

Preface

The first edition of this book was written with a retrospective view and deep appreciation of comparative medicine, surgery and comparative pathology in its broadest sense. As the author of this second edition, permit me to give my assessment of where I perceive herpetological medicine and surgery has come and where I think it will continue to progress into the future.

'One Health' was a concept emanating from joint meetings of officials of the American Medical Association and the American Veterinary Medical Association. It was a notion that was long in coming and is a most welcome advance in thought. After all, humans are animals. We share many of the same maladies. Physicians deal with but one species and two genders, while veterinarians deal with anywhere from two to several thousands of species (depending upon one's specialty), and as many as six genders (male, female, ovariectomized females and castrated males, intersex individuals, and even uniparental parthenogenetic animals). Beyond those differences, however, both professions approach their patients in much an identical fashion, and strive to achieve the same goals employing the same diagnostic and treatment techniques. These approaches certainly apply to the so-called 'lower' vertebrates as well as to human and non-human mammals.

Radiography, in all of its highly useful expressions including plain and contrast imaging, ultrasonography, magnetic resonance and three-dimensional computed tomographic scanning, nuclear isotope tracing, and so forth, is used for producing images as diagnostic tools. Physiological chemistry for analyzing blood, urine and other bodily fluids, and routine histological processing and, where indicated, highly specific immunohistochemical staining, are essential diagnostic laboratory techniques that aid in the precise characterization of neoplastic and other abnormal tissues. Doppler blood-flow detection and echocardiology are advances in diagnostic medicine that find ready applications in herpetological medicine and surgery. Often, the main obstacles to the application of some of these diagnostic modalities are access and cost. That stipulated, numerous academic and private practices now offer those diagnostic modalities. The advent of new and highly effective anesthetic agents, antibiotics, anti-inflammatory agents, and non-steroidal analgesic medications has brought the practice of herpetological medicine and surgery into the mainstream of veterinary medicine and surgery. When I graduated from veterinary school 50 years ago, many of these technologies and chemical agents were not available because they had not been invented! Commencing in the 1960s, a more realistic approach began to evolve, and as it did organized herpetological medicine and surgery became a reality. There were, however, skeptics who thought that treating reptiles and amphibians was a waste of their precious time and efforts. Those opinions did not prevail, and herpetological medicine and surgery eventually became a veterinary discipline that warranted formal recognition and board status – both of which it has justifiably earned.

Much has happened in the 19 years since the first edition of this book was published. Many more scientists and clinicians have taken an interest in reptiles and amphibians. As a result, the membership in the Association of Reptile and

Amphibian Veterinarians (ARAV) has grown exponentially, and more veterinary schools and colleges are now including academic coverage of the care and treatment of these non-domestic animals in their curricula. Crucially, in the years since the first edition was released, many individual species of amphibians, especially frogs, have become extinct, owing in part to habitat loss and, increasingly, the highly contagious fungal organism *Batrachochytrium dendrobatidis*, which continues to devastate populations in Australia and South, Central, and North America. In late 2014, a second species of this mycotic pathogen, *Batrachochytrium salamandrivorans*, was reported from European urodele amphibians.¹ This species of *Batrachochytrium* was imported with salamanders originating from Southeast Asia, some of which may represent a novel source of healthy carriers of this organism. Unfortunately, this pathogenic fungal taxon has already been isolated from tailed amphibians in The Netherlands and Belgium. Because of its inherent pathogenicity for many species of urodeles as well as populations of amphibians native to continents where native newts and salamanders lack natural immunity, this new newly discovered chytrid poses a threat to amphibians far from its point of origin. Cryptosporidiosis, because of a parasitic protozoan pathogen, is ever more frequently diagnosed in captive reptiles and, like several viral diseases of reptiles, is a major concern of captive collections and breeders. Numerous bone diseases, some of which are linked to nutritional deficiencies/excesses, and captive environmental husbandry are common in reptiles and amphibians. The precise laboratory determination of normal physiological values and the application of these analytical investigations to actual cases of infectious, nutritional, metabolic, parasitic, and neoplastic diseases are of significant importance to the early diagnosis and effective monitoring of numerous treatment regimens.

During the past two decades many novel radiographic techniques have been developed and are now placed at the disposal of veterinary clinicians, especially those attached to academic institutions and, as noted previously, also in some private practices. Clever veterinary surgeons have devised operative solutions to numerous serious conditions in both reptiles and amphibians.

Thus, for these reasons and the enthusiastic acceptance of the first edition, the publishers decided that the time was right for an expanded second edition. The choice of whether to include cases and images from the first edition was left to my judgment. I wanted to keep this edition fresh and of interest to my colleagues who have the first edition on their bookshelves – and in their memories. In addition, I kept in mind the value of many of those cases for training younger generations of veterinarians and students. In the first edition, and in this one, the reader is presented with the facts of the cases and may be asked to give a diagnosis, treatment or management plan, prognosis, or a rational means for preventing a certain condition; or to identify a particular parasitic organism, what measures to take in instances of multiple cases within a collection or colony situation, and so forth. As was the case with the first edition, the cases are purposely presented in a random fashion because in actual clinical practice, that is exactly how cases occur. Unless a clinician is a specialist, she or he is unlikely to see multiple or consecutive cases of a dermatological or ophthalmological condition in a series of one after another;

nor is one likely to have an endless number of metabolic or infectious disease cases without other diagnostic challenges comprising radiological, diagnostic laboratory investigative, or surgical procedures mixed in between the others. Also, there are instances where the reader is questioned as to the identification of a particular animal, blood cell, parasitic ovum or cyst. This form of presentation is also a means for sustaining interest in pursuing the self-assessment format. Also, in the 'real' world, one does not have the luxury of filling out a college blue book when faced with a clinical challenge. Rather, one must think, consider the facts revealed in the history, the signs shown by the patient, the laboratory results, and so forth, and winnow through several possibilities, then formulate a rational answer that includes likely diagnoses, a cogent treatment plan, and prognosis.

There is a bias in the selection of cases inasmuch as certain species of reptiles and amphibians are more often kept as 'pets' or study animals. Thus, there are more boa constrictors, green iguanas, Old World chameleons, certain monitor lizards, African frogs and toads, American alligators, North American and European turtles and tortoises and some other tropical and temperate-zone snakes than might be expected. These are the taxa that are more often sold by pet dealers and, consequently, are more likely to be seen by veterinarians.

Pioneers of comparative medicine such as the 17th century's Marcello Malpighi, the 18th century's John Hunter and the 19th century's Rudolph Virchow contributed mightily to our fund of knowledge via their experimental approaches, which included non-mammalian species. Each was a physician-pathologist, and they all shared an intense interest in investigating, in an integrated manner, the intimate anatomical and physiological relationships of cells, organs and entire organisms. Rather than merely investigating a sole entity, a solitary lesion, or an isolated organ or organ system, each explored insights that evolved into an integrated – dare I say – 'holistic' approach to a given patient. Individually those cells, organs or organ systems are interdependent (i.e. each and every part of an organism exerts an influence on its counterparts). The herpetological patient, be it a frog, toad, newt, salamander, snake, lizard, tortoise, crocodile or any other creature, must be seen and appreciated as the whole of its disparate parts.

From this, one can see that obtaining a thorough history is absolutely essential. Not only the details of the individual patient, but also:

- What environmental factors might have played a role in inducing a particular condition or disease to appear?
- How many animals in the collection are unwell or have died?
- Has microbiological and/or toxicological testing been carried out?
- Have histological examinations occurred?
- Is a quarantine program established and if so, for how long and how is it managed?
- Was nutrition per se or some deficiency in a major or minor nutritive component a contributing factor?
- What is the source of the dietary items fed?
- Did a traumatic event occur?
- Was a mixed population of animals housed together?

- Was hyper- or hypothermia involved as a contributing factor?
- What is or was the age of the patient(s) when the disorder was first manifested or noticed?
- Did other animals in the immediate environment of a particular patient also exhibit signs of a similar disease or disorder?
- Have there been recent additions to the animal colony?
- What protocols or measures are in place for cage or colony hygiene?
- What, if any, treatment has been administered to this and/or any other animals in the collection?
- What is the nature of water management?
- What is the source of drinking water?
- Is the water treated, and if so, how and with what agents or equipment?
- How is that treatment delivered or applied?
- What cleaning or sanitizing products have been used, and how often and by whom?
- Have there been changes in the personnel responsible for the care of the animals?

These are but a few of the epidemiological questions that must be asked and answered in order to assess fully whether there is any commonality in a disease outbreak in a collection or colony of captive animals. It may seem lengthy or bothersome to some observers, but these questions are essential in order to fully investigate deaths, especially in instances of multiple losses.

Obviously, the economic considerations of any particular situation play a role. The fees charged by a diagnostic laboratory for analyzing blood, urine, tissue, food, water, and so forth are often as much as or more than those fees charged for humans or conventional domestic animals. That fact being stipulated, the economic value of many captive reptiles and amphibians often justifies expensive laboratory investigations – particularly if the animal is a cherished pet or a very expensive exotic species, when multiple animals are involved in a disease outbreak and/or when the disease is communicable to humans. In some instances, legal and/or forensic issues remain to be considered and resolved, and, again, these justify the expense of professional expertise.

Long gone are the days of inexpensive, ‘disposable’ imported animals destined for the ‘pet’ trade. Import regulations are strict and the wholesale trade of highly restricted or forbidden CITES-identified species is now under close scrutiny; legal convictions now carry much stiffer sentences of monetary fines and imprisonment. Because of these factors, the forensic investigation of criminal cases involving captive reptiles and amphibians has become more commonplace in North America, Europe, and Asia.

In addition, veterinarians, especially comparative pathologists, may be called upon to serve as expert trial witnesses and give sworn testimony in cases involving reptiles and amphibians. Be forewarned, the courts demand precision in all means of documentation and testimony; the defense will surely pounce on any perceived lapse in either of these essentially important components!

In some instances, the identification of a particular species is requested. I have asked this question only in certain instances when that identification was vitally important. For instance, when an animal is toxic or venomous to humans, or when a species is CITES-listed and should not be in private hands unless legally permitted and accompanied by appropriate documentation.

For many decades, I have counseled qualified veterinarians and veterinary students to perform complete necropsies on all patients who are encountered dead on arrival, or who die on the operating table or whilst in the care of a veterinary clinician. It is astonishing what can be learned from these necropsies and how often one's initial impression or tentative diagnosis is incorrect. This type of instruction is absolutely invaluable – and essential – for acquiring expertise as an accurate diagnostician, thus making for a much better clinician when dealing with living patients!

This edition also differs slightly from the first in that although the majority of the images shown are from my own clinical archive, many others are from esteemed colleagues who have kindly and very generously shared their clinical cases and pertinent details and images. Their contributions are cited, giving credit for photographs and/or case materials.

I hope that you, the reader, will enjoy this excursion into self-assessment.

Fredric L. Frye

Marrel, A, *et al.* (2014). Recent Introduction of a chytrid fungus endangers Western palearctic salamanders. *Science* 346(6209):630–1.