SCIENTIFIC MEETING

THE FROZEN ARK PROJECT

Tuesday, 13 May 2008
The Meeting Rooms, The Zoological Society of London, Regent's Park, London NW1 4RY

Chair: Professor Sir Patrick Bateson, President of ZSL

The Frozen Ark Project – an introduction

Dr Ann Clarke, Co-founder of the Frozen Ark Project and Managing Trustee at The Frozen Ark Office at the University of Nottingham

The Frozen Ark is a global innovative conservation project that has taken on the ambitious task of preserving genetic material from the world's endangered species before they go extinct. Animal species are dying out at a rate exceeded only during the three greatest environmental disasters in the history of the world. The project aims to ensure that the information of millions of years of evolution is not lost, that future scientists will have knowledge of the world's lost animals and that genetic material will be available to aid captive-breeding programmes.

The Frozen Ark is collecting, preserving and storing tissue, DNA, viable somatic cells and where possible, the gametes and embryos, from the many thousands of vertebrate and invertebrate species expected to disappear within the next few decades. Samples are being obtained from captive-breeding programmes, from zoos and aquaria and from wild populations. The project, which has been set up as a charity, is being coordinated from the University of Nottingham. A growing number of Consortium Members of The Frozen Ark in the UK and around the world are setting up their own national Frozen Arks. A key component will be to establish a global database of what species already exist in established collections and which species are most urgently in need of collection.

If this genetic resource is not preserved, vast amounts of information about an animal's relationships, evolution, genetics, development, and ecology will be irreplaceable lost, captive-breeding programmes will fail due to a lack of genetic diversity and the possibility of bringing back extinct animals as future technologies allow will no longer be a future option.

www.frozenark.org

The Frozen Ark: priorities for collection

Professor Phil Rainbow, Keeper of Zoology, The Natural History Museum, London

The mission of the Frozen Ark Project is to collect, preserve and store DNA and viable cells from animals in danger of extinction. This talk addresses the question of what are the most important species to preserve first? Although we use the IUCN Red List criteria of Critically Endangered, Endangered and Vulnerable to identify animals that are in danger of extinction, our initial response is partly pragmatic in that we should first pick the low hanging fruit. About forty species are classified by the IUCN as extinct in the wild yet are held in zoos. They are the ones most urgently in need of sampling. Following a similar argument, any other animals held in zoos, research or equivalent collections that are endangered in the wild should similarly enter the Frozen Ark. Ultimately we then need to use international co-operation to identify the next priorities for collection. To this end, we shall call upon the expertise of taxon-specific expert advisory groups to prioritise candidate species for inclusion. It is very important to respect and protect the rights of countries and local communities over their natural resources, including those of genetic origin. Correspondingly we do not see the need for centralisation of Frozen Ark stores but encourage the establishment of such collections worldwide.

Challenges and opportunities: Cryobanking of material from endangered fish species

Professor David Rawson, LIRANS Institute of Research in the Applied Natural Sciences, University of Bedfordshire

Somatic cell and tissue collections from specimens held in aquaria will be the first material banked in the fish collection of the Frozen Ark. Generic protocols for initial handling and storage of samples are being developed, to allow short-term ‘holding’ at temperatures in the range 4 to -20^{o}C, prior to cryopreservation in liquid nitrogen. These procedures will enable both DNA and protein sample banking, and perhaps more significantly provide material in a state that may allow cell cultures to be raised from explants and the cryopreservation of these viable cell lines.

Protocols are needed that allow sample collection and initial storage at aquaria that do not have full cryo-preservation facilities, and in the future field collection, with samples subsequently being moved to a central cryobiology laboratory for cryo-banking and whenever possible the establishment of cell cultures.

Whilst the cryopreservation of somatic cells and sperm has been successfully achieved in more than 200 species of fish, the ability to cryopreserve ovarian tissue, mature oocytes or embryos has not yet been possible. This aspect of fish cryobiology is one that is being addressed by several groups worldwide, with the recognition that cryopreservation of both male and female gametes, or the resulting embryos, would enable both their cryobanking and assisted reproduction procedures enjoyed in many higher vertebrates.

Further reading

P.F. Watson & W.V. Holt (Eds) (2001): *Cryobanking the genetic resource: Wildlife conservation for the future.* London and New York: Taylor & Francis.

Cryobanks: how can we use them to support endangered species?

Professor William V. Holt, Institute of Zoology, Zoological Society of London, Regent's Park, London NW1 4RY, UK. Email: bill.holt@ioz.ac.uk

Since the first successful cryopreservation of bull and chicken semen in the early 1950s, efforts have been made to propagate rare and endangered species using assisted reproduction techniques in combination with genetic archives containing frozen semen and embryos. Such archives are known under various names such as cryobanks, biobanks or genetic resource banks (GRBs). To make best use of cryobanks for conservation, the samples being archived should be as viable when thawed as they were originally so that they can be used in genetically managed captive-breeding programmes. Unfortunately, this ideal situation is rarely met and the success of cryopreservation is species-dependent. Nevertheless, given sufficient effort it is becoming easier to support conservation breeding programmes with a combination of frozen germplasm and assisted reproduction; the black-footed ferret is a good example, where the species has been reintroduced following a successful captive-breeding programme involving assisted reproductive methods (Howard *et al.,* 2004). Recently, the potential value of cryobanks has been enhanced by the advent of novel biotech approaches to breeding. A few animals, e.g. banteng, mouflon and various felids, have been produced from frozen somatic cells by cloning technology (Holt *et al.,* 2004). While the success rate is still low in mammals, the potential for other taxonomic groups such as amphibians may be higher. It is therefore worthwhile creating GRBs as a means of supporting *ex situ* breeding programmes and indeed providing a degree of risk avoidance against disasters such as disease outbreaks.

References

Holt, W.V., Pickard, A.R. & Prather, R.S. (2004). Wildlife conservation and reproductive cloning. *Reproduction* **127:** 317–324.

Howard, J.G., Marinari, P.E. & Wildt, D.E. (2003). Black-footed ferret: model for assisted reproductive technologies contributing to *in situ* conservation. In *Reproductive science and integrated conservation:* 249–266. Holt, W.V., Pickard, A.R., Rodger, J.C. & Wildt, D.E. (Eds). vol. 8: Cambridge: Cambridge University Press.