Stem cell roles in reproduction

Citation for published version:
Betts, DH, Kalionis, B & Hillier, SG 2010, 'Stem cell roles in reproduction: what is the basic science?' Molecular Human Reproduction, vol. 16, no. 11, pp. 791-2. DOI: 10.1093/molehr/gaq078

Digital Object Identifier (DOI):
10.1093/molehr/gaq078

Link:
Link to publication record in Edinburgh Research Explorer

Document Version:
Early version, also known as pre-print

Published in:
Molecular Human Reproduction

General rights
Copyright for the publications made accessible via the Edinburgh Research Explorer is retained by the author(s) and / or other copyright owners and it is a condition of accessing these publications that users recognise and abide by the legal requirements associated with these rights.

Take down policy
The University of Edinburgh has made every reasonable effort to ensure that Edinburgh Research Explorer content complies with UK legislation. If you believe that the public display of this file breaches copyright please contact openaccess@ed.ac.uk providing details, and we will remove access to the work immediately and investigate your claim.
Welcome to this thematic MHR issue on "Stem cell roles in reproduction: what is the basic science?" The aim of this Special Issue is to emphasize the emerging role(s) of stem cells in reproduction. We are pleased to showcase five original research articles and three New Research Horizon reviews, which integrate the exciting fields of reproduction and stem cells. These papers will contribute new insights into the functions of reproductive stem cells, challenge dogmas and create new paradigms for reproductive biology research.

Virtually all post-natal organs, including those of the reproductive system, contain small populations of stem cells that have the capacity for growth, homeostasis and repair of many tissues after damage or ageing. MicroRNAs have emerging roles in the control of virtually all biological processes, including the biology of stem cells. In reproduction, germ-line stem cells (GSCs) serve as a source for gamete production and also give rise to cells with embryonic stem cell (ESC) properties. Germ-line stem cells (GSCs) serve as a source for gamete production. These papers will contribute new insights into the functions of reproductive stem cells, challenge dogmas and create new paradigms for reproductive biology research.

Stem cell roles in reproduction: what is the basic science?

Dean H. Betts1,2, Bill Kalionis3,4, and Stephen G. Hillier5

1Department of Physiology and Pharmacology, University of Western Ontario, London, Ontario, Canada N6A 5C1
2Department of Obstetrics and Gynaecology, University of Western Ontario, London, Ontario, Canada N6A 5C1
3Pregnancy Research Centre, University of Perinatal Medicine, Royal Women's Hospital, Parkville, Victoria 3052, Australia
4University of Melbourne Department of Obstetrics & Gynaecology, Royal Women's Hospital, Parkville, Victoria 3052, Australia
5Editor in chief MHR, The University of Edinburgh Queen's Medical Research Institute (QMRI), 47 Little France Crescent, Edinburgh EH16 4TJ, UK

Garett and Masuda (p. 818) review the accumulating evidence for endometrial stem cells, identify their likely sources and discuss their potential roles in endometrial proliferative disorders. Stem cells reside within fixed tissue compartments (niches). These specialized highly regulated microenvironments (surrounding cells, extracellular matrices and factors/signals) control the normal rate of stem cell proliferation, survival and fate. Alterations to this intricate control could result in stem cell transformation. Evidence that stem cell transformation could be the underlying cause in reproductive cancer is presented and the exciting potential for future stem cell studies to lead to new reproductive cancer therapies is discussed.

Stem cells from the human placenta, cord blood, amniotic fluid and menstrual blood (among other reproductive tissues) are a rich, non-invasive and ethically acceptable source of stem cells. These stem cells can be used for regenerative medicine and are potentially amenable to reprogramming for use in various patient-specific cell therapies. Many of these reproductive stem cells express known pluripotency factors such as Octamer 4 (OCT4) and SRY (sex determining region Y)-box 2. David Kristensen et al. (p. 835) demonstrate for the first time that OCT4 and its downstream factors are expressed in human somatic epithelial cells from the urogenital tract and that these cells can form spheres, a general characteristic of stem cell behaviour.

Masip et al. (p. 856) summarized the cellular reprogramming field and compared the procedures and efficiency of induced pluripotent stem cell (iPSC) generated from various somatic cell types including those from reproductive tissues. The current limitations of induced pluripotency are presented and innovative strategies for iPSC generation such as small molecule iPSC generation and non-integrated transgenic methods are discussed. The hot research topic of direct transdifferentiation, which has considerable implications for cellular therapy, is also reviewed.

Despite decades of research, the biological role(s) of fetal microchimerism (FMC) remain obscure. Several recent studies have demonstrated that fetal stem cells are the likely source of these cells.
Once fetal stem cells enter the maternal circulation early in pregnancy, they have the potential for a beneficial contribution to tissue repair, or a malevolent contribution to disease, depending on the tissue (niche) they eventually reside in. Lee et al. (p. 869) provide an extensive review on fetal stem cell microchimerism, which examines the methods used for FMC detection, the origin prevalence and ‘stemness’ of stem cells implicated in FMC, the possible contribution of FMC to various illnesses such as autoimmune diseases and cancer, and finally the potential utility of fetal stem cells for therapies.

Overall, these articles sum up the current focal points of stem cell research in reproductive medicine and encapsulate the essence of MHR, which seeks to publish and disseminate fundamental knowledge on the molecular aspects of human reproduction. Unravelling the functions of various stem cells in reproduction will increase our fundamental knowledge of the normal process of reproduction, provide insight into their role in disease and help develop strategies to harness their therapeutic potential. Enjoy the issue.