This was a series of comments by Francis Cosquieri in the Facebook group Reptile Lighting in response to a post conveying the oft repeated assertion that despite clearly demonstrable benefits, snakes don't need UV. It is reprinted with permission from the author.

It seems a crying shame to have to keep repeating the same information about the benefits of UV in this of all groups. Every time I log in to this group I keep seeing the same damned sentence - 'people have been keeping them without UV for many years.' It's almost as people are joining a lighting group to bleat about the same thing every time rather than to learn how to improve. You'll forgive me for my patience wearing thin. But OK. I will repost this series of comments again.

First of all, let's address the elephant in the room. This niggling little word 'need' that keeps cropping up. 'My snake doesn't NEED this, it doesn't NEED that, it will survive without this or that.' What an awful outlook to have when caring for a pet. You should be looking beyond what your pet NEEDS and into what can IMPROVE its life with you. If something is deemed 'beneficial' then regardless of whether it 'needs' it to stay alive or not, it is something you should be providing.
UV - it is 'beneficial' but 'not necessary.' Not necessary? What does that even mean? LOTS of things are 'not necessary' when it comes down to it:

Reptiles don't NEED to be healthy.

Reptiles don't NEED to live the fullest possible life span they are capable of.

Reptiles don't NEED stimulation or enrichment.

Reptiles don't NEED ideal temperatures.

For that matter, people don't NEED to keep reptiles in captivity at all, if you follow that argument to its conclusion.

You see how this discussion of 'needs' spirals down into a morass of ethics and philosophy?

Following that line of logic you can strip a reptile's requirements to 'oxygen, food, water and warmth are necessary, all else can be dispensed with.' This is not the way I like to look at the welfare of my animals and I think it is about time others stopped doing it too.

So sure, you can keep your python or snake or gecko without UV. That's been established for years. Congratulations.

Next question. SHOULD you keep your python or snake or gecko without UV? THAT'S a much more interesting one.

The science is absolutely crystal clear on this - UV exposure has marked effects on the health and activity of snakes. It may be possible to keep them without it, but this does not mean we are keeping them as well as we could be, or that they are as healthy as they could be. Following this line of thinking and knowingly depriving your reptile of something that is BENEFICIAL but not strictly ‘needed’ is what leads to cutting corners, resulting in a reduction in the animals’ health, the animal possibly not reaching its full lifespan and not able to exhibit its natural behaviours.

The argument is - it may not be "necessary" for them but it certainly DOES benefit them in a number of ways (not just associated with Calcium metabolism as is commonly supposed by reptile keepers, as explained below). This being the case, there is no good reason not to provide it for your pet.

So. The short answer is - YES. We wholeheartedly recommend UV for snakes, and geckos in this group.

First reason - they can see well into the UV spectrum. Let's use Burmese and Royal pythons as an example as they keep getting mentioned here. They have at least two types of UV-sensitive cone cells in the eyes - one long-wavelength-sensitive cone cell containing a visual pigment with λmax near 551nm, and the second ultraviolet-sensitive cone containing a visual pigment with λmax near 360 nm.

Their slit pupils, rather than being an adaptation for a "nocturnal" mode of life as often assumed, are actually at least partially an adaptation for UV blockage (Spectral transmittance of the spectacle scale of snakes and geckos, Van Doorn & Sivak, 2015 - Contributions to Zoology) and because of it the spectacle of these types of snake exhibit lower cutoff wavelengths than those of elapids and colubrids - it does not necessarily mean the snakes are fully nocturnal, just that they have a different method of blocking UV out from the eye. (Many slit-pupilled snakes such as vipers are diurnal also).

Second reason - On to D3 production and calcium metabolism. While they do gain a certain amount of D3 from the livers of vertebrate prey they eat, most snakes also synthesise it from exposure to UV and most snakes kept under UV have been shown to have improved levels of serum D3, which helps with Calcium and Ca:P metabolism, amongst MANY other things.

It is well known UV stimulates the production of 25-hydroxyvitamin D3, which is what allows the animal to metabolise Calcium. Experiments on Corn Snakes, Burmese pythons, Jamaican boas and others have shown a drastic increase in serum D3 levels after basking under UV:

- Acierno, Mark J., et al. "Effects of ultraviolet radiation on plasma 25-hydroxyvitamin D3 concentrations in corn snakes (Elaphe guttata)." American journal of veterinary research 69.2 (2008): 294-297.

- Bradwell, Jordan, and Jessica Hackett. "The Effects of Ultraviolet (UV) Light Exposure on the Physiology And Behaviour of Captive Corn Snakes (Elaphe guttata)." RATEL (2013): 9.

- Nail, Student-Abigail. "Does exposure to UVB light influence the growth rates and behaviour of Corn Snakes, Pantherophis guttatus?" BI6154–Dissertation at Reaseheath College.

- Bellamy, T. and Stephen, I. (2007) The Effect of Ultrviolet B (UVB) Illumination and Vitamin D3 on the Activity, Behaviour and Growth Rate of Juvenile Jamaican Boas Epicrates subflavus, received through personal communications with F. Baines author of www.UVguide.co.uk

- Artificial ultraviolet b radiation raises plasma 25-hydroxyvitamin d3 concentrations in Burmese pythons (Python bivittatus)." Journal of Zoo and Wildlife Medicine 49.3 (2018): 810-812.

UV has even been found to be one of the factors that determine niche partitioning between conspecific species of snake, for example:

- Brinker, Andrew Michael. "An ultraviolet light survey of three species of semi-aquatic snakes at the Old Sabine Bottom Wildlife Management Area, with intraorder comparisons and microhabitat descriptions [electronic resource]." UMI thesis. (2006).

The ONLY study ever performed on snakes that did not show an increase in serum D3 after UV exposure was the one on Royal Pythons by Hedley and Eatwell, but there were some issues with the methodology of the experiment.

It would perhaps be best to quote Fran Baines's comment on the study:

> "The Ball Python study by Hedley and Eatwell had no obvious methodological flaws that I could see regarding the lamp used, or blood tests done....BUT if you look at the two groups that were blood tested you can see straight away that they were not comparable at all...Making the results questionable at best. The experimental group was 100% female, and all started off with very high D3 levels...the other group predominantly male, with far lower levels ...Females always have altered blood chemistry in the breeding season, and pump vitamin D3 into their eggs so serum levels might be expected to be high... There was no way of knowing how much D3 was in their diets, and if they were D3 sufficient to start with, then no increase would occur with UV exposure anyway, because the process is self-limiting when sufficient has been produced.....but I talked this over with Dr Joanna Hedley, and she agreed that the group size was too small and the controls not ideal. But it is almost impossible to conduct research like this, with privately owned animals, in the UK - or any, in fact, outside of a lab, because of Home

> Office rules requiring licensing for even basic blood testing for anything deemed an "experiment". So I congratulate her and Dr. Kevin Eatwell on the attempt."

It is also worth mentioning again that study was the SINGLE UV study performed on reptiles that did not show rather obvious differences between the animals kept under different treatments, and a comparable study using the same methodology and time period was performed on Bearded Dragons (which obviously DO require UV and lots of it) that yielded exactly the same result as for Royal Pythons. In other words, take that result with a pinch of salt.

In other words… people are very happy to ignore the studies that show D3 synthesis under UV for other snakes (including boas and other pythons) because ONE study didn't show it in Royals, that has some glaring methodological problems? Seems like a stretch to me, especially as we KNOW how the system works and it has been shown throughout the rest of Reptile taxa.

SO… the argument has been made they get all their D3 from the livers of rodents they eat. How are we ensuring this is enough? It's one thing to make out UV is not important, but we know for sure that D3 IS, and D3 breaks down in the body of the prey in a matter of weeks. So what guarantee is there that the prey we are feeding our snakes even has enough D3 to begin with? It did not for the Burmese pythons, Corn snakes and Jamaican boas that DID show rise in serum D3 after UV exposure. (Implying their D3 levels were probably impoverished to begin with, because that is how UV works). How do we know this? Because the body has ways of precisely regulating the level of serum D3 it creates under UV!

To understand this let's examine how UV allows the body to synthesize D3; this may sound complicated but it does allow us to realise how important UV is and how clever the body's mechanisms for using it in the process really are.

When UV hits the epidermis (skin) of a reptile, a series of reactions occur wherein provitamin D3 in the body is photolysed (a chemical reaction undergone due to the presence of light) into previtamin D3.

From this point, there are two things that can happen. Either the previtamin D3 is isomerised into vitamin D3, or it is further photolysed to tachysterol and lumisterol (in other words, it gets broken down again under UV).

The vitamin D3 is then metabolised to 25-hydroxyvitamin D3 and 1, 25-dihydroxyvitamin D3, which enter the circulation. These are what is measured when blood serum is tested for the presence of D3. So it is the level of 25-hydroxyvitamin D3 in the blood that tells us whether an animal is deficient or whether it has enough.

One other very important part of this process that is worth noting is that vitamin D3 itself is also sensitive to UV and can further photolyse to 5, 6-transvitamin D3, Suprasterol and Suprasterol II.

The fact that there are not one but two points along this pathway where D3 can break down under UV is really important to note and why allowing this process to occur naturally under UV is so much better than forcing supplements into the snake's body orally. What it means is that this whole metabolic process is self-regulating. It is impossible under normal circumstances for there to be excess D3 in the animal. The animal's body either creates more for itself under UV when it is needed, or it breaks down automatically when there is enough. In other words, as long as you are providing UV you never have to worry whether the animal has enough D3 in it again.

It is a very interesting and efficient pathway, and one that is very basal to vertebrates. So it would be very unusual for any one species of snake to not use this metabolic pathway (which is why nobody seriously believes Royal pythons DON'T synthesize D3 under UV when other pythons and boas have been shown to).

TL;DR - yes the increase in serum D3 after UV exposure IS important because UV regulates the optimal levels. In Burmese pythons it led to over 500% increase in serum D3.

Third reason - it is best to be mindful that UV is not just associated with calcium metabolism... this just happens to be its benefit that reptile keepers most concern themselves with due to the regular occurrence of MBD in some species without D3. It has MANY other positive effects as explained below:

UV stimulates everything from basking behaviour to reproductive activity in reptiles (Clausen et al. 1937); melatonin production and synthesis of methoxyindoles (Firth & Kennaway, 1987) and therefore Circadian rhythm (Janik et al. 1990). At night, it affects serotonin production and thus the presence or absence of it affects production of different hormones (Enrbretson & Lent 1976).

In fact despite the common assumption that 'they don't come from high UV environments' (which is false), pythons actually bask quite a lot (I have seen them do it in the wild, there are videos on Youtube of people finding them basking, many records of it, even the local trackers often locate them from the faeces left at the mouths of their burrows where they sit quietly). They actually require a higher UV than Corn snakes (which inhabit Ferguson zone 1 - crepuscular/ shade dwellers; as opposed to Royal pythons (which inhabit Ferguson zone 2 - partial baskers).

A recent yet-to-be published study from Germany has even found Royal pythons benefit greatly from provision of UV and will spend on average 144 minutes per day under it if it is provided, this is not news to those of us that provide these snakes with UV; they readily will utilise UV to bask under if it is provided. Carpet pythons and other Australian pythons ALSO do this (in fact I would strongly suspect Carpets have higher UV preferences than Royal pythons and will positively glow beneath it from my own experience; some of them inhabit Ferguson zone 3!).

From reports by many people on here that provide UV for their animals, a profound behavioural change does become evident when it is provided, and the snakes absolutely do come out by

day and utilise that resource, even climbing up to get closer to the bulbs. As stated above, there is as-yet unpublished work awaiting peer review that implied heavy behavioural tendency to use UV.

Fourth reason (tied to the third) - Allowing the animal to exhibit its natural behaviours - which include basking and UV exposure - has been linked to a reduction in stress and welfare improvements. There's an entire field on the subject: ethology. I could start posting multiple citations on why this is the case but then we would be here all day and I think this post is long enough already (they have been posted elsewhere in response to the same question in the past though).

When we have people saying 'captives live longer than wild animals' - well there are various reasons for that, they are certainly not tied to whether the animal has UV or not, but things like predation, senescence, parasitism, pollution, inability to hunt efficiently as they grow, greater susceptibility to environmental change such as inclement weather, competition and a dozen other things. What you SHOULD be comparing them to is other animals in captivity.

When you have longevity records for, say, Royal pythons hitting 47 and 62 years, you have to ask - how were THOSE snakes kept? (Answer - not in tubs, and with access to sunlight). Contrast this with one 'big breeder' who has let slip his females live 8-10 years on a video, which is ABYSMAL for Royal pythons; you would expect at least 20-30 years. So while that is anecdotal, there certainly is a precedent for healthier snakes to be more likely to live longer.

Exposure to UV is one way of ensuring healthier animals, it really doesn't get any more unambiguous than that. Hence when we say 'beneficial' - that's a word that should be taken on board.

Now, the topic here is pythons. I kept and bred many species of python for decades, and actually seeing THEIR response to UV being offered was one of the things that actually set me off down this path that has ended up with me being of the mindset that all reptiles should be provided with it. They love it! I completely fail to see how anybody that has offered it to them would not be of the same mind, they bask readily under it including flattening their ribs, and their colours improve, often dramatically. So again there is no question that behaviourally, UV is something pythons readily make use of and enjoy.

So whether you are looking for a scientific explanation or an anecdotal one from an experienced keeper with decades of breeding pythons that has kept them both with and without UV and seen an observable difference, you have it here.

In other words - yes, pythons can detect and benefit from the presence of UV, it has significant effects on their behaviour and is the reason why UV is such an important stimulus for them, even if we ignore its role in D3 production which is its most often-touted effect on reptiles by reptile keepers. In short... UV is known to benefit the animals, they are known to use it when it is provided, there is no reason not to provide it.