

Compiled and Edited by  
Felicity Rose (UoN) & Vivek Mudera (UCL)

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## President's Statement

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**Happy New Year!** Our annual meeting this year will be held at Sheffield in July. This is our 8th meeting and we are pleased with the progress the Society is making as an established forum for Tissue and Cell Engineering Research in the UK. A new development within the Society is the start of an award scheme for Early Stage Investigators who are members of the society. The scheme opens the award to nominations from our community for individuals who have demonstrated research excellence at the start of their career in the field of Tissue and Cell engineering. The TCES award will be a cash prize and the successful Investigator will be given an opportunity to present

their research at the annual meeting to the community in a special presentation. To apply, we ask for nominations, using the form sent with this newsletter and available on the website, from applicants with at least 3 but no more than 8 years postdoctoral experience are eligible to be nominated. The committee will decide amongst the nominations in May and the award will be presented at the 2006 meeting in Sheffield. The closing date for nominations will be 4<sup>th</sup> March 2006. We encourage applications across our multidisciplinary field and hope this will provide an opportunity to encourage our rising post-doctoral researchers and academics within the TCES. I look forward to meeting up at the TCES in 2006!

Alicia El Haj  
TCES President

## From the editors

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***If you wish to contribute*** to the TCES newsletter (next edition out summer 2006) then please email us at...

[f.rose@nottingham.ac.uk](mailto:f.rose@nottingham.ac.uk) (Felicity Rose) or  
[v.mudera@ucl.ac.uk](mailto:v.mudera@ucl.ac.uk) (Vivek Mudera).

We are particularly interested in receiving research articles from both post-graduate and post-doctoral researchers so if you have presented your research at a conference recently and would like to write it up as a newsletter feature, please contact us.

We look forward to hearing from you!

If you wish to subscribe to the TCES, standing order forms are available on our website ([www.tces.org](http://www.tces.org)).

## Stem Cell Therapy in India

**Bone marrow derived** haemopoietic stem cell therapies (BM HSCT) for serious and incurable haematological disorders were pioneered at Tata Memorial Hospital, Mumbai way back in 1983-84. This is a large specialized hospital dealing mainly in malignant pathologies. To date approximately 300 allogenic and several hundred autologous stem cell transplantation procedures have been successfully carried out. Most of these transplantations were for malignant haematological disorder or for aplastic anaemia. However in a country of 1 billion people, the spread of this therapy, which is now a standard treatment had been very slow and erratic.

Presently, in India, there are a handful of hospitals (not more than 15) which regularly utilize allogeneic or autologous BM HSCT for standard indications. The All India Institute of Medical Sciences (AIIMS), New Delhi recently claimed success in using BM HSCT in cardiovascular disorders, neuromuscular disorders and diabetes with some success (unpublished data).

Two national institutes are currently engaged in the development and propagation of embryonic stem cell lines (ESCs), one is funded by Indian Council of Medical Research, at National Institute for Research in Human Reproduction, Mumbai, and the other is based at Bangalore Indian Institute of Science under the aegis of Department of Science and Technology. Our institute (Institute of Immunohaematology, Mumbai) is currently establishing *in vitro* expansion of umbilical cord haematopoietic stem cells (UCHSC) for immediate clinical application. The main application will be in standard haemopoietic stem cell therapy settings where HLA matched sibling or unrelated

marrow donor is not available. The required number of stem cells envisaged is small where direct use of umbilical cord cells is not possible such as engraftment failure or where delay increases life threatening infectious complications. L.V. Prasad Eye Institute at Hyderabad is currently harvesting stem cells obtained from the limbus of the human cornea, for clinical application in cases of blindness of corneal origin.

Research at the Centre for Cellular & Molecular Biology (CCMB) at Hyderabad is focused on developing artificial corneas using various transparent macromolecular scaffolds on which limbal bud stem cells and endothelial cells are being tested. This centre also has an active programme on sourcing muscle derived stem cells (satellite cells) for future clinical application in muscular dystrophy. The National Centre for Cell Sciences (NCCS) at Pune are involved in *in vitro* culture of different malignant (i.e. glioma) and non-malignant stem cells with a view to establishing cell lines for future therapeutic use. The Institute of Chemical Biology at Kolkata is actively pursuing and have recently succeeded in developing melanocyte culture for application in cases of resistant vitiligo and they are currently exploring feasibility in other clinical applications.

In addition, many private institutions are pursuing peripheral blood derived and bone marrow derived stem cells for disorders such as myocardial infarction and Parkinson's disease. The Indian Council of Medical Research has recently developed draft guidelines for research involving the harvesting and use of stem cells from different sources in this country. These guidelines are being discussed in various forms for a national consensus and we expect a national

guideline from these discussions in the near future.

To summarize various individual laboratories and Institutes in India are currently working on diverse areas of stem cell biology and its clinical applications. Though the amount of work is awfully meagre compared to the demands in our country, I feel a modest beginning has been made.

**Dr. Kanjaksha Ghosh.**  
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**Mumbai.**  
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National Institute of Cell sciences, Pune: [infonccs@nccs.rec.in](mailto:infonccs@nccs.rec.in).

Christian Medical College, Vellore: [administrator@cmcvellore.ac.in](mailto:administrator@cmcvellore.ac.in).

Tata Memorial Hospital , Mumbai: [info@tmcmail.org](mailto:info@tmcmail.org)

### **Research Article: Viva la revolution?**

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*Over the past decade* or so the Rotary Cell Culture System™ (RCCS™) has been increasingly applied to the culture of cells and encouraging growth into three dimensional (3-D) tissue fragments. It was originally developed by NASA as a method to simulate the effects of low gravity experienced by astronauts in space and to investigate how prolonged exposure to such conditions affects the function of their cells and tissues. It turned out that the design of a cylindrical vessel filled with culture medium set to rotate at variable speeds to simulate the effects of free-fall, with low fluid sheer was very conducive to promoting cell-cell interactions. Together with improvements, compared to static culture and spinner flasks, in mass transport of nutrients the RCCS™ was able to support growth/formation of 3-D tissue fragments several millimetres and more in size. Marketed by Synthecon the RCCS™ has seen numerous developments and is now available as a pefusable system, and by making the front of the culture vessel transparent direct imaging of the cells and study of cell association kinetics is also possible. The RCCS has been used to develop 3-D culture models of a number of different cell types including cancer cells, hepatocytes, chondrocytes, and embryonic stem (ES) cells. Co-cultures of cells in 3-D have also been established and improvements in getting cells into 3-D scaffolds have also been described

The benefits of such 3-D culture models to tissue engineering strategies are clear - the normal growth and maintenance of most cells and tissues depends on a number of complex, dynamic interactions involving various soluble factors, cell

adhesion molecules and extra-cellular matrix molecules. Getting this right and understanding the nature of these 3-D cellular interactions is a key step in accurately engineering tissues. Indeed, many cells when maintained in 2-D monolayer cultures demonstrate markedly different biological functions as compared to the situation *in vivo* or in 3-D culture models. This is particularly pertinent to cancer cells and screening the effects of anti-cancer drugs. Here the RCCS™ is proving its worth in developing tumour aggregate/spheroid models.

So, with such demonstrated benefits are there any limitations with the RCCS™? Cost is important and at several thousand pounds they ain't cheap! Some cells are positively stimulated by forces such as fluid shear stress which is minimized in the RCCS. Also, the RCCS does not lend itself well to exerting fine control over positioning of individual cells and monitoring how their interactions develop. A good example of where this is important is differentiation of human ES cells via embryoid formation (EB). Although cultivation of agarose encapsulated cells in the RCCS has been shown to significantly improve efficiency of EB formation, little is actually known about the biophysical mechanisms of ES cell 3-D interactions and nidus for differentiation.

Thus, while the RCCS™ offers a robust method for 3-D culture and scale-up it is still necessary to consider methods for manipulating cells at the micrometre scale, which combined might give the best chance of creating tissues capable of functioning normally.

Lee Buttery  
University of Nottingham

## Tissue Engineering and Regenerative Medicine International Society (TERMIS)

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*The global community* of tissue engineers and regenerative medicine practitioners has united under the banner of a new society: Tissue Engineering and Regenerative Medicine International Society (TERMIS). During the recent Shanghai Meeting (reviewed below), the newly elected Governing Board and Continental Council Members from Asia-Pacific, Europe and North America met to discuss several key issues in the development of TERMIS. One of the key issues discussed was the formation of an international registry of regenerative medicine patient trials and products. The Governing Board and Continental Chapter Councils unanimously approved the creation of the registry and Drs Joseph Vacanti and David Williams agreed to serve as initial Co-Chairs of the committee that will plan the project.

Full details about TERMIS can be accessed through their new website which has now been launched and is under active development. The website provides the latest information on the Society and its Continental Chapters, including the list of officers, upcoming meetings, membership details, and recent publications.

Forthcoming TERMIS meetings include those in 2006, in Pittsburgh from April 24-27 and Rotterdam from October 8-11. In 2007, the meetings will be in Tokyo, Europe and Toronto.

Sarah Wilburn  
TERMIS Administrator

[www.termis.org](http://www.termis.org)

## **The 8<sup>th</sup> Annual Meeting of Tissue Engineering Society International Shanghai, China October 2005**

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The 8<sup>th</sup> Annual Meeting of TESI was held at the Shanghai International Convention Centre in Shanghai, China, from the 22<sup>nd</sup> to the 25<sup>th</sup> October, 2005. This last TESI international conference was attended by over 900 delegates, with representation from over 80 countries worldwide truly making this an international meeting with the highest participation since its inception.

The first and last day of the conference focussed on single sessions by invited speakers delivering keynote lectures. Included was a keynote lecture by Prof. Anthony Atala, (Wake Forest University, North Carolina, USA) an international expert in bladder tissue engineering. His talk focussed on the use of stem cells and cloning of cells using nuclear transfer, to develop engineered tissues and organs for clinical application. This talk highlighted the importance of using tissue engineering as a tool for application in regenerative medicine. A keynote lecture by Prof. Johnny Huard (University of Pittsburgh, Pittsburgh, USA) focussed on the use of muscle-derived stem cells, distinct from satellite cells in skeletal muscle. Prof. Huard's group reported that the female MDSC's displayed higher self-renewal capacity and better stress tolerance compared to the male MDSC's. These results seem to suggest methods for improving muscle stem-cell based gene therapy, and also offer explanations for some of the anomalies reported in muscle stem cell work.

Experts in the fields of biomaterials were also well represented at the meeting with Prof. Jeffrey Hubbell and Prof. Teruo

Okano giving keynote presentations. Prof. Jeffrey Hubbell (Swiss Federal Institute of Technology, Lausanne, Switzerland) gave a particularly insightful lecture on the development of smart matrices, which contain growth factors at certain positions within the matrix, and as cells degrade the matrix by releasing enzymes, they trigger the release of bioactive factors at that precise location. Thus appropriate growth factor release for the edge of an engineered tissue construct can be distinct from what is appropriate for the centre of a construct. Having these levels of control will add sophistication to the development of tissue-engineered constructs. The invited lecture by Prof. Teruo Okano (Tokyo Woman's Medical University, Japan) focussed on cell sheet engineering, where cells are grown on temperature responsive culture dishes developed by Prof. Okano. By reducing the temperature of the dish to 32<sup>o</sup>C, the entire cell sheet spontaneously detaches due to change in surface properties, without the use of proteolytic enzymes used conventionally. The benefit of detaching whole sheets is the maintenance of intact cell-cell junctions formed and deposited extracellular matrix. These sheets are then layered and potential for these sheets varies from ocular surfaces to cardiac patches.

A special lecture given by Prof. Joseph Vacanti (Massachusetts General Hospital, Harvard Medical School, USA) stressed the importance of angiogenesis in tissue engineering of vital organs. Traditional approaches to this problem have included addition of angiogenic factors to engineered tissues, whereas Vacanti's group have developed an entire vascular circulation through micro-fabrication technology, which then allows flow through engineered tissues and organs. An expert in bone tissue engineering, Prof. Yilin Cao (Department of Plastic and

Reconstructive surgery, Shanghai 9<sup>th</sup> People Hospital, Shanghai, China) presented an overview of bone tissue engineering approaches. Prof. Cao's group have seeded bone marrow stem cell on various biomaterials and implanted these constructs into various animal models, ranging from nude mice to large mammals with very encouraging results. Based on this work, Prof. Cao's group have moved to clinical trials where bone defects are filled with either demineralised bone graft or coral seeded with autologous bone marrow stem cells implanted into the defect site. Patients have been followed up with X-ray, regular CT scanning and single photon emission CT scanning, all with good results, and in cases where biopsies have been taken, all the indications were that histologically, the engineered bone is very similar to native bone.

For the two intermediary days of the conference there were up to 8 parallel sessions, covering all disciplines of tissue engineering. There were 4 sessions each for stem cells, bone, biomaterials and scaffolds, and cardiovascular, highlighting their importance and interest in the field. There were also more practical based sessions discussing tissue engineering product development, cryopreservation and enabling technologies. Other topics covered were nerve, tendon and muscle, cartilage, biomechanics, cell-scaffold interaction, gene therapy, clinical application and computer-aided tissue engineering. Running concurrently with the podium presentations were student/post-doc sessions on these topics, encouraging the participation of young scientists in this rapidly growing field. Overall the meeting was thoroughly insightful, an amazing opportunity to appreciate the breadth of work worldwide and the explosion of growth in tissue engineering.

Umber Cheema and Vivek Mudera  
UCL

## **Tissue & Cell Engineering Society 2006 Annual Meeting**

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**3-4 July 2006  
University of Sheffield**

Invited speakers include:  
Christopher Jacobs  
Stanford University  
USA

James Kirkpatrick  
University of Mainz  
Germany

Sheila MacNeil  
University of Sheffield

**Abstract deadline 1st May 2006**  
Information & registration online at  
[www.tces.org](http://www.tces.org)

Local organiser: John Haycock

## Forthcoming Meetings

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### **1st Chinese-European Symposium Biomaterials in Regenerative Medicine**

Suzhou, China.

April 3 – 7, 2006.

[www.biomater.com/cesb1](http://www.biomater.com/cesb1)

### **REGENERATE World Congress on Tissue Engineering and Regenerative Medicine**

Westin Convention Center Hotel,  
Pittsburgh, Pennsylvania, USA.

April 24-27, 2006.

[www.regenerate-online.com](http://www.regenerate-online.com)

### **Society for Biomaterials Annual Meeting and Exposition**

Pittsburgh, Pennsylvania, USA.

April 26-29, 2006.

[www.biomaterials.org](http://www.biomaterials.org)

### **2nd International Conference on Strategies in Tissue Engineering**

Wurzberg, Germany.

May 31 - June 2, 2006.

[www.wite.org/site2006](http://www.wite.org/site2006)

### **CIMTEC 2006 (11th International Conferences on Modern Materials and Technologies)**

Sicily, Italy.

June 4 – 9, 2006.

[www.cimteccongress.org](http://www.cimteccongress.org)

### **20th European Conference on Biomaterials ESB2006**

Nantes, France.

September 27 - October 01, 2006.

[www.esb2006.org](http://www.esb2006.org)

### **Annual TERMIS-EU meeting**

Congress Center De Doelen, Rotterdam,  
The Netherlands.

October 8-11, 2006

Abstract submission starts February 2006.

[www.etes2006.org](http://www.etes2006.org)

### **Bone Research Society (formerly Bone and Tooth Society) *joint with* *the British Orthopaedic Research* **Society****

Southampton, UK

July 5 – 6, 2006

Abstract deadline 17 February 2006.

[www.brs-bors-2006.org](http://www.brs-bors-2006.org)

### **First announcement...**

#### **European Chapter of TERMIS**

London

September 4-7, 2007

## TCES Board

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