

# Conference Scene

## Stem Cells World Congress 2009



### Select Biosciences Stem Cells World Congress 2009 Palm Springs, CA, USA, 20–22 January 2009

The focus of this conference report is to present and highlight some selected topics and emerging trends from this excellent annual conference hosted by Select Biosciences Ltd. at the Wyndham Palm Springs. This conference attracted a worldwide audience of more than 100 delegates representing a number of different areas – basic researchers involved with stem cells, representatives from pharmaceutical, biotechnology and vendor companies, a diverse array of industry participants from the cord blood banking industry as well as stem-cell clinics from around the world. The scope of industry coverage presented at this conference included stem cells in regenerative medicine, pluripotency/induced pluripotent stem cells/epigenetics and biobanking. These categories represented the major themes into which the bulk of the presentations at this conference were organized. By far, the major thrust of this conference was on the application of stem cells for regenerative medicine – in this regard it is important to note that mesenchymal stem cells are the most promising types of adult stem cells for regenerative medicine and cellular therapy. Many presentations at this conference were focused around mesenchymal stem cells for cellular therapy in a number of different disease areas.

#### Stem cells in regenerative medicine

Joseph Frank, Chief of Experimental Neuroimaging Section, National Institutes of Biomedical Imaging and Bioengineering Clinical Center (Bethesda, MD, USA), presented a talk entitled ‘Cellular MRI: tracking the fate of magnetically labeled cells – translation from bench to bedside.’ The focus of this talk was to perform autologous mesenchymal stem cell (MSC) transplantation in stroke patients using cells loaded with paramagnetic or superparamagnetic nanoparticles. Frank showed that this loading does not impair the functional or differentiating capability of these cells and these loaded cells can be followed *in vivo* using MRI. According to the data presented, 30–98% of the directly transplanted cells into the tissues are dead or are undergoing apoptosis soon after implantation. These results are important as they underscore the importance and role of imaging in monitoring cell therapy.

Mauricio Rojas, Assistant Professor at Emory University (Atlanta, GA, USA), presented a talk entitled ‘Use of mesenchymal stem cells in the regulation of inflammation: implications for therapies in the lung.’ According to the data presented here, bone marrow-derived MSCs (BMDMSCs) reduce experimentally induced pulmonary fibrosis in mice. These data showed

that upon BMDMSC treatment, there is a reduction in the levels of proinflammatory cytokines. However, the levels of granulocyte-colony stimulating factor (CSF) and granulocyte/macrophage-CSF were increased in these BMDMSC-treated mice. In a mouse-model system of adult respiratory distress syndrome (a fatal, inflammatory lung condition with a 30–70% mortality rate) experimentally induced by endotoxin, Rojas showed that BMDMSCs localize transiently to the endotoxemic lung without engraftment or transdifferentiation. This suggests that the protective effect of BMDMSCs is mediated via paracrine effects (mediated via localized cytokine release at the lesion sites). In summary, MSCs probably do contribute to the repair of injured tissue including, but not limited to, acute and chronic lung injury.

Harold Bernstein, Professor of Pediatrics/ Cardiology at the University of California-San Francisco (San Francisco, CA, USA) presented a talk entitled ‘Modeling myocardial therapy with human embryonic stem cells (hESCs).’ The focus of this talk was to describe the use of hESC-derived cardiomyocytes, which are delivered intramyocardially. Cells are retained when evaluated at 60 days post-delivery and cTnT<sup>+</sup> cells (troponin-positive cells, a marker for cardiomyocytes) were detected at 60 days post-delivery. Furthermore, no teratomas were

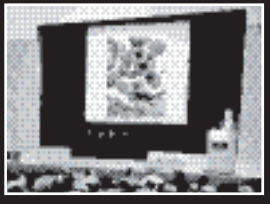
#### Enal Razvi

SBI, LLC, Mountain View, CA, USA  
Tel.: +1 415 505 8960;  
E-mail: erazvi@earthlink.net

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present. These experiments are the initial steps in the potential deployment of hESC-derived cell types for cellular therapy.

Anna Spagnoli, Associate Professor of Pediatrics and Biomedical Engineering at the University of North Carolina (Chapel Hill, NC, USA), presented an excellent talk entitled ‘Adult MSCs transplant for fracture repair.’ These data presented were based on a mouse-model system where bone marrow-derived adherent cells (enriched in MSCs) were grown *ex vivo* and injected intravenously into mice with experimentally induced bone fractures. These data showed that implanted MSCs migrate to the fracture site and engraft as newly formed osteocytes. This is an example of transdifferentiation of the MSCs to a relevant cell type at the site of a lesion. Functional data showed that infused MSCs improve fracture healing. These are important findings as a potential market opportunity for cellular therapy is in the regeneration of bones after disease or severe injuries.

Jan Nolte, Director of the Stem Cell Program at the University of California at Davis (Davis, CA, USA), presented a talk entitled ‘Human stem cells for repairing tissue damage and treating orphan diseases.’ Nolte’s research group is harvesting MSCs from two sources: bone marrow and adipose tissue. MSCs are expanded *ex vivo* using the same techniques that are used to expand marrow stromal cells. According to Nolte, hypoxic preconditioning *in vitro* can allow human MSCs to adapt to more physiological conditions in implantation. Nolte presented three important areas of research in cellular therapy worked on in their research group: stroke injury model, cardiac infarction and skeletal muscle ischemia.

In summary, the role of stem cells in regenerative medicine is firmly established. The industry challenge at this point is to translate the basic discoveries into treatment regimens that prove safe and effective and customized to various therapeutic areas. The roster of speakers at this conference illustrated this continuum – from basic research through translational medicine into business models for successful commercialization of these discoveries. Next, in this conference review, we turn to pluripotency/induced pluripotent stem cells (iPSCs)/epigenetics.

### Pluripotency/iPSC/epigenetics

An important segment of stem cell-research currently is the investigation of stem cell pluripotency and more specifically the construction of iPSCs. Research into iPSCs has expanded massively since these cells offer perhaps the closest mimic to ESCs without the associated socio-political controversies associated with hESCs, for instance. Furthermore, the potential for patient-specific iPSC generation lays the groundwork for personalized stem cell-based therapeutics in the future. For this reason, iPSCs were featured prominently at the Stem Cells World Congress 2009. Pluripotency and iPSCs in particular are assumed to be the manifestation of the epigenetic state that a particular cell adopts – the epigenetic states are plastic in that the cells can be driven into different states via the application of various distinct stimuli. In addition, epigenetics may exert a ‘fine-structure’ control on gene expression and thereby produce small differences in phenotype (of a given cell), which translates into large differences in biological function.

Costas Lyssiotis, PhD Student of Peter Schultz at The Scripps Research Institute (La Jolla, CA, USA), presented an excellent talk entitled ‘Reprogramming of murine fibroblasts to iPSC cells: chemical complementation of Klf4.’ The current state-of-the-art in iPSC research is that the number of factors required for reprogramming has gone down to three – Oct4, Sox2 and Klf4 – or two (Oct4 and Klf4) in the case of cells endogenously overexpressing Sox2 (e.g., neural progenitor cells). Costas’ research was to identify small molecule(s) that may complement the activity of Klf4, such that Klf4 overexpression is no longer required for reprogramming to iPSCs. Using high-throughput screening methods, a small molecule was identified, kenpaullone, which in fact did substitute for Klf4 in the reprogramming of fibroblasts to iPSCs, albeit at a much reduced efficiency. These results demonstrate that small molecules perhaps interact with targets *in vivo* and drive the adult, somatic cells into the pluripotent state.

Jeffrey Falk, Director of Technology Applications at AVIVA Systems Biology (San Diego, CA, USA), presented a talk entitled ‘Identification of key pathways



and biomarkers involved in human stem cell differentiation by decoding promoter methylation patterns in hESCs.' Falk presented the AVIVA system for promoter DNA methylation profiling. The data presented showed that methylated promoters residing within CpG islands are found in different stages of stem-cell differentiation. In addition, there is an apparent random chromosomal distribution of methylation in hESCs. Further results show that there are, in fact, unique changes in promoter methylation of histone H2 subtypes during differentiation. There are differences in transcription factors associated with methylated (in native ESCs) versus demethylated (differentiated) states. These results are important since methylation is an important regulatory mechanism for mediating epigenetic changes. DNA methylation (and hence transcriptional silencing) of key tumor-suppressor genes is, in fact, an important signal enabling uncontrolled cellular proliferation.

### Biobanking

The Stem Cells World Congress 2009 is one of the earliest conferences in this space that have integrated biobanking into their program. This is important since the future of the biobanking marketplace is intricately linked with the development of stem cells – for research and regenerative medicine. In this section of the conference review, we focus upon the biobanking marketplace by discussing selected presentations from this conference track.

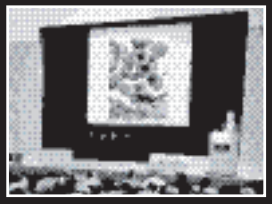
Anil Prasad, Associate Professor of Pathology at the University of Arizona Health Sciences Center (Tucson, Arizona, USA), presented an industry overview in his talk entitled 'Biorepositories: a critical resource – issues, challenges, and opportunities.' Biobanks are also known as biorepositories or tissue banks. These are centralized warehouses and distribution centers for storage and dissemination of data, information and biological samples. There are two types of biobanks: public sector biobanks and private sector biobanks. Biobanks store a number of different types of biological samples including, but not limited to, fresh/frozen/fixed tissue, tissue microarrays, serum/plasma/buffy coats, RNA/DNA from blood and other

tissues, cell lines, and extensive annotated pathology and clinical data. Importantly, biobanks support and are important for the development of personalized medicine, since they store and archive valuable biological samples. The fundamental role of a biobank/biorepository is to collect, process, store and distribute samples. We are still in the infancy of the biobanking marketplace with the leading edge being umbilical cord blood banking.

Mohammad Al-Jumah, Director of the King Abdullah International Medical Research Center (Saudi Arabia), presented a talk entitled 'Saudi biobanks – big ethical challenges with bigger hopes.' This presentation focused on the development of the biobanking industry in Saudi Arabia – a nation where all medical records are available electronically and the population is ethnically highly homogenous with very little immigration. The King Abdullah International Medical Research Center contains a cord-blood bank, a DNA bank, a tissue bank and a dry-banking repository. The presentation focused on ethical and confidentiality issues which are of paramount importance in the development of biobanking, especially the collection of biological materials in a prospective manner. This demonstrates that biobanking is truly an international endeavor with different countries taking strides to generate national biorepositories – both in the public sector and the private sector.

### Conference overview & market analysis report

This excellent conference from Select Biosciences framed the key topics in the stem cells space at the interface of the science, business and regulatory aspects. The conference brought together a truly international delegate audience from the USA, UK, Europe, Israel, Middle East, India and Asia-Pacific regions. The multiple functional areas represented at this conference are important since it creates the critical mass and synergy that enables the discussion of various topic areas and fosters worldwide collaborations not possible otherwise. I expect that this conference over the coming years will keep pace with the emerging industry trends and keep attracting a global audience of delegates.



Coincident with the Stem Cells World Congress 2009, Select Biosciences also published a market report in January 2009 entitled *Stem Cells for Cardiovascular Disease 2009*. As the stem cells marketplace evolves into distinct segments characterized by focus into particular therapeutic areas, Select Biosciences has kept pace by continuing its industry analysis and publishing such analyses in its industry reports. The *Stem Cells for Cardiovascular Disease 2009* market report focused on the technology and market landscape for stem cell-based therapeutics for cardiac and ischemic diseases. Select Biosciences industry coverage presented in this report is tuned to the types of stem cells that are most amenable to

cardiovascular regenerative medicine, all the current industry events in this market, the status of the various clinical trials in this therapeutic area, companies involved in this space (worldwide) and quantitative market trends. The industry coverage in this report is worldwide and presents a qualitative and quantitative analysis of the cellular therapy landscape in this therapeutic area.

More details about this market report can be found at the Select Biosciences website at [1].

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### Website

- 1 Select Biosciences.  
[www.selectbiosciences.com/marketreports/StemCellsCardiovascular2009.aspx](http://www.selectbiosciences.com/marketreports/StemCellsCardiovascular2009.aspx)