Understanding reptile heating systems

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Many different types of heater are available, and some are more suitable than others for providing essential heat for captive reptiles. There are a number of considerations to bear in mind when selecting heaters; suitability, cost and economy, and not least, safety. The most common types of heater used in reptile installations may be classified as follows:

Infra-red dull emitters

These are a useful heat source for large reptile terraria. They are available in a wide range of powers from 60 watts to 250 watts and are easy to install. Most are shaped rather like spot lamps but instead of being constructed from glass are made from an opaque ceramic material. They get extremely hot in operation so must be installed and positioned with great care using the special heat-proof holders provided. Cables too must be of the heat resisting variety. They are an excellent source of basking heat for tortoises and are much appreciated by all vivarium inhabitants. A note of caution should, however, be sounded. Due to their intensity, these heaters are not safe for juveniles, or indeed for any animal, if it falls on its back directly under the emitter. Death from overheating is a real possibility and can occur surprisingly quickly. The author is aware of young tortoises dying within a few minutes of inversion under a ceramic heater. They must also be positioned well out-of-reach of the animals as severe burns are caused almost instantly on contact. I have found some species, particularly box turtles and some Asiatic semi-terrestrial turtles, to respond badly to high intensity dull emitters. These seem to prefer a gentler, lower-intensity heat source. Ceramic heaters are extremely long-lived, and although more expensive to purchase initially, they will ultimately prove less costly than incandescent lamps which require constant replacement. I have some ceramic dull emitters in daily use which are now over 12 years of age and still performing as good as new.

Heat or Hot Rocks

This type of heater is promoted as 'ideal' for vivarium inhabitants, although our experience is quite the opposite. There are numerous cases of animals badly burning themselves on the imitation-rocks with a built-in heating element. It is suggested that they be avoided.

Combined light and heat sources

We have found Chromalux® and similar basking lamps to provide a very satisfactory source of both heat and light for juvenile tortoises and aquatic turtles. Note that basking lamps should not be relied upon as adequate sources of UV-B for vitamin D synthesis. In some recent experiments conducted by the author, it was interesting to note that, when given a choice of basking under a dull emitter or a combined light-heat source, the majority of tortoises and turtles preferred the combined source.

Ordinary 60-100W reflector lamps are, in many instances, just as good as specialist 'reptile' incandescent lamps in many applications. They provide a surprising amount of useful heat, although the quality of light produced is not sufficient in isolation (see last issue's lighting feature). Unfortunately, reflector lamps tend not to last for very long, so they can prove expensive in the long run.

Thermo-tubes
These are cylindrical heaters usually rated at 60 watts per 300 mm and are available in many different lengths from 300 mm to 2 m (approximately 1ft to 6ft). They are usually sold for cupboard heating, window demisting or for industrial drying applications. For small vivaria the 600 mm and 900 mm versions are best, larger units will require the 1.5 m or 2 m versions which are rated at 300 W and 360 W respectively. Thermo-tubes are extremely versatile and highly reliable. They may be used individually or in multiples for heating large reptile enclosures. Additional basking heat sources should be provided for most species, however. -Combined light-heat lamps as described above are an excellent choice.

Heat pads
Heat-pads are sometimes recommended as a universal solution to the problems of heating reptile cages. This view is not shared by the author who has encountered many behavioural problems linked to their use with tortoises. Heat pads provide very little direct radiant heat and can also seriously impair thermoregulatory behaviour in many species. They should not be relied upon as the sole heat source as they do not encourage natural basking. Some species are also prone to overheating if heat-pads are used. Heat pads can be used effectively in incubators, however, and waterproof types are also very useful for the base heating of aquatic turtle aquariums. Their other uses are somewhat limited with most tortoise species and they are definitely not recommended as the principal daytime source of heating for hatchlings. Heat pads are also well suited to base-heating box turtles and other semiaquatic species, particularly those requiring a high humidity environment and minimal temperature fluctuations, i.e. many equatorial species. We have also found heat pads to be very useful for heating sick tortoises overnight, especially those with respiratory diseases or those on antibiotic therapy where body temperature needs to be maintained within close tolerances in order for drugs to attain maximum effectiveness.

Safety
All electrical fixtures and fittings pose a potentially serious hazard. The risk of fire is particularly acute. Tortoises are especially strong and destructive, so ensure that any and all heating elements are absolutely impossible to damage or knock over. Bolt everything down firmly. Use fuses and circuit-breakers of the correct rating, and install effective smoke detector alarms. Ensure that all cables are of a professional standard, and under no circumstances risk 'temporary' set-ups. Be constantly aware that tortoises and heaters represent a very dangerous combination.

Heating for large installations
Individual vivarium accommodation is the preferred method for small collections, but where many animals are to be accommodated it is both costly and inefficient. The Tortoise Trust's own collection, for example, relied for many years upon individual electrical vivarium heaters: the energy usage (and wastage) proved to be very considerable. A move to new premises presented the opportunity to design everything from the ground up, with energy conservation and efficiency high on the agenda.
The solution ultimately arrived at involved highly insulated main buildings, with polycarbonate twin-wall roofing for maximum natural light transmission and minimum heat-loss. A first building comprising 90 sq. m. (800 sq. ft) included both a humid tropical zone (for Red-foot, Hinge-back and similar tortoises) and an arid semi-desert zone (intended primarily for G. sulcata, G. pardalis and G. elegans). A second building with 70 sq. m. (625 sq. ft). floor area was then

designed to provide additional accommodation for tropical semiaquatic turtles such as Geoemyda, Rhinoclemmys, Cyclemys and Heosemys species. Roofs were angled at 50* to allow for maximum solar gain (at our latitude of 52*N, the optimum angle will vary according to location) and black plastic water containers were placed against a rear wall to provide a heat store. Additional thermal mass was provided by constructing the internal tortoise enclosures from concrete blocks. These were painted dark brown to increase solar heat absorption during the day - at night they act as an impromptu storage radiator, drastically reducing overnight heating costs. For further design hints on such buildings, organic gardening and permaculture manuals are a good source of advice.

The main heating for our buildings is provided by a combination of under floor hot-water piping and a number of central heating radiators. These are both efficient and economical. The main boiler is oil-fired. This system has proved extremely cost-effective to install, and the running costs are less than 25% of those incurred with our previous electric heating system.

The under floor heating 'pads' were constructed by excavating a 20 cm deep pit and filling this firstly with 15-cm-thick insulation material and then overlaying this with cement containing embedded plastic hot-water heating pipes. This method has proved extremely effective and is greatly appreciated by all tortoises. Some pens were also equipped with wall-mounted central heating radiators. To improve basking possibilities, these were fitted at just above floor-level and a mound of earth positioned just in front of each radiator. The slope facing the radiator is self-selected by tortoises wishing to take advantage of the heat for basking.

The role that insulation can play in reducing heating costs and improving thermal stability should not be underestimated. Our own tropical house was lined with 40 mm thick aluminium foil-lined insulation sheets on all external walls and ceilings. This alone reduced heat losses by 40%. The floors of the tortoise sleeping quarters were also insulated from ground losses by 80 mm thick insulation sheets which reduced overnight heat pad losses to almost zero. Insulation sheet is a very useful material, easy to install, and in conjunction with polycarbonate twin-wall it offers many design possibilities for energy efficient reptile maintenance. With ingenuity, these materials can be employed in most vivarium and terrarium installations to great effect.

Thermostats

It should be noted that the comments made earlier in respect of incubator thermostats and temperature controllers apply equally in regard to heating. Obviously this application is by no means as critical but some reliable method of controlling temperatures is certainly required. In practice, ordinary on-off air temperature thermostats of the central heating type will be found more than adequate for controlling thermo-tubes and similar background sources whilst the precision and security of electronic controllers will be found of enormous benefit where infra-red dull emitters are to be employed

It is extremely important when designing or installing any vivarium lighting or heating system to understand the biological implications for the animals concerned. Tortoises and turtles are reptiles and, as poikilotherms or exotherms, they are largely dependent upon their environment for adjustment and maintenance of body temperature. They have only a very limited ability to compensate for environmental temperatures either above or below their preferred optimum (P.O) level. Outside the P.O temperature, normal metabolic activity will be impaired and at excessively low or high temperatures death will occur. Unfortunately these figures are not known in detail for every species of reptile but almost all reptiles have a P.O temperature range between 20 °C - 35 ºC, and with terrestrial testudines the range is usually between 22 °C- 30 ºC. This is certainly

a good starting range when dealing with a species with unknown preferences. Mesic species almost always have a somewhat higher P.O temperature than those species which dwell in lush jungle or undergrowth. The latter are also inclined to display poor thermoregulatory abilities. It is extremely important to note that the critical thermal maxima of many terrestrial species is in the range 34 to 36°C. If maintained at these temperatures without the possibility of escape, death can occur very rapidly. Many accidental deaths in collections occur when tortoises become inverted beneath a heat lamp, for example. It is also important to recognise that as temperatures rise beyond about 28°C many species will show disinterest in feeding and will prepare to enter a state of aestivation.

The term 'preferred optimum' is in itself somewhat misleading and there are some indications that just because a particular temperature range may be favoured by self-selection this is not necessarily the temperature which is most conducive to long-term health or survival. For example, many tortoises will, if allowed to, bask under a heater all day. This can have quite serious metabolic side effects. So, although the 'preferred optimum' temperature should be taken as a general guide, it should not necessarily be available at all times. Temperatures in the wild are cyclic, peaking at about mid-day and falling off towards evening. By far the best guide to ideal captive maintenance conditions will be gained from a careful study of the species' natural habitat and prevailing climate. Ordinary tourist guide-books dealing with the region inhabited by the species are often a very useful source of climatic, seasonal and habitat data. The many technical publications available from geographic and meteorological authorities are also a source of valuable captive maintenance information.