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Portrait of a Herpetologist as an Older Man—Chapter 5
Monitor Lizards and the Leader of Them All, the Komodo Dragon

James B. Murphy
3100 Connecticut Ave NW, #431
Washington, DC 20008

Portions of this article have appeared elsewhere [see Murphy and Walsh (2006); Murphy et al. (2019)]

The public sees the Komodo dragon, with its awesome morphology and unsettling feeding behaviors, as a combination of crocodilian, lizard, and dinosaur—a creature that mercilessly tracks and devours its prey. This amalgamation of fear, respect, and adoration has driven the research machine for many years.

– Kurt Auffenberg and Walter Auffenberg (2002)

Since I got my first living Nile monitor (about 30 years ago) and became acquainted with his life habits in the terrarium, the monitor lizards have fascinated me all the time, these "proudest, best-proportioned, mightiest, and most intelligent" lizards as [Franz] *Werner strikingly called them*.

– Robert Mertens (1942)

Modern comparative methods allow the examination of the probable course of evolution in a lineage of lizards (family Varanidae, genus Varanus*). Within this genus, body mass varies by nearly a full five orders of magnitude. The fossil record and present geographical distribution suggest that varanids arose over 65 million yr ago in Laurasia and subsequently dispersed to Africa and Australia. Two major lineages have undergone extensive adaptive radiation within Australia: one evolved dwarfism (subgenus* Odatria, *pygmy monitors), whereas the other Australian lineage (subgenus* Varanus*) remained large, and several of its members evolved gigantism.*

– Eric R. Pianka (1995)

Introduction

In 1926, the first living Komodo dragons (*Varanus komodoensis*), known as "oras" in Indonesia, were placed on exhibit in New York's Bronx Zoo (Figure 1) and the Amsterdam Zoo (Figure 2), but the effort to display them in New York was less than satisfactory. W. Douglas Burden (1927) painted this gloomy picture, "After watching these great carnivores in the wilderness of romantic Komodo, it was painful to see the broken-spirited beasts that barely had strength to drag themselves from one end of their cage to the other. Surely, it is not all a matter of diet and a change of climate. Perhaps, as in the case of many mammals, *Varanus komodoensis*, in order to survive, demands the freedom of his rugged mountains." In 1934, a dragon on display at the Smithsonian's National Zoological Park (NZP) lived only two years after capture by the Griswold-Harkness expedition. Five dragons were exhibited at NZP over a 40-year span, the average longevity being five years and the maximum being 12 years (Figures 3 and 4). Because the largest specimens were generally wild-caught, dragons at other North American and European zoos fared poorly as well (see Flower, 1937; Jones, 1965; Rookmaaker, 1975), no doubt due to the fact that adult animals often have difficulty adjusting to captivity.

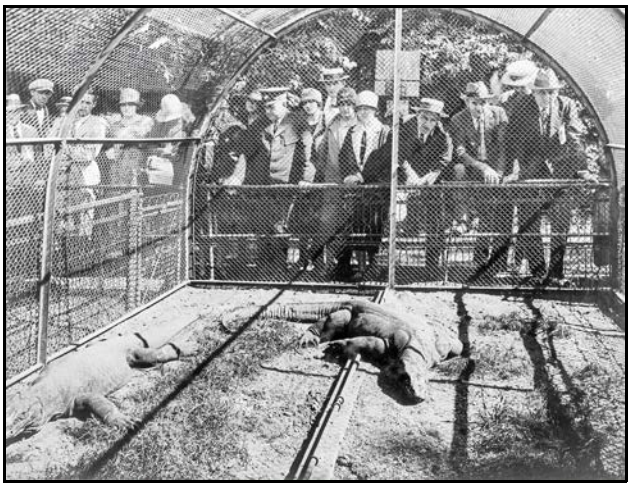

Figure 1. Komodo dragon exhibit at the Bronx Zoo (Wildlife Conservation Society). Undated photograph (possibly early 1930s.), courtesy of Wildlife Conservation Society.

Figure 2. Komodo dragon with keeper at Natura Artis Magistra in Amsterdam, photographed between 1926 and 1931. Komodo dragons were added to the collection in 1926. Five years later, 12 eggs were laid in a hole and protected by the female. Note tortoise in back right corner of exhibit. Photograph provided by Eugène Bruins, Natura Artis Magistra Archives.

Figure 3. Keeper Roy Jennier next to "Xomo," the first Komodo dragon at Smithsonian National Zoological Park. This lizard was collected by the Griswold-Harkness expedition in 1934, cost $780 at that time, and lived two years. Hot water pipes in rockwork provided heat. This image was duplicated in color on a postcard for sale. Photograph provided by Smithsonian National Zoological Park Photo Archives.

Rookmaaker (1975) reported that his grandfather had captured 12 dragons in 1927, using 200 men to surround a dragon which was "snared by means of a noose attached to a stick." One went to the Amsterdam Zoo, one to Rotterdam Zoo, one to Berlin Aquarium, two to Surabaya Zoo, and two to London Zoo. Five died before reaching their destination. The Amsterdam specimen is pictured with a rope muzzle around its head. Dragons rarely lived beyond five years in captivity, and most did not survive the first few months. Zoo visitors were excited about viewing these huge, carnivorous lizards so collecting expeditions to Komodo were mounted to secure specimens for display until World War II brought collecting to an end for many years.

I was able to see this varanid in the wild while teaching a course in Jakarta, Indonesia, for the Smithsonian's Zoo Biology Training Course, developed by Chris Wemmer and Charlie Pickett. On Komodo Island, Bill Zeigler from Brookfield Zoo and I watched males bipedally combat, and we saw courtship and copulation. The rangers demonstrated running speed by tying a goat haunch to a rope, and running nearly full speed with a lizard following nearly as fast. To demonstrate agility, the bait was hung from a tree about eight feet above a group of mostly female dragons, about six feet or less in length. The dragons repeatedly jumped to retrieve it, but the effort was unsuccessful.

At the time the Indonesian government put on feeding demonstrations, using freshly killed goats, several times a week. Tourists were stationed on a bluff above. Twenty lizards, ranging in size from subadults to large adults, were imprinted to the lower space, with the largest ones forming a close circle in front and the small ones darting in to grab scraps. We watched a ranger throw a very large goat into the middle of the circle and I timed the scenario from when the goat hit the ground until I could no longer see the tiniest bit of goat—**seven minutes**! This story has a very unhappy ending. The rangers decided to permanently discontinue these feedings, but the largest dragons stayed, waiting for goats from the sky, and starved to death, according to Quentin Bloxam (pers. comm.).

On Rinca Island, I heard a deer distress call, and after 15 minutes a large dragon slowly crossed the dirt path, presumably tracking the deer, and ignoring me completely. A subadult lizard about three feet long foraged for prey by directing its rapidly-flicking tongue under mostly flat rocks with spaces beneath Those places were thoroughly checked by the animal for over two hours but prey was not available.

At the London Zoo, there were several intriguing reports on dragon behavior that seemed to contradict the belief that dragons were always dangerous to man and were delicate captives. Hill (1946) mentioned a dragon at the zoo pushing a shovel over the stones in his cage,"and the more noise he can make with it, the more it seems to please him." Curator of reptiles Joan Beauchamp Procter (1928) wrote: "The dragon, whose name is Sumbawa, walked around a very long table, and without paying attention to the audience ate a large fowl, several eggs, and a pigeon from her hand, allowing itself to be scratched and patted even when swallowing the fowl with enormous gulps, treatment which even dogs will not always permit" and "She [at death proved to be a male] would tear a pig to pieces but can be trusted with children." Sumbawa was the host at children's tea parties starting only a few weeks after arrival at the Zoo and was per-

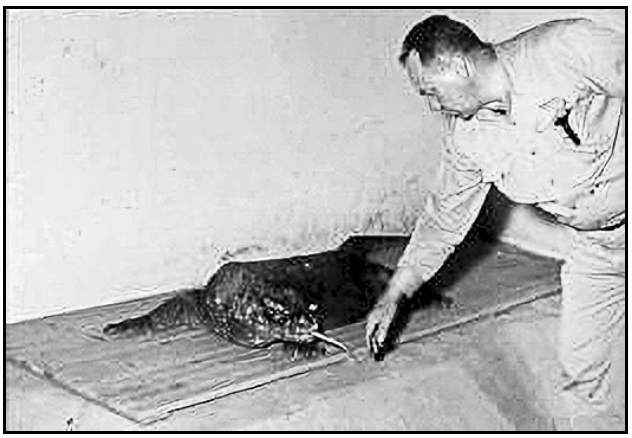

Figure 4. Supervisor of reptiles Jack DePrato and dragon named Kalana at Smithsonian National Zoological Park in late 1960s. Photograph provided by Smithsonian National Zoological Park Photo Archives.

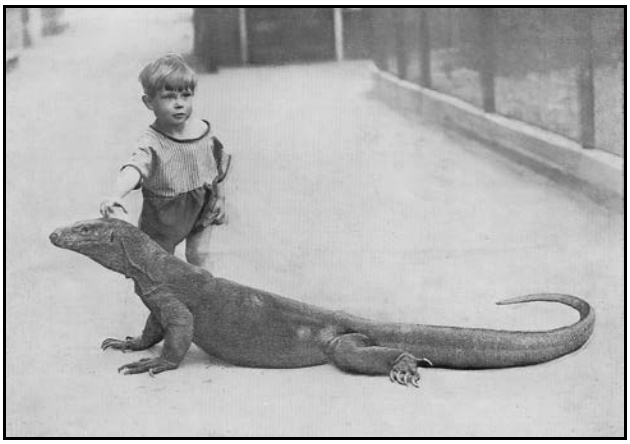

Figure 5. Sumbawa standing next to a two-year-old child. Photograph by F. W. Wood is from Joan Procter's article "Dragons That Are Alive To-day" (Procter, 1928–1929). Photograph provided by Kraig Adler.

fectly tame with all the guests. Procter (1928–1929) included a photograph of a two-year-old child standing next to Sumbawa (Figure 5) and examined dragon behavior, "The question of the ferocity of these lizards is, perhaps, the most misunderstood of all. All the lizards of the genus *Varanus* are savage, predatory, and highly strung, and they use their teeth, claws and slashing tails with great effect, as I have personal cause to know. At the Zoo we consider any large monitor more dangerous to deal with than a crocodile twice its size. But, allowing for this, *V. komodoensis* is the gentlest, most intelligent, and most tractable of them all. This is comparing them with specimens only half their weight ; species such as *niloticus*, *albigularis, bengalensis*, *salvator*, *nebulosus*, *varius*, and so on. It is quite true that they are very nervous, and also that they could no doubt kill one if they wished, or give a terrible bite when taking food from the hand greedily, but there is no vice in them."

Sumbawa accompanied Procter on strolls through the Zoo during her inspections, "investigating everything which might be of interest." The lizard responded to the voice of its keeper or curator, but disliked having its tympanum touched.

In 1942, curator Gustav Lederer described the habits of a tame dragon named Bübchen, which lived at the Frankfurt Zoo between 1927 and 1944 (Figure 6). It was taken on long walks through the zoo by the director. The dragon was in excellent health up to its death from an Allied bombing raid, in which the Aquarium was demolished, thus living 16 years, 8 months and 21 days. Some reptiles can recognize their keeper and are able to distinguish him from other persons. At Frankfurt, the dragon knew the veterinarian after the second treatment and could no longer be persuaded to leave its hiding place once the vet appeared. The lizard even recognized the operating table and fled from it (Lederer, 1931). Keeper Albert Schick allowed zoo visitors to interact with a dragon outdoors at the Frankfurt am Main Zoo (Figure 7). At Berlin Zoo, dragon Moritz was tame and followed its keeper like a dog (Figure 8).

Figure 6. A Komodo dragon at Frankfurt Zoo in Germany during the early 1960s, with keeper Albert Schick. Photograph provided by Hans-Dieter Philippen and Gerard Visser.

Figure 7. An adult Komodo dragon was allowed to walk among zoo visitors with keeper Albert Schick at Frankfurt Zoo. When the lizard arrived at the zoo in 1958, it measured 2½ meters. Photograph by R. Faust, provided by Christian Schmidt.

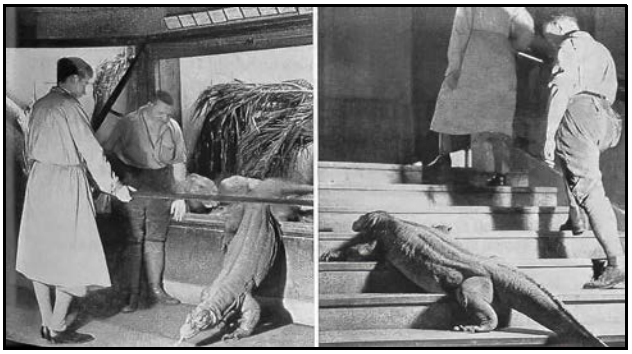

Figure 8. Moritz was an adult male Komodo dragon at Zoo-Aquarium Berlin. Two dragons from Rinca arrived at the zoo in 1927; Moritz lived until 1944. The other dragon named Max died shortly after arrival. Moritz is climbing out of its terrarium and following its keeper like a dog. Photograph provided by Archive Zoo-Aquarium Berlin.

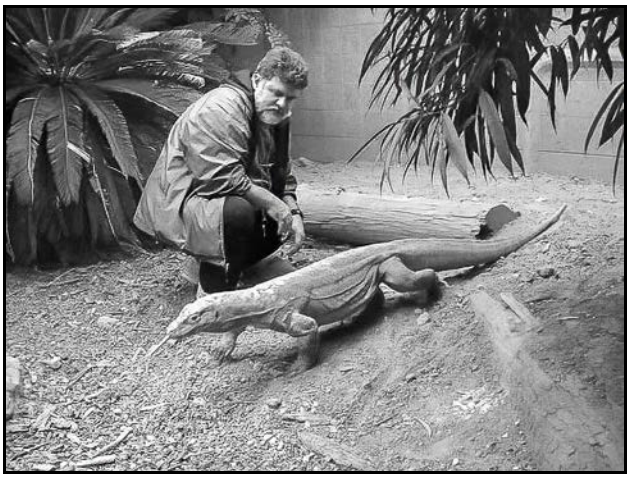

Figure 9. Kraken with keeper Trooper Walsh during one of the experimental trials to study play behavior at Smithsonian National Zoological Park in 1999.

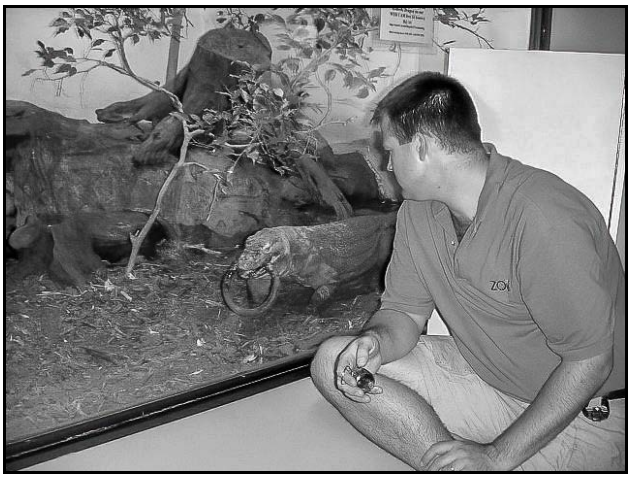

Figure 10. Keeper Rob Lewis records Kraken's behaviors during experimental trials at Smithsonian National Zoological Park in 1999. Photograph by Trooper Walsh.

Not all dragons are placid toward humans. Walter Auffenberg (1995, pers. comm.) told me about a large dragon tracking his children during his study on Komodo. The dragon's tail drag was superimposed over his children's footprints and Walter interpreted this as a potential predatory episode. Later, the dragon entered his tent, tore apart articles of clothing, and carried off a soiled handkerchief. Of the 55 hatchlings produced by the NZP female between 1992–1995, at least two were aggressive toward humans at hatching and remained so through adulthood.

Until recent decades, captive dragons had not been thoroughly investigated, due to lack of success in maintaining viable populations. At NZP several years ago, keeper Trooper Walsh asked me if I'd ever seen a dragon play. I was highly skeptical as this behavior is rarely mentioned in the literature. At the NZP in 1995, Kraken was a young female dragon, approximately 2½ meters in total length, that had hatched at the zoo three years earlier. Kraken often exhibited play-like behavior—removing a handkerchief or notebook from keeper Trooper Walsh's pocket, scraping his shoes with its forearm, playing tug of war with a plastic cup, interacting with him by using empty cardboard boxes, as well as pieces of cloth and scarves. Kraken stood on its hind legs, directed tongue flicks to Walsh's face, rested its head on his shoulder, and closed its eyes. Kraken carried Frisbees, shoes, plastic toy action figures for children, and other objects around in its mouth but made no attempt to swallow them (Figures 9–12). The lizard stuck its head into a plastic bucket, raised its anterior trunk so that the container covered its head and walked around the exhibit. The dragon placed its snout inside a shoe, lifted it off the substrate and moved throughout the cage. When Walsh whistled, Kraken turned its head toward the source of the sound. Kraken could discriminate between prey and non-prey; it would gently take a rat offered with tongs and never showed an inclination to bite Walsh. Kraken regularly turned its head to follow the flight patterns of birds flying overhead. See Burghardt et al. (2002) for an initial behavioral inventory and quantitative analysis of the trials with Kraken.

Several zoos have done research on their Komodo dragons.

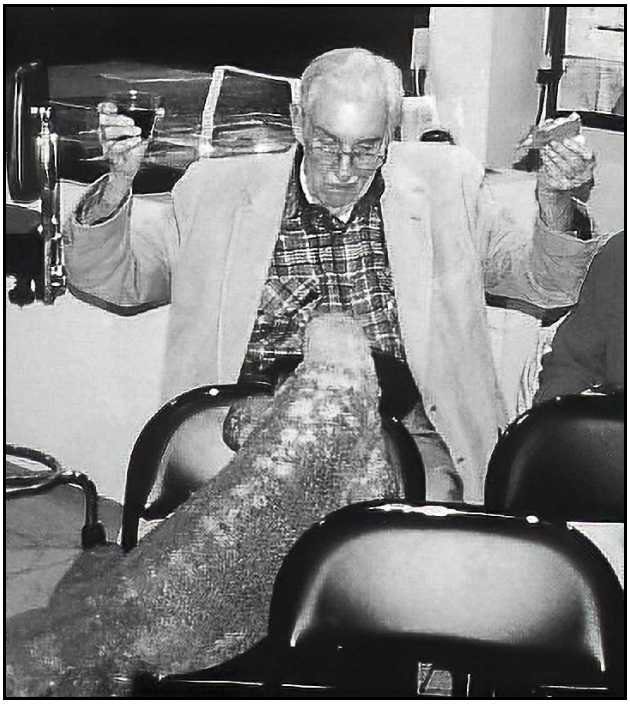

Figure 11. Kraken begs pizza from a familiar volunteer at Smithsonian National Zoological Park in 1998. Photograph by Trooper Walsh.

Figure 12. Kraken investigates an unfamiliar visitor at Smithsonian National Zoological Park in 1998. Photograph by Trooper Walsh.

Figure 13. Ultrasonography of a dragon at London Zoo in 2005. Photograph provided by Richard Gibson, London Zoological Society.

At the Dallas Zoo, curator Ruston Hartdegen and associates discovered that a dragon could discriminate between its permanent keeper, another reptile keeper who had less contact with the dragon, and a keeper from another animal department. The dragon was calm with the familiar caretaker, nervous around the less-familiar reptile keeper, and displayed defensive behavior to the keeper from another animal department (R. Hartdegen, pers. comm.). Kraken at NZP exhibited the same responses toward familiar and unfamiliar persons.

At London Zoo in 2005, the staff utilized ultrasonography on dragons to determine sex and assess reproductive condition (Figure 13). In 2005, a large male named Raja was given target training (Figure 14). He was trained to associate a target on a stick with a food reward. The target was moved into and out of the restraint crate so that the dragon became comfortable entering this restricted space, which facilitates moving him. This was an interesting example of operant conditioning that used food as the initial cue; then the reward frequency was gradually reduced, using a clicker (sound producing device) as a bridge between the reward and the target (R. Gibson, pers. comm.).

A dragon named No-Name at Pittsburgh Zoo would come when called "NO" by the staff (Figure 15). Also at the Pittsburgh Zoo, a study was initiated to test a dragon's spatial memory by examining whether dragons use proximal (near-by) or distal (far away) visual cues to remember the location of a food reward hidden in the lizard's exhibit. Preliminary results support

Figure 14. A large male dragon named Raja in a restraint box for target training at London Zoo in 2005. Photograph provided by Richard Gibson, London Zoological Society.

the hypothesis that a dragon used proximal cues to remember the location of the food and additional experiments are underway to determine if a dragon can use distal cues in other circumstances (H. Ellerbrock, pers. comm.).

Another surprising finding was that dragons are parthenogenic (Watts et al., 2006). Two females—at Chester Zoo and London Zoo—produced offspring without male fertilization. Genetic fingerprinting identified parthenogenetic offspring produced by the lizards. "This reproductive plasticity indicates that female Komodo dragons may switch between asexual and sexual reproduction, depending on the availability of a mate — a finding that has implications for the breeding of this threatened species in captivity. Most zoos keep only females, with males being moved between zoos for mating, but perhaps they should be kept together to avoid triggering parthenogenesis and thereby decreasing genetic diversity."

Fry et al. (2009) published a paper from which I quote here: "Our multidisciplinary analyses paint a portrait of a complex and sophisticated tooth/venom combined-arsenal killing apparatus in *V. komodoensis* and its extinct close relative *V. priscus*.

Figure 15. Dolly Ellerbrock and a dragon named No-Name at Pittsburgh Zoo. This enormous male dragon was called "No" by the staff and would come to them when called. No-Name hatched at Smithsonian National Zoological Park in 1993 and died in 2012. At death he measured approximately 3 meters in total length and weighed ca. 100 kilograms. Photograph by Herb Ellerbrock, Pittsburgh Zoo.

Thus, despite a relatively weak skull and low bite force, we suggest that the combination of highly and very specifically optimized cranial and dental architecture, together with a capacity to deliver a range of powerful toxins, minimizes prey contact time and allows this versatile predator to access a wide range of prey including large taxa. These results indicate that *V. priscus* was the largest venomous animal to have ever lived." Some researchers urge caution until additional evidence is forthcoming that dragons are venomous (see Weinstein et al., 2012; Weinstein et al., 2013).

In summary, Komodo Dragons will prove to be interesting subjects for future behavioral studies. What I have presented here is mostly anecdotal but systematic studies to further examine the causes for these unexpected responses by dragons toward humans will be fruitful.

Also, we might ask why humans are motivated to interact with dragons and why are these lizards often personalized? It seems as though large reptiles in zoos, especially dragons, are often given pet names but this rarely occurs with smaller ones. Retired NZP curator Dale Marcellini offered an interesting observation — perhaps the size and shape of dragons (and other reptiles such as crocodilians) which are somewhat similar to humans may be the main reason that humans pay more attention to these large reptiles and, as a consequence, may well initiate interactions with them. In an attempt to dominate all animals, some humans may specifically focus attention on large, possibly dangerous reptiles even when there are potential risks. In other cases, humans motivated to understand why reptiles operate the way they do may concentrate on dragons and other gargantuan reptiles. Detailed comparative studies with small reptiles and humans would be enlightening.

In my experience working with living reptiles for nearly 60 years, no other species has interacted with humans like Komodo dragons—these lizards are something special. Noted varanid biologist Eric R. Pianka put it this way: "Varanid lizards differ from other lizards in several ways. They have more aerobic capacity and greater metabolic scope, most varanids range over larger areas, and they are much more intelligent than other lizards. If you doubt this, go to a zoo that has a Komodo dragon, make eye contact, and look into its eyes. You will be impressed with the way it looks back at you!" (Pianka, 2002).

Acknowledgments

I dedicate this contribution to Gerard Visser, Curator of Fishes and Reptiles at the Rotterdam Zoo in the Netherlands. He is Co-Chair of the European Amphibian and Reptile Taxon Advisory Group and EEP-coordinator for Komodo Dragons. Gerard has had a positive impact throughout his professional life on studying and conserving dragons. I also acknowledge Trooper Walsh for his sustained effort to follow the history of these lizards in the AZA studbook.

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Marvin L. Jones, retired registrar at the San Diego Zoo, died after suffering a massive heart attack on 4 April 2006. I consulted Marvin regularly about the history of dragons in zoos and aquariums during preparation of several manuscripts, our last conversation occurring two days before his death. His knowledge of zoo history was encyclopedic and he was always willing to share his knowledge with his colleagues. He is still missed.

Judith Block and Bill Lamar reviewed this manuscript and made helpful suggestions for improvement.

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About This Month's Cover

Mary Boehler's image of a timber rattlesnake, *Crotalus horridus*, shared first place in the contest for best photograph conducted at the January 26 virtual meeting of the Chicago Herpetological Society. Mary had this to say about her entry:

> The photo was taken on a hike in southern Illinois on May 25, 2021. This small timber rattlesnake was on a ledge about 4' off the ground. I happened to notice the snake as I was walking on the trail (a good reminder to look UP for snakes, not just DOWN). I was able to climb on the ledge and took some photos from above with my cell phone. I then admired the snake for a few minutes, and finished my hike still experiencing the joy of discovering my favorite species of snake.
>
> I like this photo because it shows the snake simply resting. A snake who is coiled rather than outstretched generally makes the best model for photographs, but when coiled most often rattlesnakes are in a defensive posture with their rattle up. While this makes for a dramatic photo, it also displays the unease the snake is feeling. This particular snake did not seem to react to my presence—never moved its head to watch me and never went into a defensive position. Also, with rattlesnakes so much interest is placed on the rattle—how many segments, is the rattle broken or intact? This snake has his or her rattle hidden, so we are left with some mystery. Another reason I like this photo.
>
> On the day I found this beautiful snake, I was hiking with my friend John Palis, who introduced me to some CHS members who I now consider friends. I joined the CHS shortly after meeting these "ambassadors," and am starting my third year as a CHS member. Nursing is my career, and field herpetology is my passion. I enjoy sharing photos and doing what I can to educate friends, family, and coworkers about reptiles and amphibians.