

Use of incubators in wildlife care

An information sheet for wildlife rehabilitators and their vets

Dr Liz Mullineaux MRCVS,
RCVS Recognised Specialist in Wildlife Medicine (Mammalian)



Figure 1 (above): Incubators are extremely useful in the care of neonatal animals such as these young European hedgehogs

Figure 2 (right): Brinsea Vetario® incubator with nebuliser on right which changes medication from a liquid to a mist, so that it can be more easily inhaled into the lungs



Why use an incubator

An incubator provides a quiet, safe, temperature-controlled environment.

Incubators are useful in situations where animals are unable to adequately control their own body temperature, such as in neonates (*Figure 1*) and when injured and diseased. In some cases, incubators can also be used to control the humidity (moisture content) of the animal's environment, provide animals with increased levels of oxygen and allow nebulization (*Figure 2*).

Where wild animals are sick or injured, incubators can only be of benefit alongside veterinary care. Incubator use may be written by vets into Standard Operating Procedures (SOPs) for wildlife centres. The British Veterinary Zoological Society (BVZS) 'Good Practice Guidelines for Wildlife Centres' provides further information and is available on the BVZS website.

How to choose an incubator

Incubators are increasingly available, especially from online sellers. Some of these models are ex-hospital or cheaper imported models. A good incubator should have accurate and adjustable temperature control, ideally with a digital read out (*see Figure 5*). The incubator's construction should be solid and easy to clean, so it does not harbour infectious agents. There should be easy access to the animal and good observation of the patient, ideally with an internal light, should be possible without the need to open the door. A lightweight incubator that is portable is especially useful for neonatal wildlife casualties

Body temperature in animals

Mammals and birds are 'homeotherms', they are usually able to maintain a stable body temperature through the metabolic action of their bodies. Body temperature reference ranges for common species of British mammal and birds are given in *Figure 3*. Reptiles and amphibians are 'poikilotherms', their body temperature depending upon environmental temperature.

Neonatal mammals and birds are much less able to control their body temperature than adult animals and rely instead upon the warmth of their mother (dam) and/or the nest environment. Sick and injured animals may also struggle to maintain body temperature and become 'hypothermic' (low body temperature) or 'hyperthermic' (high body temperature). Animals with a high temperature due to infection are described as being 'pyrexia'.

Species	Body temperature reference range
Badgers	36–38°C
Deer	38.6–39.3°C
Foxes	39–40.5°C
Hedgehogs	35.4–37°C
Otters	35.9–40.4°C
Rabbits & hares	38.5–40°C
Birds	41–44°C

Figure 3: Body temperature reference ranges for some common British wildlife species

Figure 4: A digital thermometer can be used to measure rectal/cloacal temperature



Figure 5: A digital read-out is an extremely useful feature to have on an incubator

Measuring body temperature

A rectal (or cloacal) digital thermometer (Figure 4) is probably the cheapest and easiest method of measuring body temperature. Wildlife rehabilitators can easily be shown how to do this by their veterinary surgeon or veterinary nurse.

Providing warmth to wildlife

There are several ways in which extra warmth can be provided to animals including wildlife species. These include stopping further heat loss by using extra bedding, silver foil or bubble wrap. Hot-water bottles, microwavable heat pads or grain bags can be useful as a temporary source of heat in an emergency, but their use needs to be closely monitored as all these things cool rapidly and potentially draw heat away from the animal. Heat sources may also be easily chewed, scratched and otherwise damaged. Electric heat pads can also be used but pose a risk of overheating (or even burning) the animal, can be easily damaged, and do not work very well with very small animals.

In contrast to other methods an incubator provides a safe, monitored warm environment for the animal and is the best way of helping maintain body temperature. The environmental temperature provided by the incubator should be measured using a maximum/minimum thermometer unless a digital display is provided (Figure 5). The body temperature of the patient (Figure 3) should also be measured periodically.

Appropriate environmental temperature

All mammalian and avian casualties will benefit from being kept in an environmental temperature within their 'thermoneutral range'. This is the range of temperatures in which an animal expends no energy to maintain its body temperature. The thermoneutral temperatures for some common adult British mammals and birds are given in Figure 6. For birds the thermoneutral range depends upon size, with smaller birds requiring higher temperatures. Reptiles and amphibians should be kept within an 'activity temperature range' in which it can control its body temperature. ATR values for British reptiles and amphibians are also given in Figure 6.

How to warm an animal

The first stage of treating a cold animal (hypothermia) is to prevent further heat loss, by wrapping the casualty in insulating materials such as blankets, bubble wrap or silver foil. At this time the incubator can be switched on and allowed to warm to the required temperature (see Figure 6 for adult animals). Once the incubator is warmed to the correct temperature the animal can be transferred; the amount of bedding should be reduced at this stage to allow warming from the environment in the incubator.

It is important, at the same time as warming the patient, to ensure that it remains well hydrated and adequate appropriate food is provided. Excessive warming if the patient is dehydrated or has a low blood glucose level (hypoglycaemia) can be detrimental and possibly life-threatening. See page 3 for specific information on treating adult and neonatal animals.

Species	Temperature
Mammals	15–25°C
Medium and large birds (>500g)	15–25°C
Small birds (50-500g)	20–30°C
Very small birds (5-50g)	25–35°C
Reptiles	20–30°C
Amphibians	15–30°

Figure 6: Thermoneutral and active temperature ranges (ATR) for adult British animals



When animals are hypothermic and require careful warming, alongside appropriate fluid therapy, a temperature adjustable incubator is indispensable.



Image © Emma Keeble



Figure 7: Crop tubing (gavaging) an owl. This technique can be used to provide fluids and food to birds

Adult animals

Hypothermic adult animals should be warmed in an incubator set to their thermoneutral range (see Figure 6). The temperature of both the incubator and the animal (Figures 5 and 6) should be recorded at regular intervals. These animals are likely to be dehydrated and/or 'shocked' (hypovolaemic), warming alone will not correct these things and may indeed make them worse. All adult animals must therefore, be provided with adequate fluid therapy at the same time as warming and veterinary care (in person, over the telephone or in written SOPs). Injured animals also require pain relief (analgesia) and this can only be prescribed by a veterinary surgeon.

If the animal will drink, then an oral rehydration fluid can be provided in a shallow bowl. If the animal will not, or cannot, drink then fluid must be given in other ways. In birds rehydration fluids can most easily be provided by crop tubing (gavaging; Figure 7), provided the bird can lift its head and swallow. In mammals intravenous (Figure 8) or intraosseous fluids are usually required to rehydrate patients and these must legally only be administered by a veterinary surgeon or veterinary nurse.

Subcutaneous fluids can be given in both mammals and birds, but are often poorly absorbed in hypothermic animals and provide inadequate rehydration in most cases. Fluids for subcutaneous (and intravenous and intraosseous routes) use must be veterinary products, sterile and warmed before use.



Figure 8: Badger in an incubator on intravenous fluids

Neonatal animals

Dependent animals (those that would naturally be in a nest) should be kept in an incubator set at 28-30°C until they are of an age where they can maintain their own body temperature when the heat can be reduced to the thermoneutral range for that species (Figure 6). Very small neonates may require an artificial fabric 'nest' to be created in the incubator (Figure 9).

Like adult animals, neonates are frequently dehydrated upon arrival and should be fed with an oral electrolyte solution. Neonates also frequently have a low blood glucose level (hypoglycaemia) and should be fed appropriately soon after the initial electrolyte feed (Figure 10). If the neonate is unable to lift its head, and/or swallow, then it will need to be given fluids and glucose by injection – this should be under veterinary direction.



Figure 9: A fabric 'nest' should be created to support very small neonatal birds and mammals



Figure 10: Neonatal animals, such as this owllet (above left) and hoglet (above right) should be fed as soon as possible after admission, once they have received appropriate rehydration



The Brinsea Vetario incubator provides an ideal, temperature adjustable, environment for neonatal wild animals





Figure 11: Brinsea incubator with piped oxygen connected



Figure 12: Animals with respiratory problems, such as this young crow, should be supported on their chest in sternal recumbency



Figure 13: Good veterinary care is essential for all wildlife cases and is especially the case if oxygen is used

Use of oxygen

Why animals need oxygen

All animals need oxygen for their basic cell function. Air contains 20.95% oxygen and this is more than adequate in healthy animals. There are however, some medical conditions where the animal's respiratory (airways, lungs, air sacs) or circulatory (heart, vessels, blood) systems are compromised and they may benefit from additional oxygen. Medical conditions where oxygen may be useful include; breathing difficulties, heart problems, shock, sepsis and head trauma. Oxygen must only be used under veterinary direction.

Providing oxygen to animals

Oxygen can be provided to animals using a variety of means including; masks, hoods, nasal prongs and oxygen cages. Some of these methods can be stressful for the patient and are inappropriate for wildlife cases. Incubators into which oxygen can be piped (Figure 11) can be very useful for wildlife casualties and neonates. These allow the patient to be observed whilst receiving oxygen in a stress-free environment. The temperature in an oxygen cage often rises quickly and becomes excessive, so incubators with temperature monitoring and control can be very useful (Figure 5). The body temperature of the animal should also be measured where possible (Figures 3 and 4).

Oxygen flow rates of around 1 litre per minute supplied to an incubator should maintain a 40-45% oxygen concentration in most cases. Remember opening the door of the incubator will cause the oxygen concentration to fall and should be limited to essential monitoring of the animal only. Patients with respiratory (breathing) problems will benefit from being supported on their fronts (*in sternal recumbency*; Figure 12) rather than lying on their sides. If the animal has to lie on one side then it should be carefully turned onto the other side every few hours.

Humidification of oxygen

Any supply of oxygen that is going to be used for more than a few hours should be humidified. This prevents drying and dehydration of the lining of the airways, which causes damage and can lead to infection. The humidifier (a sealed reservoir filled with saline) is usually connected close to the oxygen cylinder but may also be part of the incubator (see below).

Dangers associated with oxygen supplementation

At very high levels of oxygen supplementation for over 12 hours oxygen toxicity can occur, although these levels are in practice hard to achieve. Too much oxygen can also reduce carbon dioxide levels in the incubator, so that the stimulus to breath is reduced, although this effect is uncommon in veterinary patients. The oxygen flow rates suggested above should ensure patient safety.

The greatest danger of oxygen supplementation is perhaps the welfare of the animal where there is inadequate veterinary care.

Veterinary care and use of oxygen

Healthy animals do not require oxygen supplementation. Oxygen is only required where there is a reduction in the animal's own ability to utilise oxygen as a result of trauma or disease. Oxygen will only help support the patient, it will not treat the underlying clinical problem. It is important to establish a clinical diagnosis early on in order to prevent the animal from suffering unnecessarily and ensure best care. A veterinary diagnosis and treatment is therefore needed as soon as possible (Figure 13). Although oxygen can be provided in wildlife hospitals and homes, it should be remembered that these are critically ill animals and are likely to benefit from professional veterinary monitoring and care and all the facilities of a veterinary hospital. Oxygen must only be provided as part of a treatment package prescribed for that animal by a veterinary surgeon.



10 Tips

for the safe use of oxygen in wildlife hospitals

(also see incubator manufacturer's guidelines)

1. Use oxygen only in a well-ventilated room. Do not cover incubators using oxygen or oxygen canisters.
2. Keep incubators using oxygen and oxygen canisters well away from any other electrical equipment (at least 90cm), heat source (at least 150-300cm) or open flames.
3. Never smoke or allow anyone else to smoke around oxygen.
4. Avoid using lotions, creams and wound dressings that are petroleum based.
5. Store oxygen canisters safely and securely in the upright position, away from heat and sunlight, in a well-ventilated area.
6. Turn off oxygen cylinders when not in use.
7. Ensure all equipment used with oxygen is correctly maintained according to the manufacturer's instructions.
8. Don't use anything that may cause a spark near oxygen.
9. Ensure there are smoke detectors in all rooms where oxygen is used.
10. If there is a fire, switch all oxygen off. Notify the fire brigade that there is oxygen on site.

Safety considerations when using oxygen

Oxygen is generally quite safe but does need to be treated with great respect because of fire safety. Oxygen itself does not burn, but most other things burn more vigorously when oxygen is present. Certain things make this risk greater, by allowing oxygen levels to build up excessively and/or by igniting easily. **10 tips** for safe use of oxygen in the home or wildlife hospital are given *left*. Only incubators specifically designed and safety tested for oxygen service should be used with oxygen gas and the manufacturer's guidelines should also be carefully followed. Further useful information is also listed at the end of this sheet. Wildlife centres should consult fully with their veterinary surgeon so that oxygen is used safely and effectively for animals in their care.

Humidity and nebulisation

Most good quality incubators have a water reservoir to humidify the air entering the incubator. If this does not happen the air in the incubator can become too dry and this can cause the patient to dehydrate, as well as causing damage to the lining of airways. Usually the reservoir is filled with a water soluble disinfectant solution to avoid bacterial build up and the risk of infection. Some incubators have a digital display that allows humidity to be recorded and controlled (*Figure 5*). Oxygen, when used, should be humidified (see above).

Nebulisation

Some incubators have a chamber and pump that allows medication to be delivered into the incubator chamber as a 'mist' (*nebulisation, Figure 2*). Antiseptic solutions, drugs to dilate the airways (bronchodilators) and antibiotics can be used in this way. This can be especially useful for respiratory infections in birds and small mammals. All nebulisation should be carried out under veterinary direction.

Useful further reading

BOC Health Care (2012). The Home Oxygen Handbook. BOC Healthcare UK.

British Veterinary Zoological Society (2016) Good Practice Guidelines for Wildlife Centres. BVZS.

Cowen, S. (2017). Care and hand-rearing of young wild animals.

In: Mullineaux, E., Keeble, E. (Eds.) BSAVA Manual of Wildlife Casualties (2nd edition). BSAVA Publications, Gloucester.

Mullineaux, E and Keeble, E. (2017). First aid.

In: Mullineaux, E., Keeble, E. (Eds.) BSAVA Manual of Wildlife Casualties (2nd edition). BSAVA Publications, Gloucester.

Copyright © 2018 Brinsea Products Ltd. All Rights Reserved.

Brinsea
Incubation Specialists



Brinsea Products Ltd.

32-33 Buckingham Road, Weston Industrial Estate,
Weston-super-Mare, BS24 9BG

Tel: +44 (0) 845 226 0120 Fax: +44 (0) 1934 708177



www.brinsea.co.uk