Ultraviolet Light as a Critical Component of Companion Bird Husbandry

▶ Why it Matters

Proper husbandry of any species is crucial for ensuring healthy, well-adjusted pets. The closer we come to recreating the conditions of the species in the wild combined with the benefits of modern science, the more likely the animals are to not merely survive but also thrive.

While we have made enormous strides in avian nutrition over the past 40 years with the advent of formulated diets, little attention has been paid to the role that sunlight plays in metabolism and behavior.

Many of our pet birds are hatched and live their entire lives indoors with no exposure to UVB lighting or the sun.

Cases of hypocalcemia, rickets, egg binding, stunting syndrome, and nutritional secondary hyperparathyroidism are frequently blamed on diet without looking at all the contributing factors. Nutrition is key to animal welfare and does not stop with feeding only, we must consider the whole environment with all that we provide to our pets and consider how well this mimics or replicates what is provided to them in the wild.

Figure 1
Orange Fronted Conure (Eupsittula canicularis) basking under a linear bulb emitting UVA and UVB light

► How it Works

Birds rely on both dietary intake and cutaneous absorption to maintain adequate Vitamin D levels.

Most birds possess a uropygial gland found at the base of the tail, which aids in the endogenous synthesis of Vitamin D^3 when exposed to sunlight (UVB). The secretion of this gland contains Vitamin D precursors (7-dehydrocholesterol), which are converted to the active form of Vitamin D^3 when exposed to ultraviolet light (either sunlight or UVB) and warmth. During subsequent preening, this active form of Vitamin D^3 is ingested by the bird.[1]

Avian epidermal cells undergo both lipogenesis and keratinization and have been called "sebokeratinocytes".[2] The skin acts as a sebaceous secretory organ, with the sebum serving as a moisture barrier and helping maintain the pliability of the keratinized epidermis. Birds secrete 7-dehydrocholesterol onto featherless areas of skin with 30x more 7-dehydrocholesterol on the featherless leg skin than on the back.[3] It is worth noting that several species of pet birds, such as African Greys and Macaws, have bare facial patches which may allow for more direct exposure to UVB. This explains how species that lack a uropygial gland can still maintain water resistance in the feathers and can produce precursors to Vitamin D^3.

The process of converting precursors to active Vitamin D is so effective that it has been shown that poultry have NO dietary requirement for Vitamin D^3 if they are supplied with adequate UVB radiation.[3]

► Relationship to Diet

The addition of a UVB light-producing source appears to have at least some benefit *independent of diet*.

In a study by Stanford utilizing African Grey Parrots, the provision of a pellet diet with an increased Vitamin D^3 and calcium content significantly increased the plasma concentration of ionized calcium and 25 hydroxycholecalciferol over a seed-fed group. The addition of 12 hours daily of artificial ultraviolet radiation (UVB) significantly increased the ionized calcium concentration independent of the diet fed. Additionally, plasma 25 hydroxycholecalciferol (circulating D^3) significantly increased in the seed group after the provision of UVB radiation.

This study concluded that the provision of adequate dietary calcium and D^3, plus UVB radiation is essential for the prevention of disorders of calcium metabolism in captive African Grey Parrots.[3]

In contrast to dietary sources of Vitamin D, hypervitaminosis D ("overdosing") does not occur with solar or UVB exposure. UVB and short-length UVA convert excess Vitamin D into harmless by-products.[4] This is known to be a self-regulated and recycling process.

► Behavioral Changes of Birds Exposed to Sunlight

It has been observed that some male canaries that had stopped singing started to sing within hours of being provided with a UVB light.

A canary that has been kept indoors, when taken into the sun, will spread all the feathers of the wings into a parabola shape and tilt to follow the sun, exposing as much of the preen-oil-covered feathers as possible to the rays.

This behavior is similar to the behavior of reptiles such as chameleons who will flatten out and turn towards the sun when basking to maximize exposure.

Anecdotally, birds that are exposed to the sun will begin to preen vigorously and increase activity levels.

Figure 2
A canary spreading its wings to maximize exposure of the preen-oil-covered feathers to the UVB light

► More than One Type of UV Light

In addition to the need for UVB light, birds utilize UVA light in many ways.

Birds possess a fourth ocular cell within the eye (tetrachromacy) that humans (trichromacy) do not possess. Humans can see around 1 million colors, but not deep blues into ultraviolet or high reds into infrared, whereas tetrachromates, such as birds, can see further into the blue spectrum and infrared, up to potentially 100 million colors.[5]

This superior vision allows birds to see fluorescent markings on potential mates and predators that are invisible to our eyes. It has been shown that 72% of parrots have UV-reflective plumage.[3] This explains how many of the monomorphic species can differentiate sex easily between pairs. The provision of full-spectrum+UVB lighting unveils fluorescent markers and enables birds to more easily pick partners and recognize their mates even within a flock.

UV also provides cues to food ripeness and in the case of raptors, urine trails left by rodents, but only in the presence of proper UVA lighting.[5] It is reasonable to conclude that UVA light allows birds to see as they are meant to see the world.

Any lighting solution we choose should therefore provide both UVA and UVB light in the correct proportions.

► How Pet Owners Can Supply UVB

Placing a cage near a window or in a sunroom will not provide a benefit as most windows filter out the beneficial UVB and UVA rays. They do let infrared rays through, however, which is the reason cages placed near windows can easily overheat.

There are essentially two ways to supply UV radiation to our pets.

► ► Natural Sun Exposure

Taking your bird outdoors 2 or 3 times a week for a 30-minute+ session (although any amount is beneficial).

Birds should always be caged and protected, as well as supervised. In addition to terrestrial predators (cats, rats, raccoons), raptors will readily strike a caged bird with unfortunate consequences.

If the weather is warm, a bath can be offered to realize benefits to the feathers and skin in addition to UV. In any case, a dish for drinking water should be provided.

Create a temperature gradient by partially covering or placing part of the cage in the shade so that the bird can escape overheating. Even when the air is cool, radiant heat can build up in the body. It is not necessary to have direct sun as scatter reflection will bounce off surfaces such as walls and cage bars. Even cloudy days can offer a benefit.

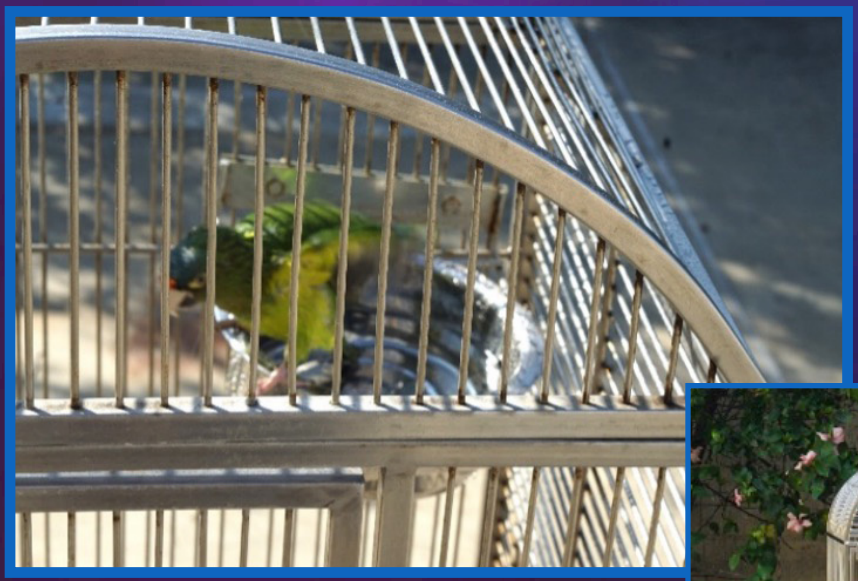

Figure 3
Conure enjoying a bath while receiving natural UV

Figure 4
African Grey receiving sun under supervision

►► *Exposure to Artificial UVB (UVB fixtures and bulbs)*

When adding artificial lighting sources, it is important to recognize that all bulbs are not equal.

There are two types of bulbs and it is understood that linear UVB bulbs are superior to compact fluorescent bulbs. This is because they cover a wider area of the body and thus produce more usable light. Therefore, whenever possible a linear bulb is always best.

►►► *Linear Bulbs*

Among linear bulbs, you may encounter T8, T5, or T5HO (high output) bulbs. The T5HO bulb produces more than twice the amount of UVB radiation than the T8 so the type of bulb is important.[4]

►►► *Compact Fluorescent Bulb*

If a compact fluorescent bulb is the only option, the 3U lamp shape is more efficient than the pigtail shape especially when used with a reflector. All types should be positioned horizontally to maximize light projection as shown below.

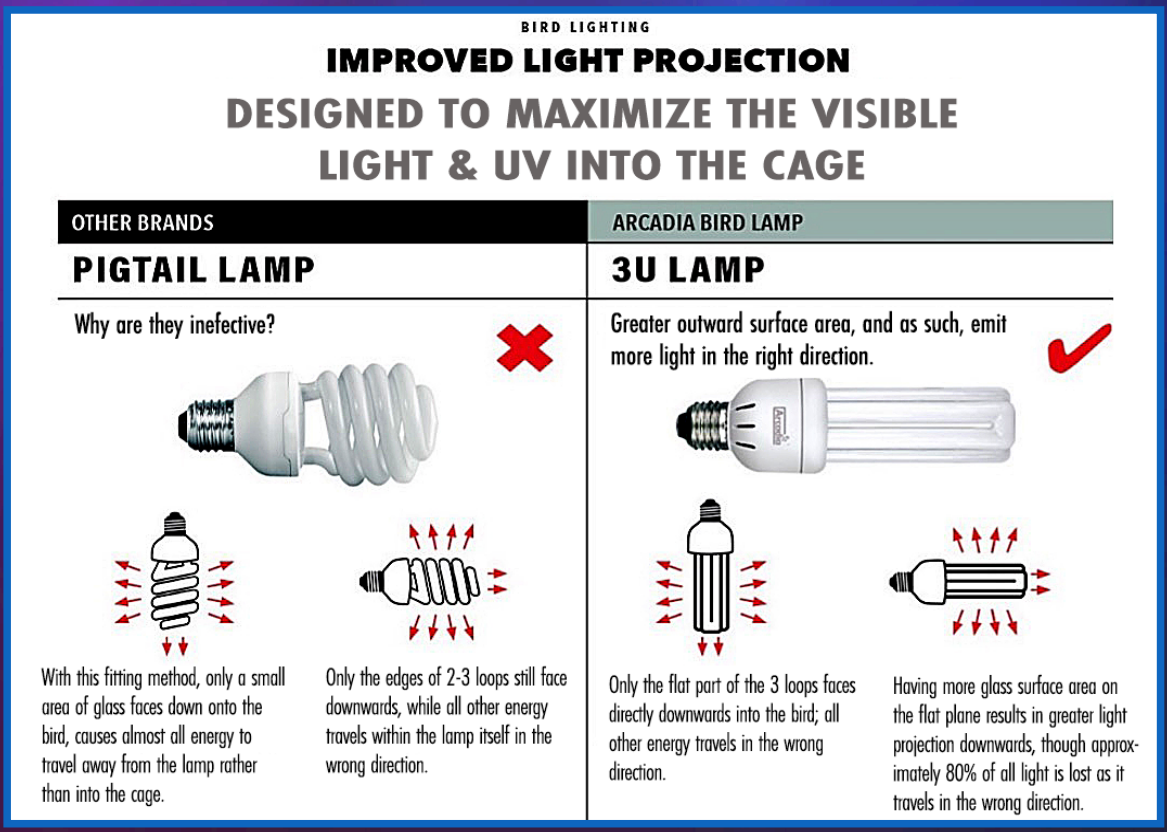

Figure 5 Comparison of Pigtail and 3U Lamps showing light projection courtesy of Arcadia [5]

► ► ► *Led Bulbs*

There have been attempts to create LED UVB bulbs. Despite being labeled as "Full Spectrum", it is currently impossible within physics to create LED solutions that can match the spectrum of the sun in UV, as T5 lamps do very well.[5]

► ► ► *Mercury Vapor Lamps*

Mercury vapor lamps give off UVB but also substantial heat and thus are unsuitable for pet bird cages.

► *How to Choose a Bulb*

The choice of bulb and/or fixture will depend on your caging and goals for lighting. Electrical cords and bulb components must be kept away from the reach of beaks and feet which may determine which type of fixture will work best. Distance from bulb to bird's head must be consistent with the manufacturer's specifications.

► *Manufacturer specs for popular bulbs are found below:*

Brand	Watts	UV-B	UV-A	Kelvin	Type	Heat
ZooMed Avian Sun Compact	26W	5%	Y	6800K	3U Lamp	No
ReptiSun 5.0 UVB T5HO-High Output Linear Lamp	15W	5%	30%		T5HO Linear Bulb	No
Arcadia Pure Sun Midi 22"	14W	2.4%	12%	7000K	T5 Linear Bulb	No
Arcadia Pure Sun Mini 12"	8W	2.4%	12%	5800K	T5 Linear Bulb	No
Arcadia Pure Sun Compact	20W	2.4%	30%	5800K	3U Lamp	No
Arcadia T5 HO Linear 46"	54W	2.4%	30%		T5HO Linear	No
Hagen Exoterra UVB 100 Compact Fluorescent	13W	"moderate"	Y		Pigtail Coil	No
Exo-Terra Reptile 5.0 Linear Fluorescent	13W	"moderate"	Y		T5 Linear Bulb	No
Exo Terra SolarGlo	160W	Not given	30%	4500K	Mercury Vapor	Yes
Flukers Sun Spot	100W	Not given	Y		Mercury Vapor	Yes

Popular Bulbs Suitable for Birds

ARCADIA

3U Type

Linear T5

Linear T5HO

Zoo Med

T5H0 Linear Bulb

3U Type

Hagen Exo-Terra

Pigtail Style

► Setting Up the Lights

Several key factors greatly affect how much radiation reaches your bird: Keep these points in mind when setting lights up for the enclosure.

Reflectors: The use of a reflector can double the quantity of available light.[4]

Distance from the bulb to the bird's head.

Barriers between the bulb and the bird: A bulb sitting on wire mesh can reduce the output by 30-50%.[4]

Age of Bulb: Most bulbs have a "burn-in" period of approximately the first 100 hours when they produce higher UV and should be kept at a further distance from the animal. Consult the manufacturer's instructions regarding this.

Bulbs designed for reptiles may be used; however, the distance between the bulb and the bird may need to be greater depending on the strength of the bulb.

Bulbs have a finite lifespan as the phosphors inside the tube become depleted due to the processes used in creating the radiation until it eventually wears them out. However, the bulb will continue to emit visible light long past the time that the UVB is no longer being produced. It is recommended that a bulb be replaced when it produces less than 70% of the initial level of UV.

Bulb longevity and cost are due to the quality of the phosphors used in them. Some manufacturers recommend replacing their bulbs after 6 months while others guarantee a year. Arcadia, Exo-Terra, and Zoomed offer an email bulb replacement reminder service that will alert you when it is time to change the bulb.

Ideally, one can measure the UV output with the Solarmeter 6.5 (or 6.5R) which easily captures the bulb's current UVB output, sometimes allowing the use of the bulb to be extended for a longer period. While not inexpensive, this is a valuable tool in the serious keeper's kit and may prove cost-effective when monitoring bulbs in the long term. It is also the only way to be certain that the bulb is working properly, as defective bulbs do exist even when purchased brand new.

Figures 6-9 demonstrate variations in UVB strength among bulbs. Figure 6 is a new bulb bought from Amazon represented as a "UVB bulb for reptiles". The target UVI for the species in question is 3.0.

Figure 6
The ideal UVI of 3.0 measured by the Solarmeter 6.5R is achieved at 3"/7.6 cm. from the cage top and then decreases rapidly to unacceptable levels. An animal sitting more than 3" away from the top would receive inadequate levels of UVB even with a brand-new bulb.

Figure 7
At a distance of 8"/20cm UVI is only 1.8

Compare to a bulb from a nationally recognized and tested brand:

Figure 8
Perfect 3.0 UVI as far as 9"/22.86cm from bulb

Images courtesy of Vickie Allgood

► What Level of UV is Recommended?

There has been little research on what level of UV index is most beneficial for birds while also being safe. However, this has been extensively studied and researched in reptiles. If we consider many of our pet birds to be forest/temperate species (from areas of high solar activity but spending time in dappled sun and shade) a UV index of 2-4 as measured by a Solarmeter 6.5 would be reasonable compared to reptiles from the same areas. There would logically be a need for a higher level of UVB for desert species such as cockatiels and budgerigars due to exposure in their natural environment.

However, in the keeping of pet birds that are housed in the fixed, small environment of a cage, pending further research, a modest index would be prudent. In addition, the bird must have adequate space to escape the bulb and the ability to self-regulate exposure as they would in the wild.

Dr. Sheryl Calway of Oakmount Exotic Animal Medicine and Surgery Department, Oakmount Veterinary Hospital (part of IVC Evidensia) recommends that her avian patients have access to a UVI of 1-2 most of the day (10-12 hours), with bulbs always positioned overhead and other perches available away from the bulb.[7]

This is a reasonable starting value and points to the need for further research into this essential component of avian husbandry.

► About the Author

Donna Garrou has kept and bred birds and reptiles for more than 30 years. She has been the chief surgical technician for 17 years at The BIRD Clinic avian-only practice in Orange, CA and is the developer of Kitty Kollar (www.Kittykollar.com), the first esophageal tube protective collar for animals.

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▶ Additional Reading

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