



**SOLVING THE CALCIUM
CONUNDRUM
WITH
DR. ROBERT G.
SPRACKLAND**

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Reptileapartment.com



Contents

[Introduction](#)

[Lizards in the wild](#)

[UVB & the Parietal Eye](#)

[Serotonin & the Reptilian Brain](#)

[Lizards, Third eyes, and Scandinavian suicide](#)

[UV Exposure & Behavior](#)

[Calcium & UV](#)

[Vegetables as Calcium Blockers](#)

[On Publishing](#)

[Recommended Diet](#)

[Sharing and the Next Generation](#)

[Husbandry 101](#)

[A Final Thought on Diet](#)

[Perspective](#)

Introduction

I had the opportunity recently, to interview Dr. Robert Sprackland and ask him about his views and insights into the misunderstood world of vitamin and mineral supplementation when it comes to reptiles. In case you've been living under a rock or for some other reason, are unaware of just who Dr. Sprackland is; he is the author of nine books and is considered by most in the herpetoculture industry as an authority on all things saurian or lizard related. Specifically, he has worked with the monitors for the most part to my knowledge and his book on Savannah and Grassland Monitors is where I first became familiar with his work. He has also published numerous times in Reptiles magazine and the now defunct Vivarium Magazine as well.

There's a lot of internet experts around that are talking of Vitamin D3 and general vitamin and mineral supplementation when it comes to lizards and I wanted to get the straight information directly from a reputable source. The conversation that follows is one of insight and education that no one who owns a lizard should miss.

Lizards in Wild

"As far as vitamin supplementation in the wild where do lizards obtain that from?"

“Well in the wild it’s the same for any wild animal, they get it from their diet. They live in environments where they have evolved to such a degree that they eat the things in that environment that they need to sustain themselves. When we change an environment; one of the things that happens when we change a habitat is that somewhere in there we are going to take out some element that the creatures need for their nutrition. I mean even before we get to the point of we’re taking away their homes and actually killing them but you know you take away any link in the food chain and you’re taking away somebody’s source of vitamins and minerals down the line. For the most part, you look at any animal that’s in the wild and of course I’ve not yet seen a lizard or a turtle or a bird or a rhinoceros go to the health food store and order calcium. So the fact that they’ve all been here for so long and have been here longer than we have, I’m really inclined to believe that the natural diet they have is taken care of that.”

UVB & the Parietal Eye

“That would be my best estimation as well. Now then, I notice also too that in your book Savannah and Grassland monitors you were talking about feeding hatchling monitors including the vitamin d₃ and calcium supplementation as necessary. Then

on the next page you mention something which when I first read it took me back. I reread it and I understood it but it was still amazing in regards to UVB lighting. You were speaking to the parietal eye and said that you've seen lizards survive without UVB lighting. Has there been anymore research done on that?"

"If you go to Giant Lizards the 2009 edition there's a section there where some of the people that I had contribute to the sections on breeding and reproduction I mentioned different aspects of having kept animals for a very longtime without ultraviolet light. In fact I can't remember the gentleman's name off the top of my head, but the fellow who was the co-author of Daniel Bennett's book on Savannah Monitors mentions that he has kept and bred the animals without ever giving them ultraviolet light. For a long time people in the zoo world people in serious reptile collections before we knew what we know about UV were keeping the animals and frequently breeding them.

I mean I remember from the time I was a preteen, I used to breed *Anolis* and they were in the house and the adults were in a ten gallon terrarium and the little ones the eggs were incubated in plastic bags like the ones I got from the fish shop. The old information I got from the American Museum of Natural History where they were

breeding snakes all the time. Back then an incubator was where you'd put the eggs on some peat or sphagnum with a little bit of moisture in a plastic bag seal it up so there's lots of air like when you get a fish bag stick them in a closet someplace in your house like a linen closet which is usually near the water heater so that the temperature stays stable and your eggs will hatch. So that's what we used to do when I was young and dinosaurs ruled the world.

I was able to hatch about a 60 to 70% for anoles so obviously it wasn't great but it was way better than what people had been doing five and ten years earlier. I was able to do the same with Collared Lizards and Desert Banded Geckos *Coleonyx*."

"Right, Coleonyx variegatus."

"Back then I was very focused on the native stuff. Again you know 13 or 14 years old and as I went on I bred a few other things when I was younger at that time we had no idea about ultraviolet light being important, being relevant, there were a few people doing research in the very highest levels of academia but that stuff had filtered into the medical community. So I wouldn't say it's new, I would say the information is about 30-35 years old now. But what we're learning about it is only recently coming together to make sense.

Now let me see if I can make sense of what I just said. Now that would be priceless.

OK, you probably heard somebody at one time or another say you know

'Here's a living thing, now the most important thing for living thing is water, or the most important thing is oxygen or the most important thing is calcium.'

That is the most meaningless opening line statement there is because if you have a living thing and take away the water it's dead, OK so let's leave the water and take away the second most important thing and take away all the oxygen in the system.

It's dead. Wait we're going to put the oxygen back and take out number three let's take all the carbon out. Well it's dead. So when you talk about what is the most important thing my question has to be under which circumstances are you more dead than another? The answer is your dead. This explains in a more holistic way looking at everything to do with a living system including the diet in reptiles. So let's look at what began many years ago as investigations into the function of the pineal eye.

It was found eventually within a few years of realizing that it did anything somewhere in the 1960's that it was most sensitive to certain wavelengths of ultraviolet light. It subsequently became established that the most important thing it did was to control what we refer to as the limbic system. It affects behavior, the

biological clock, regulation of some of the autonomic nervous system such as heartbeat, respiration; but specifically behavior, attitude, and we later found out emotions and feelings.

Serotonin & the Reptilian Brain

Well from that, when the herpetologists and the more general physiologists and neurologists started talking, the research went on to find out that the chemicals released by the pineal in lizards is the same that is released in humans. Which is serotonin, and lo and behold it affects the same parts of our brain as the lizard brain. A few more years and it was discovered that serotonin was the great magic; it's the neurotransmitter, the chemical in our brains that under normal conditions it keeps us regulated, emotionally stable. In the absence of serotonin we tend to become more and more depressed. Physiologically depressed, then mentally depressed, then physically depressed, and ultimately in some cases to the point of suicide."

Lizards, Third eyes, and Scandinavian suicide

Now yesterday I posted a Power Point, a presentation I have been giving for a few years it called Lizards, Third eyes, and Scandinavian suicide. It's what happened when; in the early to mid 1960's a couple of fellows who became well known

herpetologists decided to study whether or not the third eye in lizards does anything. I mean people have known about it for a long time it was beautifully illustrated in the 1870's and no one had the foggiest idea if it did anything and if so what. So even from the 1800's it was realized that anatomically it's very much like an eye, it was called a rudimentary eye it even had a fine nerve that was called an optic nerve then it became known as the parietal nerve then it became the pineal nerve we like to change the names of things in anatomy it gives us reasons to put out new editions of the text book. So you can understand why I want to keep cranking them out.

Well anyway, the consensus was up until the 1960s that the pineal eye was some remnant from a fish ancestor that was no longer functional. It had all the parts but the optic type nerve was not robust enough to carry say an optical signal and the lens became in the simplest terms developed to be an extremely major cataract very early in the development of the lizard and that it was covered over by a scale so the opacity was such that it was functionless as an organ.

But this is where the first study was unable to determine if it did anything. They were monitoring a couple of interesting chemicals in the lizard, now they we're really going heavy duty here. They were either looking at lizards who were OK they way

they were or at lizards who had a parietectomy in other words they actually surgically removed the parietal eye. Subsequent to that in the next few years colleagues would start doing things like simply covering the eye with wax. You'd get a good dark candle and then drip the wax on the pineal eye and it's blocked out. But in the beginning stages I guess because there was more physiologically appropriate 'You got to cut something out of this organism in the name of science right'.

"Right, it's all in the name of science."

UV Exposure & Behavior

"So anyway, what happened was it became obvious as people began looking at, well first of all these guys were looking at the Galapagos lizards and saying my gosh there is an eye and whether its covered or not there does seem to be a difference but it's a very small difference in the chemicals produced but we don't notice any behavioral differences. Then somebody else came along and said that's interesting let's look at some more lizards; see if there's difference in something else and one of the first lizards studied was in the Caribbean the very popular pet Curly Tailed Lizard *Leiocephalus carinata* and this is the one I really like the lizards in this case that had the parietal eye removed, they were still removing them at that point.

The social behavior changed, remember what I said we know that serotonin controls our limbic system it determines if we're in control of our moods. Well these little guys got what we call today a major testosterone surge in their case it was a grotesque imbalance of serotonin and the little males would become incredibly aggressive they would challenge, chase off, and often defeat the large resident male of the colony.

Imagine if you will that you had a small pack of dogs around your neighborhood and they're all the size of say Collies but there a couple hangers on that are Chihuahuas and they know their place they might be loud but they know their place. Now imagine you could do something with these Chihuahuas like in the science fiction movies right. This Chihuahuas decides I am as big as my attitude and I am coming after the top Collie and I am going to keep after him until he's scared; he's going to be so confounded that he will leave and he does.

So this is all in the literature its all been verified there were lots of studies done on different species. It was discovered for example in Collared Lizards probably *Chrotaphytus bicinctores* back then the distinctions weren't made and so, one of the downsides we're not quite sure exactly which species was used but probably *bicinctores* and what was discovered there was is that Collared Lizards that had the parietal eye

removed became lets say more fond for lack of a better word, they changed their thermal preference and became more active at lower temperatures. And so in the afternoons or in the mornings they'd come out earlier and in the afternoons they'd hide longer and in the evenings they'd stay out much longer than they used to because they were more comfortable with the cold.

So why am I telling you all this stuff about the pineal eye and serotonin is because its all controlled by ultraviolet exposure. It's the amount of UV that determines how much serotonin is going to be produced. But here's the other thing the amount of UV also determines how much vitamin D is going to be activated into Vitamin D3. For a human being, if you were to stand outside on a good sunny day and depending on your latitude but roughly midday say between ten o'clock and three o'clock when the sun is above a certain height we're getting the maximum field or dispersion of ultraviolet wavelengths you would need about 5 minutes of that exposure per week to provide all the Vitamin D3 in activated form that you would need."

"5 Minutes?"

"OK, now we know a lot about vitamin D3 production and activation in humans some other mammals and a few birds. Everything that has been extrapolated about

reptiles and vitamin D3 has come from the human mammal model..."

"I knew it."

Calcium & UV

"And a handful of studies measuring bone density and circulating blood calcium levels now let me explain why that's important. A very reputable Zoo I won't mention any names, I love what everything they do and they published a lot of stuff looking at the relationship between UV exposure, different wavelengths of exposure and I think they are the group which came out with that it's the B spectrum that's most significant. Because they would measure the blood calcium levels of their animals exposed to different amounts of UV different wavelengths of UV and compare that with examples of animals that had not been exposed to UV and what really comes as no surprise is that the animals that were exposed to UV produced considerably more blood calcium levels than those that did not."

"Right, that makes sense."

"But the amount of calcium in the blood physiologically tells us very little. Unless we know how the mechanism works and what the exact calcium need of the animal is. So for example, providing that ultraviolet light it may have enhanced or even

super enhanced the conversion of Vitamin D into Vitamin D₃ therefore sequestering more calcium I mean its very possible that as a net result that the animals could have become overly imbued with calcium. So they would have a particularly rare and nasty condition known as hypercalcemia what this would do is cause different types of osteological problems, the equivalent being bony cysts on the bones; it would make muscle contraction very difficult, I mean there was a whole cascade of things that would go wrong when you have too much calcium. But we don't know, at least it hasn't been published that I'm aware of how much is too much."

Vegetables as Calcium Blockers

"Exactly and that's what my thing was, is that all these people talk about well don't feed this vegetable or don't that vegetable and feeding too much of this vegetable will definitely block the calcium but then when you read the vitamin and mineral supplements that you buy at any pet store it says dust said crickets, dust vegetables. I mean how much is dusting? If I put Mount Fuji on the food and they eat it, is that dusting? Then a couple of them actually say well, use a tablespoon. OK, per what? And that's the whole thing, which is driving me nuts is people are saying spinach will cause calcium blockage and Kale will cause calcium

blockage..."

"Well, the ones you've got on this list for me were Spinach, Kale, beet leaves, and rhubarb. I could not find any literature that has any problems with beet leaves and that shouldn't be a surprise because frankly there's not a lot of literature looking at absorption inhibition or digestive absorption inhibition in vegetables. There's very little for humans, there's obviously not going to be a whole lot for the other things. However, Spinach, Kale, and Rhubarb all do inhibit calcium absorption and drastically, the reason is that when they being broken down in the intestines one of the residues they give off is oxalic acid and the unfortunate thing there is that once you've got oxalate it binds to calcium and that calcium is not going to go across the membranes and into the bloodstream its going to stay right there in the gut and go out in the lizard poop. So, yeah they do inhibit the absorption of calcium. For that reason feeding the animals that material can be dangerous. Now small quantities probably are going to do anything especially if you're not feeding them spinach, kale, cabbage or rhubarb every feeding. If you're giving them a good balance of the other things; the majority of the green leafy vegetables are very good and very important. But spinach is a good source of certain nutrients but to make spinach really work for

the animals it should be a small part of a mixed meal.”

“Now in your opinion is it possible that feeding the above listed vegetables with the exception of beet leaves in a balanced diet would that lead to any possible diseases or ailments such as MBD or any type of bone density issues I guess would be the best way to put it.”

“Oh yeah, if your not getting any calcium into the system, what any body will do as a result is to start catabolizing the skeletal calcium and this is exactly what happens in older people when they get osteoporosis. Actually in humans it's very rare that they are not getting enough calcium. What they're usually not getting is enough sunshine to activate the vitamin D3 they are eating into the active form. This is one of those things that I don't like about supplements; you know you take your vitamin D3 supplements and that's great. You can take lots and lots of Vitamin D supplements but if you don't get the UV exposure, its like if you want to start a campfire and you got a lot of lighters but nobody flicks the lighter. You have to put the thumb into the equation or you're not going to get a reaction. UV is the thumb in this reaction. When I used to teach my students, my medical students, my nursing students, and we got to the stuff about osteoporosis; the three things that

really combat that are also applied to our reptiles. Number one is the diet since in humans it's almost impossible to be calcium deficient with reptiles it's not so difficult. Number two is to have that ultraviolet exposure. Now for humans as I said we know it's about five minutes a day and that's for a normal twenty something or thirty-something and as you get older it takes more exposure."

"Now is that because of a hardening of the skin?"

"Well, there is the drying of the skin and greater keratinization. It's also the fact that our physiology reacts differently and as we get older we tend to put on more of a cutaneous fat layer is going to slow things down we also put on a bit more bulk which means we're going to need more vitamin D to move more calcium and also the fact that as we age we become physiologically slower. Here's that wonderful phrase 'Youth is wasted on the young.' If I had that energy now I..."

On Publishing

"Well I would say that you kept your youth pretty busy; you're up to what now, five books?"

"Number nine just came out, and I am working on the background material for two more right now. The one I am doing with my wife is the first one we're doing jointly."

Since both of us have suffered disabling conditions in our life; we're both disabled I'm on social security disability because I am very limited on what I can do. We're doing a book about the service and therapy dogs. What they are and how they are trained, how to get them and what they do. Uh, the American disabilities act and how it actually affects the animals and what you're allowed to do with them and so on. The other book is a very large book on reptiles and amphibians kind of an encyclopedia and not like the thin encyclopedias that are out there with title encyclopedia we are talking something like the encyclopedia Tropical Fishes."

"Right like the ones TFH used to put out."

"Yes! The ones that if that you threw it a car the car would stop. I am working on the completely new and updated encyclopedia and because I am doing it will be a very different and new presentation"

Recommended Diet

"What would be a diet that you'd personally recommend for omnivorous or vegetarian species in captivity?"

"A very regular or staple diet of things such as carrots, broccoli, I would give them what ever green leafy vegetable I had, spinach in moderation iceberg lettuce doesn't

provide much but water but in captivity I am always concerned about hydration some people say don't give them any and I say give them some because its good for the kidneys. Give them corn, the various beans, peas, even on occasion nuts, dandelions everything about dandelions seems to be taken for eating. The flower and I am talking about the yellow one not the fluffy one, the leaves are good for salads and are very nutritious. But again we're not giving them a natural diet and so as a consequence I would be sure there was some type of calcium supplement. I would also go very easy on the foods that are very high in potassium. Because what really happens in many of the dietary conditions that we perceive as calcium deficiency is sometimes marginally calcium deficiency but much more likely phosphorous super abundance."

"OK, now how does that occur?"

"Phosphorous is very common. It's in darn near everything, various fruits, and all the fruits I like. Grapes, bananas, most of the berries, peaches, pears, OK I don't like apples but they're on the list too and tomatoes. All of those things are fine for humans they have got great nutrient value. But they're very high in phosphorous so the trick is to keep that kind of fruit minimal in the diet of the reptiles or if you're

going to use it you have to find calcium supplementation.

The problem is even putting a fairly large amount of, what did you say before dusting, isn't going to compare because there's some things to remember about digestion. When we're digesting or any living thing is digesting it can only digest a certain amount of what it's eating. So if you take the idea that say something the size of a Collared Lizard is capable of eating maybe two grams of protein during the course of a days feeding its not going to metabolize its not going to breakdown and digest all of that protein its going to digest a certain percentage it has a certain capacity. It only produces a certain amount of enzymes for a certain amount of time, and then in that time; the enzymes that can breakdown the protein and get the protein into the bloodstream break. There's just a certain amount of enzyme that isn't going to be produced and there's a certain amount of food that's not going to get doused in the enzymes and its going to take the jolly scenic route through the large intestine and comes back into the world as a slightly less pleasing form."

"That was a very nice way to put that."

"It was very disparaging when I was in University and I realized one day, I was looking at 3 years of my notes and it really became apparent that in professional

biology the three things that are most prevalent as far as studying interests and repertoire are sex, death, and poop.”

Sharing and the Next Generation

“I must say I'm quite surprised at how much you share on the social networking sites.”

“Well there's another generation out there who wants to get into Zoology and actually wants to work with animals and not just their DNA. Not just do a protein analysis but actually try to figure out what makes the whole thing work. There's this organism and then the environment that it lives in you know just like we're talking about now. What happens if you take the UVB out of the environment? Because we put some pollution in the air that so happens to filter UVB. It's very unlikely, since UV can pierce almost anything. But I mean if you just take out a certain wavelength or certain group of wavelengths out of UV what people don't understand on a large scale is that the results would be very widespread and catastrophic. Because there are so many small, essential, fundamental uses in the biological world. It goes back to what's more important the water...”

“Or the carbon. Right.”

"You've got your car, what's the most important part in there? Let me tell you something if you lose your dollar fifty key you're not going anywhere. I don't care if you're driving a Lamborghini and paid one hundred and eighty thousand bucks for it; if you don't have the key to turn it on all you have is a one hundred and eighty thousand dollar paperweight if you can lift it. It's the same thing with Vitamin D, or Vitamin A, or Vitamin B or a little bit of sunlight. The other thing that goes along with this is that UVB is out during the warmest parts of the day. You have to remember that enzymes only work at certain temperatures. Below a certain temperature and they're dormant, above a certain temperature and they breakdown they're just, they're gone. So what do reptiles do when they are thermoregulating? Well, depending on what they're doing. I need a certain temperature so I can go and hunt grasshoppers and catch them or I need a certain amount of energy today because the girls are looking good and it's breeding season. I need to digest these 47 crickets I just ate in the last three hours and each of those is going to have a slightly different temperature need for the enzymes that are required to determine whether you're running, mating, or digesting.

Husbandry 101

If I were to cite the two most important things to help people make their husbandry better is to really stay on top of the thermal regime and the other is the ultraviolet regime. Even if it's not necessary because they don't need as much calcium as we think they do. It has still been demonstrated repeatedly that ultraviolet light does affect the behavior. It does sequence the chemicals that affect the limbic system. It's the difference between having a reptile that's alive and healthy and having one that's alive and has in essence seasonal affective disorder. Which is going back to that power point that I was talking about is why Scandinavian's so frequently jump out of windows and commit suicide. I have been keeping reptiles for over half a century now; I got my first reptile when I was four years old. It was a little department store turtle it was a red eared slider..."

"You didn't try to eat it did you?"

"No, and I didn't try and run it on the carpet like a matchbox car either."

A Final Thought on Diet

"Interesting figure put out by the American medical association; about three to four years ago it was the last year I was teaching. 82% of Americans die each year

because of disease. More than accidents and just dying in your sleep and all that; I forget the exact number but it was significant amount of those it something like 70% of them are dying from a disease that has a direct link to dietary insufficiency you know whether its obesity, heart attack, or having a diet that's killing your kidneys or having too much sugar so you can imagine 82% of Americans, Human beings who have control and are being bombarded with health information are dying from nutritionally related diseases.

How much more appalling must the number be when you're looking at a captive reptile? That's where the sheer numbers get to the point, where you get to number one what's the temperature, number two what's the UV, and number three should be, what the hell are you feeding that thing? I think if people handled those three issues well everything else could be resolved. Everything else would be manageable. But any one of those things out of sync and you're not going to have a healthy animal. At this point what I'd like to do as much as possible is give the next generation and people who are still doing it, or want to get into it, as much information and if they don't have to make the same mistakes we did and we can share the cutting edge information"

Perspective

I can say with honesty, I've never read anything as in depth as this when it comes to the connections between calcium, diet, and UV Radiation. I wanted to give a general closing round-up to this entire piece and I feel I owe the reader something here because there is a lot of quality information here to absorb.

No matter how hard I tried I couldn't conceive of a clever wrap up to this piece. So instead I will leave you with this. I hope that you have taken away from this piece a working knowledge of the importance of the UV, Calcium, & dietary needs of our captive reptiles and do nothing but your absolute best to provide them with the care they need.

Thank you Dr. Sprackland for giving us so much material to work with and we look.