Symposium: Cryopreservation and assisted human conception

Guest Editors: Thomas B Pool & Stanley P Leibo

Introduction

Thomas ‘Rusty’ Pool was the featured editor in a previous issue of RBMOnline (Volume 4, number 2). Briefly, his academic career has been wide-ranging, including a BSc in agriculture and an MA from Sam Houston State University in his native Texas. His thesis research focused upon gametogenesis in invertebrates and he was awarded his PhD in developmental biology from the University of Virginia in Charlottesville, Virginia in 1976. Dr Pool began collaborative studies on in-vitro fertilization in non-human primates in 1982. This work culminated in the live birth of the first cynomolgous monkey produced by IVF and the first live birth of a non-human primate resulting from the transfer of a frozen-thawed embryo produced by IVF. In 1990, he helped found the Fertility Center of San Antonio, a private, office-based programme and currently serves as the Scientific Director. He is active in the ASRM, the American Association of Bioanalysts (AAB) and the Pacific Coast Fertility Society. His research interests include improving embryo culture media and the in-vitro growth environment. He now serves as a member of the Editorial Board of Reproductive BioMedicine Online.

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Stanley P Leibo received degrees from Brown University and the University of Vermont, and his MA and PhD degrees from Princeton University, all in the USA. He began his career in cryobiology at Oak Ridge National Laboratory in Tennessee. After 7 years at Rio Vista International in Texas, he became Research Associate Professor at Baylor College of Medicine. In 1991, he was appointed Research Professor of Biomedical Sciences at the University of Guelph in Canada. In 1999, Dr Leibo was appointed to his present positions as Doris Zemurray Stone Chair of Reproductive Biology and Professor of Biological Sciences at the University of New Orleans, and also as Senior Scientist at the Audubon Centre for Research of Endangered Species. He has been author or co-author of 120 peer-reviewed articles and chapters, and has delivered 140 invited lectures in North America and 25 other countries. He was elected President of the Society for Cryobiology and of the International Embryo Transfer Society, and currently serves on the editorial boards of five journals.

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The preservation of viable biological material, either through slow-cooling methodologies or by rapid-cooling procedures such as vitrification, has been a valuable adjunct to experimental reproductive science for over 50 years and to clinical assisted reproduction for nearly two decades. From a practical perspective, contemporary assisted reproduction technology (ART) centres worldwide are charged daily with the task of storing cells of reproductive interest in a cost-effective, efficient manner that preserves biological viability for the future. With the advent of better culture media, new therapeutic modalities such as percutaneous epididymal sperm aspiration (PESA), micro-epididymal sperm aspiration (MESA), testicular sperm extraction (TESE) and intracytoplasmic sperm injection (ICSI), the ability to retrieve cells efficiently from diverse locations in the male and female reproductive tracts, the demands for effective cryopreservation strategies are ever more important to reproductive medicine. The potential for developing patient-specific ancillary cell lines, such as stem cells, now fuses somatic cell cryobiological methods with those directed towards reproductive cells in the clinical setting (Reubinoff et al., 2001).

How crucial has cryobiology become to ART? The significance of having effective cell storage methods at our
disposal is particularly well illustrated by considering the case for embryo cryopreservation. Successful cryopreservation and thaw procedures, along with tailored patient preparation schemes, can enhance significantly the cumulative pregnancy rates from an oocyte retrieval. Veeck (2003) has summarized the extensive cryopreservation experience in the Cornell programme and reports post-thaw survival rates of 76.4% for zygotes, 78.6% for cleavage-stage embryos and 77.2% for blastocysts (not significantly different). Of interest, clinical pregnancy rates, along with implantation rates, following the transfer of thawed embryos were significantly higher for blastocysts, a clear indication of continued developments in our field. But perhaps of equal importance, the projected augmented pregnancy rate per cycle, calculated by combining pregnancies from fresh and cryopreserved transfers, is 85.2% for blastocysts, 76.9% for cleavage-stage embryos and 71.2% for zygotes. In another demonstration of the impact of cryopreservation upon efficiency of assisted reproductive technology, Tiitinen and colleagues (2001) reported that frozen embryo transfers, involving either one or two embryos, following fresh transfers of single embryos have produced a cumulative delivery rate of 52.8% per oocyte retrieval with a twin rate of 7.6%. This illustrates another critical application of cryobiology to clinical ART: the increasing importance of the role of cryopreservation in reducing multiple births in human assisted reproduction is undeniable (Gerris et al., 2003). Therefore, cryobiology is one of the fundamental tools that currently bridges safety and efficiency in human assisted reproduction treatment, yet our field cries for even more. The oncologist, as well as the urologist seek solutions from the interface of reproductive medicine and cryobiology. Improvements in culture technology, such as the advent of commercially available sequential culture systems, have allowed essentially all programmes of assisted reproduction to perform culture to the blastocyst stage. These events, in turn, have stimulated the concomitant search for more effective means of blastocyst cryopreservation and uterine preparation for the transfer of thawed, late-stage embryos. Although cryobiology has become an integral component of ART, the value of continued studies into the fundamental properties of the behaviour of embryonic systems, either intact or in some way manipulated, at reduced temperatures cannot be overstated. Even under ideal circumstances, such as recipients receiving embryos derived from donor oocytes, the clinical pregnancy rate from frozen embryo transfer is approximately two-thirds that from the fresh transfer of embryos (Check et al., 2001). It is therefore clear that new information and strategies for the preservation of human gametes and embryos are critical to the expansion of effective clinical services and it is to this end that this symposium is directed.

References

Check JH, Choe JK, Nazari A et al. 2001 Fresh embryos transfer is more effective than frozen for donor oocyte recipients but not for donors. Human Reproduction 16, 1403–1408.


