

Biomaterials repositories: the science and business of biobanking

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The International Embryo Technology Society (IETS) established the Companion Animal, Non-domestic and Endangered Species (CANDES) Committee in 2001. One of the committee's most significant activities has been the organisation of symposia in conjunction with the annual meeting of the IETS. The first workshop on the implementation of artificial insemination was held in 2009 in San Diego, CA. The second workshop, which centred around international regulations for the import and export of reproductive specimens, was held in 2011 in Orlando, FL. In 2014, the CANDES committee underwent reorganisation, resulting in the creation of a new sub-committee on Biobanking, which is currently chaired by Drs Monique Paris and Pierre Comizzoli. It was the creation of this new sub-committee that prompted the organisation of the pre-conference symposium, 'Biomaterials Repositories: The Science and Business of Biobanking', which is the subject of this Research Front. The symposium was held before the 2016 Annual Meeting of the IETS held in Louisville, KY (*Reproduction, Fertility and Development* Vol. 28(1–2), 2016). It was our goal to develop a program that addressed some of the numerous factors influencing the development, maintenance and use of biobanks.

We were fortunate to have two excellent keynote speakers who gave their perspective on two biobanks at very different stages of development. Dr Mary Hagedorn from the Smithsonian Institution (Hagedorn and Carter 2016; Hagedorn *et al.* 2016) discussed the development of a biobank for corals, a diverse taxa with unique challenges for gamete cryopreservation that is in dire need of conservation. In contrast, Dr Phil Purdy from the National Center for Genome Resource (Purdy *et al.* 2016) presented data from a well-established, government-run biobank for agricultural species that is an excellent example of what CANDES-based biobanks could be.

The remainder of the symposium was divided into four main themes. The first, 'Emerging Techniques for Germplasm Cryopreservation,' included talks on freeze drying spermatozoa (Kaneko 2016) and the vitrification of oocytes (Mazur and

Paredes 2016) and embryos (Hinrichs and Choi 2016), techniques that could significantly enhance the viability, and utility, of samples following thawing/warming. The second session, 'Biobanking in Practice,' provided an interesting contrast between oocyte vitrification for the treatment of human infertility and the application of sperm cryopreservation to endangered species conservation (Santymire 2016). The third session, 'Unique Challenges to Cryopreservation,' highlighted the diversity of reproductive mechanisms between fish (Torres *et al.* 2016), reptiles and amphibians (Clulow and Clulow 2016), and mammals (Pukazhenthir 2016) and the importance of tailoring cryopreservation protocols for each taxa. The fourth and final session, 'Management of Biospecimens,' addressed the significant logistical challenges for maintaining these large repositories of genetic material and transporting these samples between countries in the context of the Nagoya Protocol (Comizzoli and Holt 2016). Researchers involved with biobanking were encouraged to be vigilant and voice their opinion about the Nagoya Protocol and the consequences it could have on the future development and use of biobanks.

The papers in this issue clearly demonstrate that biobanking is now much more than a simple tool. It is a multidisciplinary science related to standard collection, storage and access of the biological samples, as well as their appended data. Even if samples do not necessarily have a monetary value, biobanking is also a business involving the international trade of samples and data that are critical for fundamental science and multiple biomedical applications (from veterinary medicine to conservation efforts). Finally, biobanking is a political issue requiring researchers involved with biobanking to be active and critical participants in the development and implantation of international agreements that could significantly alter the science and the business of biobanking.

This symposium was dedicated to Dr Naida Loskutoff, an active member and avid supporter of the International Embryo Transfer Society and the founder of the CANDES committee in

2001. Dr Loskutoff spent 23 years as Director of Reproductive Sciences at Omaha's Henry Doorly Zoo where she was internationally recognised for efforts to develop and apply reproductive technologies in non-domestic and endangered species. She was also a passionate teacher who spent considerable time mentoring, and inspiring, students at home and abroad. The establishment of the CANDES committee fulfilled her passion as both a scientist and a teacher by providing researchers and students a forum to advance the field of reproductive biology in companion animals, non-domestic and endangered species. For more than 10 years as Chair of the CANDES committee, Naida strived to provide valuable intellectual and technical expertise in CANDES-related matters to the committee members, IETS members and the Board of Governors, as well as national and international governmental regulatory agencies and species conservation programs. Dr Naida Loskutoff was posthumously awarded the Distinguished Service Award at the 2016 Annual Meeting of the IETS as further evidence of her lasting legacy to this society. The CANDES committee and the symposium documented in this Research Front would not have been possible without Naida.

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References

- Clulow, J., and Clulow, S. (2016). Cryopreservation and other assisted reproductive technologies for the conservation of threatened amphibians and reptiles: bringing the ARTs up to speed. *Reprod. Fertil. Dev.* **28**, 1116–1132. doi:10/1071/RD15466
- Comizzoli, P., and Holt, W. V. (2016). Implications of the Nagoya Protocol for genome resource banks composed of biomaterials from rare and endangered species. *Reprod. Fertil. Dev.* **28**, 1145–1151. doi:10/1071/RD15429
- Hagedorn, M., and Carter, V. L. (2016). Cryobiology: principles, species conservation and benefits for coral reefs. *Reprod. Fertil. Dev.* **28**, 1049–1060. doi:10/1071/RD16082
- Hagedorn, M., Carter, V. L., Lager, C., Camperio Ciani, J. F., Dygert, A. N., Schleiger, R. D., and Henley, E. M. (2016). Potential bleaching effects on coral reproduction. *Reprod. Fertil. Dev.* **28**, 1061–1071. doi:10/1071/RD15526
- Hinrichs, K., and Choi, Y-H. (2016). Micromanipulation of equine blastocysts to allow vitrification. *Reprod. Fertil. Dev.* **28**, 1092–1096. doi:10/1071/RD15389
- Kaneko, T. (2016). Sperm freeze-drying and micro-insemination for biobanking and maintenance of genetic diversity in mammals. *Reprod. Fertil. Dev.* **28**, 1079–1087. doi:10/1071/RD15386
- Mazur, P., and Paredes, E. (2016). Roles of intracellular ice formation, vitrification of cell water, and recrystallisation of intracellular ice on the survival of mouse embryos and oocytes. *Reprod. Fertil. Dev.* **28**, 1088–1091. doi:10/1071/RD16021
- Pukazhenthi, B. S. (2016). Saving wild ungulate diversity through enhanced management and sperm cryopreservation. *Reprod. Fertil. Dev.* **28**, 1133–1144. doi:10/1071/RD15412
- Purdy, P. H., Wilson, C. S., Spiller, S. F., and Blackburn, H. D. (2016). Biobanking genetic resources: challenges and implementation at the USDA National Animal Germplasm Program. *Reprod. Fertil. Dev.* **28**, 1072–1078. doi:10/1071/RD15399
- Santymire, R. (2016). Implementing the use of a biobank in the endangered black-footed ferret (*Mustela nigripes*). *Reprod. Fertil. Dev.* **28**, 1097–1104. doi:10/1071/RD15461
- Torres, L., Hu, E., and Tiersch, T. R. (2016). Cryopreservation in fish: current status and pathways to quality assurance and quality control in repository development. *Reprod. Fertil. Dev.* **28**, 1105–1115. doi:10/1071/RD15388