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### **The Effects of Natural Light on Animals and an appraisal of the value of True-lite.**

#### **Introduction**

There are frequent references in the literature pertaining to Reptile Husbandry on the supposed beneficial effects of exposure to Sunlight, but until recently very little serious research had been attempted on the effects of light on metabolism. Reptiles are dependent upon Solar Radiation as a source of body heat, but in common with most animals, it now seems certain that exposure to natural light is as much a physiological requirement to them as is food or water.

In a previous article on artificial light in the Vivarium (Blatchford, 1975) I described the fluorescent tube True-lite which had just become available through the fore-sight of John Greatwood of the Streatham firm of J.G. Animals. Although in the intervening years True-lite has become accepted and widely used there is considerable controversy as to its value.

In the present article I hope to present sufficient evidence to establish two basic points.

The first is that light really can have a beneficial effect on Reptiles and the converse that the wrong kind of light can have a detrimental effect on their general welfare and behaviour.

Secondly, I hope to show that True-lite is not just a gimmick. The light which it produces has been designed to duplicate daylight and it has been demonstrated on many occasions that this lamp has a profound influence on the physiology and behaviour of subject animals. To scientifically prove its beneficial effects on Reptiles, as has readily been done with mammals, would be difficult as the normal concept of controlled experiments requires large numbers of very similar animals or large numbers of observations of learning ability etc., It is not possible to produce the desired uniformity of animals required in the same way that mammals, with their formidable sex lives, can be mass-produced, nor are learning tests viable with the majority of reptiles. Consequently, Reptiles as a Class have been virtually ignored in this field. There is one other consideration.

Photobiology is a very new science and there is much to be learned with regard to our own species before funds and research time will be devoted to such luxuries as improving the lot of captive reptiles. In the meantime we must be content with extrapolating from the known facts, gleaned from the obliging mammals, and hopefully our own observations.

### **Artificial light in reptile displays**

The subject of artificial lighting in connection with reptile husbandry was first raised by Josef Laszlo of the Houston Zoological Gardens in an article in the International Zoo Yearbook (Laszlo, 1969). In it he described the beneficial effects attributable to the use of a unique type of fluorescent lamp (Vita-lite) that had been designed to simulate the spectrum a colour of natural daylight.

Long term captives had become more active under newly installed Vita-lite tubes and basking had become more pronounced. Furthermore, snakes which hitherto had refused all food began feeding voluntarily after a few days exposure to the light. Examples cited were, Bitis garonica - after a five month fast again after four days exposure, Trimeresurus purpureomaculatus fed for the first time since its arrival at the zoo six months earlier after only twelve hours exposure.

The most dramatic case concerned an apparently healthy *Trimeresurus trigonocephalus* which was placed in a cage that contained living plants and was illuminated with Gro-lux tubes. The snake refused all food and after five weeks was failing rapidly it lay on its side and appeared to be near death. A 15 watt Vita-lite was installed in the cage and after three days the snake had recovered sufficiently to accept dead mice offered with forceps.

Laszlo attributed these impressive findings to the unique spectral emission of Vita-lite and suggested that reptiles in captivity are exposed to the wrong "Type" of light and to an "inadequate level of light". It is this factor which possibly separates the so-called difficult species from the remainder. Presumably the latter are sufficiently adaptable to withstand inferior lighting they receive.

Laszlo's paper is discussed more fully in the Herptile (Blatchford, 1975) an article that coincided with the first introduction of Vita -lite into this country. At some point in its journey across the Atlantic the name of the lamp was changed to True-lite.

The effectiveness of True-lite lies in its similarity to Natural Light and before describing the salient features of the lamp it is necessary to explain the parameters by which light is measured.

1. Wavelength: The light by which we see is known as Visible Light and is just a small part of the total spectrum or range emitted by the sun. Visible Light lies between 380 and 770nm. The units of wavelength are nanometers, one nm. 0.000,000,001 metres, see fig. 1. (after Wurtman and Neer, 1970).

In this context wavelength means colour, thus the lower the wavelength the closer the colour of the light to the blue end of the spectrum. The full spectrum of the sun extends from, about 290nm to above 4000 i.e. from the invisible Ultra Violet to the invisible Infra Red and beyond.

2. Relative Radiance: The ratio of the brightness or quantity of radiation at each particular wavelength in the visible spectrum is fairly constant. Thus it is possible to draw a curve of colour against relative radiance for the purpose of comparison with artificial lights. Any deviation from the curve for natural light': by the curve recorded for the artificial light is a deviation from the normal make-up of the environment which a plant or

animal would experience. Such deviations are described by Thorington (1969) as "Polluted Light". The Sun's spectrum is continuous with a mid-day peak in the blue-green from 450 to 550nm. There is very little change in the spectrum throughout the year at any given point on the globe although the UV content and the overall brightness vary according to season and time of day (Nurtman, 1975).

3. Colour Temperature: If a lump of steel is heated sufficiently it will glow with an incandescent white light. Such a light is said to have a colour that is a result of a temperature. Thus, a theoretical black body could show, if heated correctly, a specific colour at a particular temperature. The units of colour temperature are degrees Kelvin and for the purposes of comparison natural light is said to be equivalent to an ideal incandescent source radiating at 5,600 degrees K. (Wurtman, 1975). Natural light is the product of the light produced by the Sun and the refractiveness of the sky (atmosphere). Thorington (1974) describes natural light as Global Illumination falling in the range of 5,500 to 6,800 K. So apart from wavelength and relative radiance artificial lighting must produce illumination that fits within the range compatible with the real thing, in this it manifestly fails.

Although the Human species is diurnal countless centuries of domestication have attuned us to accepting artificial illumination at night. Essentially, this illumination has been a variation on fire e.g. campfire, candles and tapers, oil-lamps, gas mantles, etc. all of which are characterised by low colour temperatures.

Most homes are now equipped with incandescent lamps which are the normal hot, tungsten filament bulbs that have a colour temperature of only 2,000 K. To us the light they produce is acceptable on two counts, one sufficient light is available to satisfy vision and two, the low colour temperature appeases our need for the comfort of fire. Thus, we can relax and feel at ease in their light. Compared to natural light however, filament bulbs produce gross distortions, their radiation is shifted strongly to the red and in fact 90 per cent of the total emission is in the Red region and therefore lost as heat (Wurtman, 1975).

The evolution of the fluorescent lamp has produced a lighting environment totally alien to the human experience. The white fluorescent tube in general use has been designed to give maximum brightness for a given energy consumption. Therefore they peak at the wavelength (555nm. yellow-green) best suited to the brightness photoreceptors of the human eye. One obvious consequence of this is the distortion of

colour that is apparent under fluorescent lamps.

A second consideration is that lamps are designed to fulfil the needs of vision, a fairly obvious statement. However, although the level of illumination deemed necessary by architects is 50 to 100 footcandles, it is only about ten percent of the light available out of doors in the shade of a tree on a sunny day (Nurtman, 1975). so adaptable is the human optic mechanism that we do not detect the gloom in which we spend most of the working day. In terms of radiation sixteen hours exposure to ordinary fluorescent light is less than would impinge from exposure to natural light for just one hour.

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# CHRIS MARTIN SERVICES

## Information sheet - Truelite

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