

## Human Embryonic Stem Cell Lines with a Canadian Origin

**E**mryonic Stem (ES) cells have over the past few years created great hopes for the possible cure of devastating disease. At the same time they have given rise to heated ethical and political debate, since they are derived from human embryos. We know from decades of experience with ES cells derived from the mouse that these cells can be expanded to large numbers *in vitro*, and that they can be induced to differentiate into any cell type of the adult body. Recent discoveries have revealed a similar potential also in human ES cells. The range of tissue damage and diseases that conceivably could be treated by transplanting differentiated derivatives of ES cells is virtually unlimited. Those probably closest to becoming reality include Parkinson's disease, diabetes, macular degeneration and spinal cord injury.

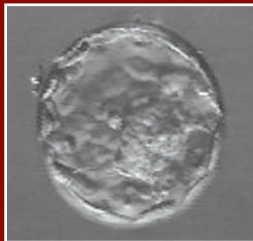
Fueled by scientific interest ignited by ES cells, there is an intensive search for stem

consists in total of less than 100 cells (*see fig A*). Some of these cells, after isolation, can be propagated into virtually unlimited numbers. By changing the culture conditions, they can be induced to differentiate into practically any cell type of the body. Today, it is not yet possible to predict how these vastly different sources of stem cells – embryo or adult – will eventually compare in future cell based therapies. It is therefore vitally important to continue extensive studies with both, so that we can be ready to apply our knowledge as soon and best as possible once final answers have been found.

future therapeutic use, these conditions are less than ideal, due to the risk of transmitting animal pathogens. For this reason, large efforts are now placed on the development of new protocols, allowing the derivation and culture of new hES cells under completely Xeno-free and well-defined conditions.

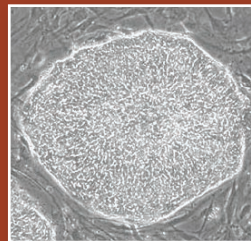
Despite all hopes, the promises come at a price of some risks that still need to be addressed before any clinical trials can be initiated. Although ES cells can be propagated to large quantities, these cells, like any other cell culture, do acquire genetic and genomic abnormalities with increased passage numbers. Such

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**FIGURE A**

*Blastocyst stage embryo, 6 days after fertilization. The inner cell mass can be seen as a clump of cells at the middle to 4 o'clock position.*



**FIGURE B**

*Colonies of tightly packed human ES cells. The thin elongated cells surrounding the colonies are fibroblast "feeder" cells derived from mouse embryos.*

cells in the adult body. To date, several tissues have been identified containing cells with stem cell properties. However, with the exception of hematopoietic stem cells, their numbers are very limited, they are difficult to isolate, and as far as research can judge to date, they have restricted capacity to differentiate into therapeutically useful cells. Human ES cells are derived from cells of a very early pre-embryo, not more than six days after fertilization. At this stage, the pre-embryo has not even implanted in the uterus wall, and

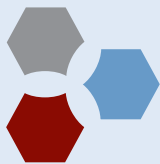
Before ES cell-based therapies can go into clinical applications, some issues still remain to be solved. As each cell line originates from an individual embryo, the genetic background will be unique. For transplantation of ES cell-derived cells/tissues, it will be important that a large number of ES cell lines are available for the various haplotypes found in the human population. In addition, most hES (human embryonic stem) cell lines derived to date have been cultured in conditions with animal-derived (Xeno) components. For the

changes may give rise to traits commonly found in cancer cells. One way of solving this problem that our laboratory is working hard on right now is the use of so-called "suicide genes". These are genes that are silent and have no effect on the transplant recipient. However, if a problem such as tumour growth would occur, the transplanted cells could easily be removed from the body. By simply giving an otherwise harmless drug to the recipient, the suicide gene is activated in the transplanted cells. This creates a toxin that kills those – and only those – cells, leaving the rest of the body unaffected.

Taken together, all these aspects call for the need of more than a few hES cell lines. The worldwide scientific community has responded to this need, and today a large number of hES cell lines have been established. However, the vast majority of these lines are poorly characterized and only a handful is effectively available to the research community. The most commonly used lines are available from the USA and Israel. The distribution of these, as well as most others, is encumbered by intellectual property limitations.

Canadian researchers have realized this bottleneck and embarked in a nation-wide collaboration to develop new hES cell lines

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## Call for Nominations

# Help Shape The Future Of Your Profession

### **DIRECTORS-AT-LARGE (Two to be elected)**

In accordance with the Society By-Laws, OSMT members are invited to submit nominations for one (1) position of Director-at-Large and one (1) position of Director-at-Large MLA/T, each for a two-year term. The election for these positions will take place by MAIL BALLOT, prior to the Annual General Meeting on Sunday, October 14, 2007.

*Deadline for submission of nominations is  
Monday, July 16, 2007.*

*Nomination forms may be obtained from the OSMT office at  
(416) 485-6768 or 1-800-461-6768.*

### **DISTRICT DIRECTORS (Four to be elected)**

The terms of office for the current Directors of Districts 1, 3, 5, and 7 expire this year. Responsibility for the election of these Directors rests with each Academy/District Committee.

#### **DISTRICT DIRECTORS**

**District 1**  
Irene Sottile  
Thunder Bay  
(807) 346-2703

**District 3**  
Wendy Baillargeon  
Ottawa  
(613) 798-5555 x 16102

**District 5**  
Jan Church  
Richmond Hill  
(416) 586-4800 x 4485

**District 7**  
OSMT Office  
Toronto  
(416) 485-6768

Deadline for submission of nominations from each of these districts is Monday, July 16, 2007. For further information and nomination forms, contact your District Director.

Participation in the election of District Directors is determined by the District in which you live or work. If you are not sure of your boundaries, contact the OSMT office.

### **DEADLINE FOR SUBMISSION OF ALL NOMINATIONS IS**

Monday, July 16, 2007. All nominees and nominators must be current members of the OSMT.

*Your commitment and service can make a difference*

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in this country. This huge effort resulted in the establishment of the two first Canadian hES cell lines named CA1 and CA2 in our laboratory. These have been approved for use in Canada by the Canadian Institute of Health Research's Stem Cell Oversight Committee (SCOC). They are now well-characterized

very limited intellectual property limitation attached. These will all be free for the Canadian scientific community to use and they will be listed in the registry of the CIHR SCOC.

One of the major concerns of the public regarding the derivation of hES cell lines lies in the inevitable destruction of human embryos. It is important to understand though how this process is done. Embryos that can come

destruction, couples are offered the possibility to donate the embryos for ES cell derivation. An informed process is always applied, the couple is made aware of all options they have, and researchers who have an interest in gaining access to the embryos are never allowed direct contact with the donors. Seen in the light of these strictly controlled procedures, it is clear that ES cell derivation does not in fact contribute to the destruction of any embryos. Instead, it offers an opportunity to "a good cause" for those embryos already destined to be destroyed.

Although this area is developing fast, opening up new ethical dilemmas, we are in a country fortunate to have a legal framework for Stem Cell research. This opportunity allows for the creation and scientific use of hES cell lines under strict ethical regulations. In this exciting era, our legal framework and public support will also be pivotal in the future for keeping the Canadian leadership in the area of stem cell-based regenerative medicine. ♦

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through a country-wide effort and a large number of Canadian and international scientists are including them in their research studies. Most importantly, they are distributed freely within Canada. We are currently working hard on establishing further well-characterized, high quality hES cell lines here in Canada, with

in question are only those produced during assisted reproduction cycles and are no longer required by the couple for reproduction. Whether in frozen storage or fresh, it is always surplus embryos that the couple has already decided not to use for reproductive purpose. As an alternative to immediate