will overcome the hype, and the means to reduce *Salmonella* in herps will be available. We know some iguana and turtle owners who can't wait for that day!



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The Incredible, Medical Egg

It's Sunday morning and you've found an animal at risk of dying in your very large and very valuable collection of green tree pythons and you need to reach your vet right away so you call and she says "Yes, this is an emergency, meet you at my clinic in twenty minutes!" and you jump in the car and drive there very fast with one hand on the wheel and the other cradling the patient and you rush through the clinic door and hand your vet an egg.

An egg???

Not as strange as it may sound. A new area of expertise has been developing in avian medicine, especially through the efforts of veterinarians, including Dr. Julie Langenberg at the International Crane Foundation. Avian eggs can actually undergo diagnostic procedures and treatment when the life of the embryo appears to be threatened.

Here's how it works. The stages of hatching — detectable movement, entering the aircell, vocalization, pipping, emergence — have been characterized for many crane species. Eggs are radiographed if they are 24 hours behind the schedule which is typical for that species or show weakened movement. Four views are obtained, providing a three-dimensional image of the embryo within the egg. From the x-rays, such problems as malpositioning and deformities of beaks and bone can be identified. Some of the malpositioned embryos go on to hatch successfully after assistance.

What are the possibilities for egg medicine in herpetoculture? Imaging techniques for suspect eggs come to mind. Assessment of embryo development, identification and evaluation of diapause, and diagnostics for delayed hatching could all be possible in the near future. Better definition of variable and unpredictable lay-hatch intervals might evolve.

How about techniques, such as culture of embryos, to diagnose infectious diseases or identify *Salmonella* carriers? And, use of therapeutics, such as antibiotic injections into eggs. Perhaps endoscopic exams of the insides of developing eggs. Or, sex identification to meet demographic and genetic goals for captive propagation programs — it's all being done in birds. How about reptiles?

Looking for an exciting new dimension in herpetoculture? You just can't beat an egg.

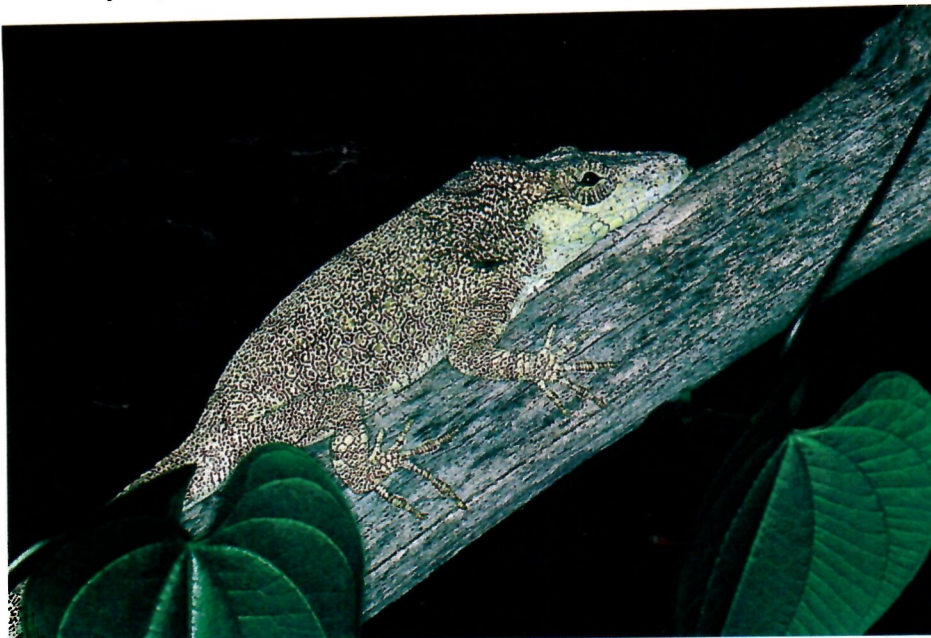
Mmmm Mmmm Good

After January 1st, after the hype about global networking and the dawning of a new age. After the first glimpse of the new millenium is viewed on some island in the South Pacific and the last drop of French champagne is drunk. After all that, a few sobering realities may likely settle in. Tomorrow may not feel all that much different from yesterday. We still have to feed our collections, pick up their poop, and figure out how to finance our herp addictions.

The culture of herps is teetering. It's large enough to sustain mega-shows, but too small to provide attainable, stable incomes for most herpetophiles. The market zooms upward for one species, crashes for another. We raise captive bred offspring that sell for a fraction of the cost to produce, tolerate regulations that inhibit our abilities to grow. Herpetoculture needs stability. A steady influx of cash. A source of income that is marketable globally.

While we grow and learn and develop new species and create new morphs for herptoculture, why not try another angle too? Something that provides what is needed worldwide. Why not resurrect an old idea, as ancient as the reptiles we keep. Let's raise reptiles for food.

It may be hard to stomach, but different cultures relish different foods. Those French who give us the best champagne also eat our horses. And many living in the Pacific paradises — where we will first glimpse the new millenium — eat dog and cat. Indeed, there is an accounting for taste, and it goes hand-in-hand with culture. Paul Theroux touched on this in his book, *The Happy Isles of Oceania*: "It was a theory of mine that former cannibals of Oceania now feasted on Spam because Spam came the nearest to approximating the porky taste of human flesh. 'Long pig,' as they called a cooked human being



Chameleon anole (*Chamaeleolis guamuhaya*). These beautiful anoles are now bred in Europe and the U.S. but there can be a significant death rate of embryos during incubation. Egg imaging could help identify the problems associated with egg incubation and increase hatching rates.

reproductive years following the onset of sexual maturity, followed by declining reproductive rates. Knowing the reproductive profile of a species will allow commercial breeders to more effectively manage their operations and will provide wildlife agencies a framework for the sound management of wild populations.



Captive-bred hatchling Parson's chameleon (*Calumma parsonii*). Herpetocultural databases could help provide the framework for management of species.

Living Art

The human environment is one of the growing chaotic ecosystems *du jour*. In this chaotic cultural soup, with shifting and repressed needs to relate to nature, some amphibians and reptiles will be adopted into the human environment. They will be domesticated; they will be transformed by selective breeding for traits that fill human needs and appeal to human aesthetics. Some will become living works of art — catered to, admired and highly prized like show koi carp. In the ethno-ecological environment, they will be selected, culled and transformed by the evolutionary forces of culture. They will enter a symbiotic relationship, feeding human needs for interrelating with life and triggering the neuroprocesses associated with the experiences of beauty and wonder.

In their turn, these transformed species will have found a new ethno-habitat, a niche in the human environment allowing them to survive independently of the state of their original ecosystems. The long term effects of living art are difficult to predict in a world where responsive programmable robotic cyberfauna may be just around the corner. On the other hand, it's also possible that, as in Philip K Dick's brilliant science fiction novel *Do Androids Dream of Electric Sheep?* living animals will become some of the most prized possessions of future civilizations (1968, 1996, Del Rey; *The inspiration for the sci-fi cult movie "Blade Runner" starring Harrison Ford*).



Corn snakes (*Elaphe g. guttata*) were the first examples of captive-bred living art in herpetoculture. Photo courtesy of Rainwater Reptiles (see color classifieds for more information).

Eye of Newt, Toe of...

Years ago an article in the *Vivarium*, titled *Are Salamanders Extinct?*, addressed the apparent lack of interest by the herpetocultural community in salamanders and newts. Little has changed since, and this group remains neglected both by hobbyists and zoological institutions. One reason for this we assume is the propensity of many salamanders to remain concealed, thus making them poor subjects for display. Exceptions are the aquatic newts. Thousands, mostly from Asia, are collected annually for the pet trade without any thought to the management of wild populations, and several once common species may become threatened as a result. This is particularly true of newt species from China. Considering that the Chinese have ruthlessly exploited their turtles to the brink of extinction, it would seem wise to address the newt issue before it reaches a state of crisis.

The management of aquatic newts and salamanders should be a high priority of wildlife agencies wherever species are exploited in significant numbers. On the herpetocultural front, the beauty of many species, from barred tiger and fire salamanders to some of the European newts, certainly deserves notice and preservation. One of the great puzzles has been the relationship of U.S. hobbyists to the hellbender, one of the world's most bizarre and impressive salamanders and the fourth largest salamander in the world (after the Chinese and Japanese giant salamanders and the congo eel). Yet there have been few efforts to develop a herpetoculture of this unique American species, one with great commercial and display potential, like a creature from a Japanese sci-fi movie.



Helmeted iguana (*Corytophanes cristatus*). This attractive species makes an outstanding display but has yet to be established in captivity. Preventing the loss of species in herpetoculture is one of the ideas you will find in the second part of this article to appear in the January issue of the *Vivarium*.



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(Jorgens 1997). Jorgens stated that locals kill the frogs to protect children and pets from the frog's potent toxicity. Not surprisingly, he mentioned that the frogs became more common away from human settlements. When describing *P. terribilis*, Myers et al. (1978) issued a formal warning in their introduction with the following, "These frogs should be considered as potentially dangerous if improperly handled. No effective antidote is known for batrachotoxin poisoning. The epithet that we have chosen for the new species is "*terribilis*," a Latin adjective meaning terrible or frightful. The name describes the extraordinary toxicity of the frogs' skin secretions, and alludes to the fear once evoked by the poisoned blowgun darts of a more warlike people." This warning should be taken seriously. It is coming from highly respected scientists that have spent their lives studying poison frogs, one of which tests for the presence of alkaloids in poison frogs through *taste*. If it garners his respect, it should have yours!

A combination of batrachotoxins makes the concoction so lethal for all three, highly toxic varieties — batrachotoxin, batrachotoxin A, homobatrachotoxin, 4-hydroxybatrachotoxin, 4-hydroxyhomobatrachotoxin and pseudobatrachotoxin (Daly et al. 1987). In fact, the toxins are amongst the most potent of all nonprotein poisons (Myers et al. 1978; Myers and Daly, 1983). Also found within the mixture exuded by *P. terribilis* and possibly *P. bicolor*, are l-calycanthine and d-chimonanthine, which are indole alkaloids; another alkaloid shared between the three species is noranabasamine, a pyridyl-piperidine (Daly et al. 1987).

The toxins work to prevent the closing of sodium channels in the surface membranes of muscle and nerve cells (Myers and Daly, 1983). In doing this, there is an influx of positive sodium ions into the cells. Cells use ion pumps to regulate intake and removal of ions to create an electrical potential across the cell membrane. The pumps maintain a negative inner membrane charge; animal cells must maintain a negative charge internally to facilitate the conduction of action potentials in neurons to transfer information across the nervous system (Lehninger et al., 1993). Losing the ability to close the sodium channel and losing the inter-

nal, negative charge (sodium ions have a positive charge), the cell becomes depolarized and is unable to function correctly. The toxins from these frogs irreversibly depolarize nerve and muscle cells. Ultimately, the toxins cause heart arrhythmia, fibrillation and failure (Myers and Daly, 1983).

Considering the toxicity of the frogs involved, two methods are known for poisoning darts via frogs; all of this information derived from Myers et al. (1978). With the virulence of *P. terribilis*, darts are simply swabbed across the back of a live animal. When using *P. bicolor* and *P. aurotaenia*, the animals are skewered with a wooden stick into the mouth and out through one of the hind legs. The dying frogs secrete toxins which are collected on darts and sometimes cured by a fire. One frog can potentially poison 20–30 darts.

Few are the organisms that are absolutely free of predation by all others at every life stage. Even as toxic as *P. terribilis* is, the snake *Liophis epinephelus* can consume it, as well as toxic toads of the genus *Atelopus*, without any apparent ill effect (Myers et al. 1978; Daly et al. 1978; Daly et al. 1987). Myers et al. (1978) indicated that if the poisons from *P. terribilis* are detoxified by the snake, it must start with the saliva. The exact mechanism through which the snake manages to negate the effects of the toxins is not known. Nevertheless, the toxins and the warning coloration are formidable antipredator mechanisms; there may be mimics of *Phyllobates aurotaenia* and *P. lugubris* in sympatric frogs like *Eleutherodactylus gaigae* (Duellman and Trueb, 1986) and *Colostethus talamancae*.

The indigenous uses of poison frog toxins on darts is remarkable. Aside from dart poisoning, the only other mention of indigenous peoples exploiting poison frog toxins in daily activities comes with what is called "tapirage." It is a process reported as having been practiced by indigenous peoples of the Amazon drainage and the Guianas. Silverstone (1975) described the practice, referring to accounts in European literature dating as far back as the sixteenth century. The process supposedly changes the colors of feathers in living parrots. Green feathers are removed from young parrots. The skin toxins of *Dendrobates tinctorius* (and/or the blood of the frog) are spread over the defeathered areas. The resultant feathers that regrow are supposed to

be red or yellow in color rather than green. The practice of such a custom has yet to be substantiated by western science. While many if not most scientists remain doubtful, it does not seem outside the realm of possibility considering the vast array of toxins identified from poison frogs and their tremendous chemical variation.

Age old stories of witches and their brews, with the fantastic concoctions therewithin, seem a perfect place for poison frog skins to appear, listed on dusty, old recipe pages. The biochemical nature of the toxins are remarkable as well as formidable. Exploitation of the compounds proves to be a story of a detailed understanding in indigenous peoples of their environment. One thing is for sure, predators bearing fang to claw need pay respect to the tiny, yellow frogs of the Colombian Chaco.

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About the author: Danté Fenolio is beginning graduate studies at the University of Oklahoma. He also works with amphibians for Catholic University in Goiás, Brazil, directs the Amphibia Research Group, helps his parents with their new online company which sells images of exotic wildlife (rainforestimages.com), and still finds time for enjoying amphibians in captivity.

Literature Cited

- Breder, C. M., Jr. 1946. Amphibians and reptiles of the Rio Chucunaque drainage, Darien, Panama, with notes on their life histories and habits. Bulletin of the American Museum of Natural History, vol. 86, article 8, 375–436, pls. 42–60.
- Daly, J. W., Brown, G. B., Mensah-Dwumbah, and C. W. Myers. 1978. Classification of skin alkaloids from neotropical poison-dart frogs (Dendrobatidae). Toxicon. 16:162–188.
- Daly, J. W., Myers, C. W. and N. Whittaker. 1987. Further classification of skin alkaloids from neotropical poi-

son frogs (Dendrobatidae), with a general survey of toxic/noxious substances in the amphibia. *Toxicon*. 25(10):1023-1095.

Duellman, W. E. and L. Trueb. 1986. *Biology of Amphibians*. Johns Hopkins University Press. 670 pp.

Duellman, W. E. 1993. *Amphibian Species of the World: Additions and Corrections*. The University of Kansas Museum of Natural History. Special Publications No. 21, 372 pp.

Frost, D. R. 1985. *Amphibian Species of the World*. Published as a joint venture of Allen Press, Inc and the Association of Systematics Collections Lawrence, Kansas. 732 pp.

Jorgens, D. 1997. Impressions from the biotope of *Phylllobates terribilis*. *American Dendrobatid Group*. No. 32., pp 2-4. Reprinted from Datz, *Aquarien-Terrarien*, 1/97., 40-43.

Lehninger, A. L., Nelson, D. L. and M. M. Cox. 1993. *Principles of Biochemistry*, 2nd ed., Worth Publishers. 1013 pp.

Myers, C. W., Daly, J. W. and B. Malkin. 1978. A dangerously toxic frog (*Phylllobates*) used by Emberá Indians of Western Colombia with discussion of blowgun fabrication and dart poisoning. *Bulletin of the American Museum of Natural History*, vol 161, article 2, pp. 307-366.

Myers, C. W. and J. W. Daly. 1983. Dart-poison frogs. *Scientific American*, Feb. 1983, offprints #1534.

Neuwirth, M., Daly, J. W., Myers, C. W. and L. W. Tice. 1979. Morphology of the granular secretory glands in skin of poison-dart frogs (Dendrobatidae). *Tissue and Cell* 11(4):755-771.

Silverstone, P. A. 1975. Frogs worthy of a maiden's kiss. *Terra Magazine* 13(4):19-21.

Zimmerman, E. 1983. *Breeding Terrarium Animals*. T.F.H. Publications, 384 pp.



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**Nov 21, 1999: 1999 NY Metro Reptile
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Plains, NY - Info: (914) 526-4845 or
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Nov 23, 1999: NY Metro Reptile Expo,
Westchester County Center, White Plains,
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**Nov 27, 1999: Lancaster County Reptile
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Exhibition Center, Leola, PA - Info: (610)
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**Nov 27-28, 1999: International Reptile
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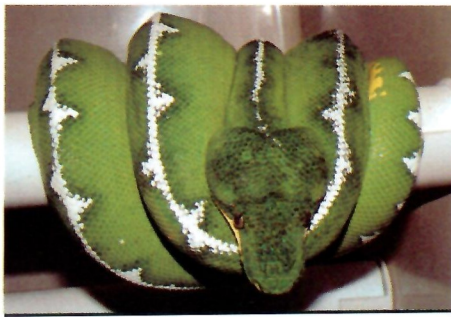
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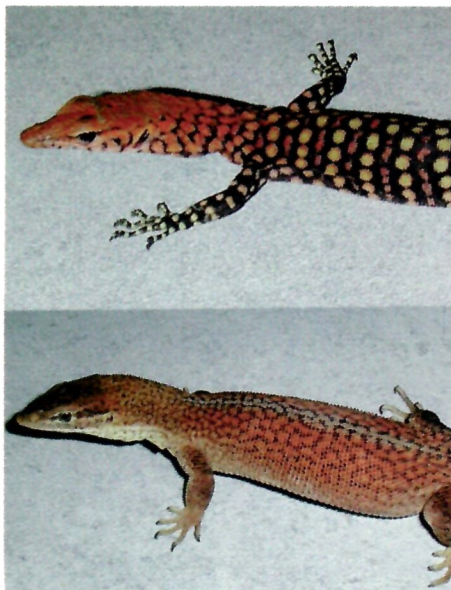
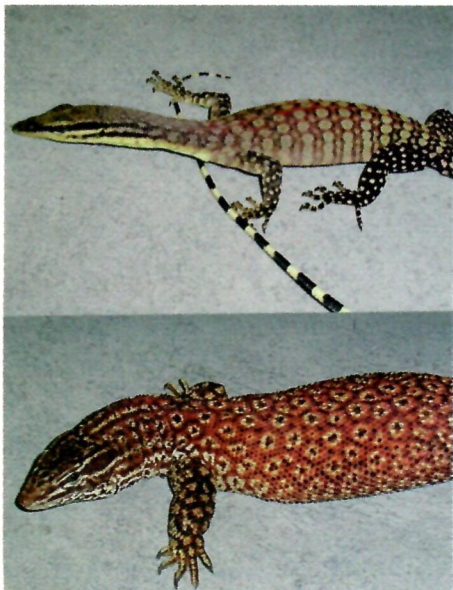
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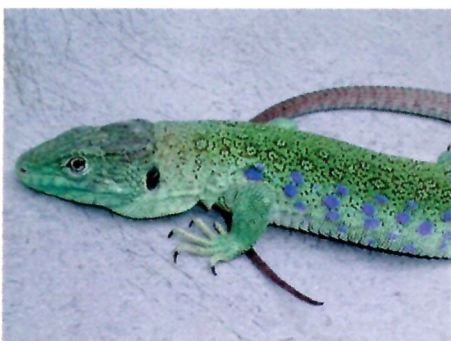
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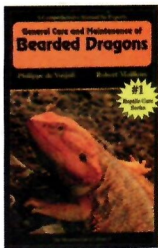
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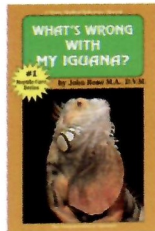
Published by Philippe de Vosjoli.



General Care and Maintenance of Bearded Dragons

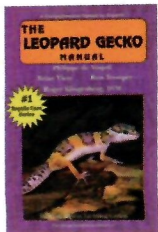
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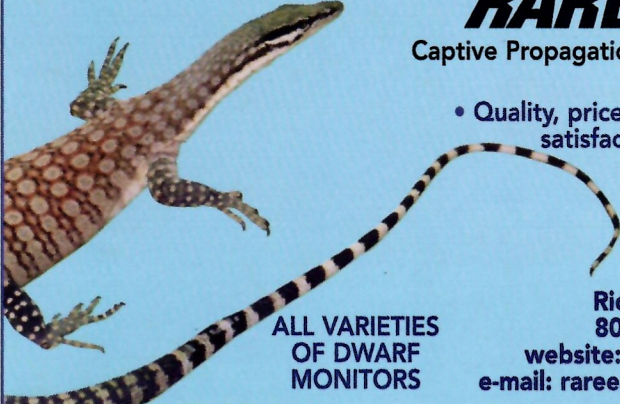
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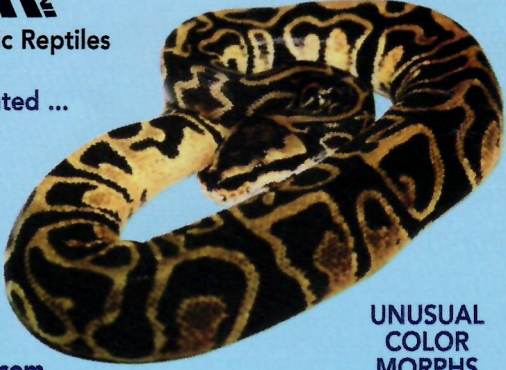
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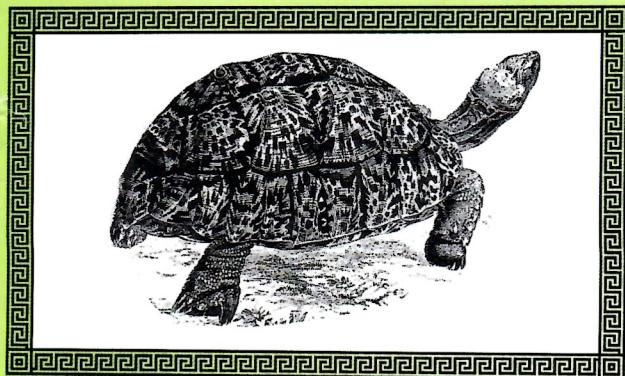


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***TORTOISES OF THE WORLD:
VOLUME 8:***
**Richard Cary Paull and Liz Palika's
SHE SAYS; HE SAYS**

LEOPARD TORTOISE

This book is a full treatment of the Leopard Tortoise.

Color coverage of:

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- Safety
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- Origin and relatives of Leopards

A big mystery is solved; pyramiding is explained!

This is a very interesting book. The two authors have different opinions; these are not masked at all in the book. Indeed, each author has her or his own type font! Together they bring a wealth of experience with tortoises, rescue, and writing.

Liz Palika is the author of many pet books on dogs, nutrition, and the two Complete Idiot=s Guides to Reptile and Amphibians and Turtles and Tortoises. She is an accomplished Leopard Tortoise breeder.

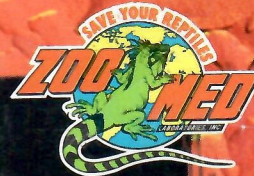
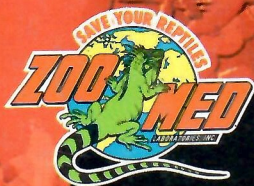
Richard Cary Paull is the author of many tortoise books. He placed his male Leopard Tortoises with Liz, before she wrote about reptiles. Under Liz's devoted care, her females and Richard=s males have produced many offspring.

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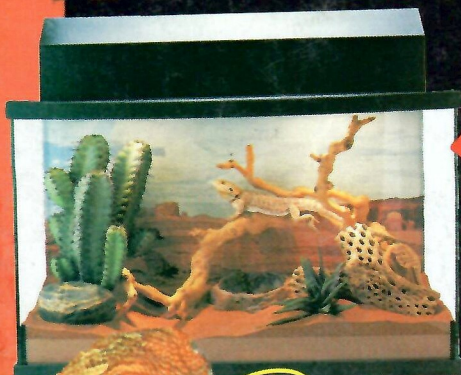
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The Right Way to Set up

BEARDED DRAGONS



Wow!

FIRST

Use a 15/20 H gallon glass terrarium for juveniles. Then, you need a minimum of 20 gallons of space for each adult kept (i.e. 60 gallon terrarium for 3 adults.)

SECOND

Very Important! Bearded Dragons are an Australian desert type lizard that greatly benefit from the sun's UVA and UVB rays. Use Zoo Med's **Reptisun 5.0**

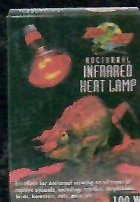
Fluorescent lamp in order to provide the necessary UVA and UVB wavelengths to process calcium in their bloodstream, and induce normal feeding behavior.

REPTISUN 5.0



THIRD

HEAT. Use Zoo Med's **Ceramic Heat Emitter** or **Nocturnal Infrared Heat Lamp** To keep The Terrarium at 80-85° during the day. Provide an additional Heated "Basking Area" (during daylight hours only) with Zoo Med's **Repti Basking Spot Lamp**.



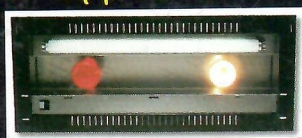
Zoo Med's **Deluxe Repticare Rock Heater** can be added as a "Safety Stone" to assist in food digestion.



FOURTH

Zoo MED manufactures many Types of **Reptile Hoods** and **Clamp Lamps**

which accommodate all types of Heat Lamps and Fluorescent Tubes.



The Slider Hood

FIFTH

MONITOR your temperature with Zoo Med's **Deluxe Analog Thermometer** or **Deluxe Min/Max thermometer**.



SIXTH

SUBSTRATE -

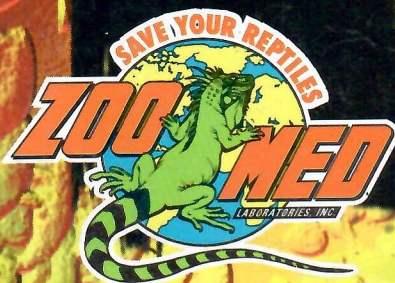
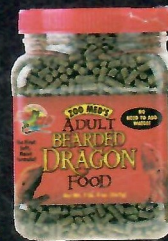
Use Zoo Med's natural **Repti Sand**, which comes in Natural Red or Desert White colors, for that "Natural Desert Look!"



SEVENTH

Use Zoo Med's **Bearded Dragon**

Foods for a complete, natural diet for your Bearded Dragons!



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