tces newsletter 1 conference focus

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

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TCES President's Welcome

Our newly elected committee has expanded to include some energetic members who have initiated a newsletter for the past participants and members of our Society. The Society has been successfully building over the past 5 years under the Chairmanship of Julia Polak followed by Adam Curtis. I took over this year as Chairman and have been pleased to welcome a number of new members onto the committee. Our yearly meetings have continued to combine some keynote speakers who have played an important role in building the tissue and cell engineering community with an open submission informal atmosphere which promotes our early stage and postgraduate community. This year we are hosting two meetings: The first was in the spring at Keele which welcomed the postgraduate students and research fellow community to an informal work in progress meeting and which was very successful and well attended. The second will be held in Bristol co-sponsored with BSMB and organised by Anthony Hollander. Registrations are due in soon so we urge you to attend the meeting which has an excellent programme of speakers.

This year we are aiming to formalise our membership programme to enable members to receive biannual newsletters and obtain reduced rates at our meetings. You should be receiving in the autumn an invitation to maintain your interest in the society through a formal membership programme. I hope you all will continue to participate in the TCES annual meetings which next year may be held in London and we look forward to seeing you all at Bristol!

Alicia El Haj
Chairman TCES Society

TCES Spring Conference at Keele

The TCES Spring Meeting for Students and Postdoctoral Researchers was held on 14th & 15th June 2004 at the new medical school building on the Keele University Campus to allow the younger/less experienced members of this research community to present their work. There was an excellent turn out, with some 80 delegates attending, not only from leading UK institutes but also from international research groups (such as University of Oulu, Finland and University de Cergy-Pontoise, France). General subjects presented included forefront research on skin, cartilage and bone tissue engineering, biomaterial scaffold development and novel monitoring and assessment techniques. Professor James Richardson, (an orthopaedic consultant surgeon at Robert James and Agnes Hunt Orthopaedic Hospital, Keele University, Oswestry) gave an excellent plenary lecture describing current clinical applications tissue engineering, including data presented on autologous chondrocyte implantation techniques. Best Oral Presentation Prize was awarded to Mary Morgan from University College London and Best Poster Prize was awarded to Elizabeth Pearson from Nottingham University.

Dr Sarah Cartmell
University of Keele

Alicia and Felicity announcing the prize winners

Mary Morgan (UCL) receiving her prize for best oral presentation

Elizabeth Pearson (UoN) receiving her prize for best poster presentation

TCES Spring Conference at Keele

Winning Abstract for Best Oral Presentation

Elastic scattering spectroscopy: a novel technique to monitor tendon structure in situ.

M Morgan, O Kostyuk, RA Brown and V. Mudera.

University College London, Tissue Repair and Engineering Centre, Institute of Orthopaedics, RNOH Campus, Stanmore, London. HA7 4LP

Elastic scattering spectroscopy (ESS) is a non-destructive technique presently under investigation for quantitative assessment of dynamic matrix structure. Flexor tendons are load-bearing structures comprising densely packed bundles of longitudinally aligned collagen fibrils. Under physiological loading tendon fibres straighten and compact, losing characteristic crimp.

Cadaveric rabbit digital long flexor tendons (46) were statically loaded *in situ*: (i) under intrinsic resting load, (ii) passively extended and (iii) with 1 kg load plus passive extension. White light was delivered to the tendon surface via a fibre optic probe and the backscattered light (320-750 nm) detected both parallel and perpendicular to the tendon long axis. Anisotropy Factor, AF (Kostyuk *et al*., 2004), was calculated as a ratio of maximum to minimum backscatter intensities obtained in orthogonal probe positions at 600 nm and tendon morphology (light and transmission electron microscopy) was co-related with the ESS signals.

Backscatter spectra in the parallel probe position had a significantly lower intensity ($p<0.05$) than those obtained in the perpendicular axis, with AF = 4.26 ± 0.25. As tendons were loaded, the AF progressively increased. Though this was not statistically significant for the passively extended tendons (4.96 ± 0.33), it reached significance using 1 kg load under full extension, with AF = 7.17 ± 0.54. This increase in AF co-related to structural changes under load and extension with evidence of loss of crimp seen in histology and a change in average fibril diameter and fibril density. In addition, ESS was also able to distinguish structural differences between normal and scarred tendon sites. Using AF, we are able to quantify structural changes in tendon matrix under different loads *in situ*. ESS is a novel quantitative and non-destructive technique for application in structural studies which can be used for real-time, dynamic studies in tendon (patho)physiology, tissue engineering bioreactors and correlating between the two.

Funded by the UK EPSRC and Royal National Orthopaedic Hospital Trust.

Kostyuk O., Birch HL., Mudera V. & Brown RA. (2004). *J Physiology* 554 (3): 791-801.

TCES Spring Conference at Keele

Winning Abstract for Best Poster Presentation

Control of Chondrocyte Attachment to a Physically Modified 3D Polymer Scaffold

EA Pearson. CJ Roberts, KM Shakesheff.
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Biodegradable poly(α-hydroxy acid) polymers have been widely investigated as candidates for tissue engineering biomaterials. Poly(DL-lactic acid) ($P_{DL}LA$) is of particular interest due to its biocompatibility and suitability for porous scaffold formation. It is recognised however that the affinity for cell attachment to PLA is relatively low. We aim, through physical modification of $P_{DL}LA$ to modulate and improve specific cellular interactions. These scaffolds have also been engineered to simultaneously block non-specific cell interactions while promoting specific integrin interactions.

$P_{DL}LA$ porous 3D scaffolds were fabricated by a salt leaching process[1]. The modification of a PLA continuous phase with poly(ethylene glycol) (PEG) and an RGD peptide sequence was achieved using a method of physical entrapment[2]. Quantitative analysis of cellular adhesion, viability and morphology of ovine meniscal chondrocytes (OMCs) on the scaffolds was carried out using Hoescht DNA, Alamar blue™ assays and SEM respectively. State-of-the-art surface analysis techniques were utilised to assess the spatial distribution of the surface modifying species within the porous scaffold.

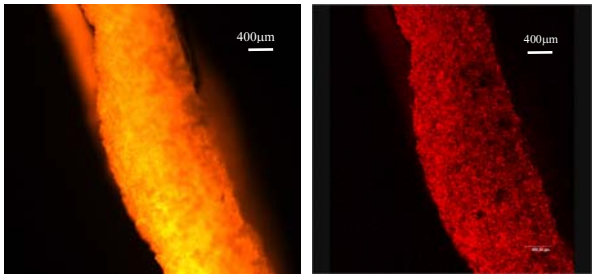

Figure 1: Confocal images showing the penetration of physically entrapped fluorescently labelled PEG molecules into the centre of a $P_{DL}LA$ porous scaffold. The samples were cross sectioned through the centre of the scaffold and imaged in fluorescence mode (left) and confocal mode (right).

Modification with a second polymeric component (PEG) was shown to be successful throughout the construct. A significant difference in both cellular viability and morphology was observed between the modified and unmodified scaffolds.

We have demonstrated a simple and rapid method of physically engineering a 3D polymer scaffold. This method has been employed to modify the polymer surface thus producing a differential cellular response in terms of viability, adhesion and morphology.

REFERENCES: [1]Mikos, A. G., Thorsen, A. J., Czerwonka, L. A., Bao, Y., Langer, R., Winslow, D. N. and Vacanti, J. P. *Polymer*, 35, 1068-1077 (1994). [2]Quirk, R. A., Davies, M. C., Tendler, S. J. B., Chan, W. C., Shakesheff, K. M. *Langmuir*, 17, 2817-2820 (2001).

International Conference on Strategies in Tissue Engineering, Wurzburg. Germany – An Overview

The International Conference on Strategies in Tissue Engineering (June 17-19, 2004) was held at the Congress Centre, Wurzburg. Germany and was jointly organized by the Wurzburg Tissue Engineering Initiative and BioMedTec Franken e.V. under the auspice's of TESI and ETES. Both Prof. Bob Nerem (President of TESI) and Prof. Jons Hilborn (President of ETES) were present and gave keynote presentations.

The conference was held over three days and divided into 15 sessions some of which were held in parallel. It was attended by a large international contingent with keynote speakers from the USA, UK and all across Europe. These sessions covered the breadth of Tissue Engineering disciplines with two sessions devoted exclusively to Stem Cells. These had quite a few presentations asking the same fundamental question. How do we define a "mesenchymal stem cell"? strategies included identifying various surface markers using flow cytometry or immunostaining combined with ability to differentiate into multiple lineages. A few presentations outlined strategies to isolate and culture these cells with data on amplifying rates and ability to maintain multi lineage potential in culture with the bone marrow being a common though not exclusive source for these cells.

An entire session was devoted to GMP in TE, which is an important aspect highlighted for a deliverable therapeutic TE product, there was also a session on Gene Therapy and Ethics, which highlighted the ethical issues in cell sourcing. Not surprisingly the musculoskeletal system dominated most of the sessions but there were also dedicated sessions on Liver, Pancreas and Parathyroid as a group and Kidney, Genitourinary systems and Breast with presentations highlighting the complex strategies as well as the diverse applications of Tissue Engineering.

The session, which focussed on Biomaterials and Biomechanics highlighted the importance of understanding biomechanics once a TE construct is implanted. Prof. Jons Hilborn's keynote lecture was particularly insightful on the effect of movement and correlation with Young's modulus of implanted construct on the fibrotic response in vivo. This has important implications for successful TE outcomes. Another session focussed on bioreactors and analytical tools and clearly identified the urgent need for non-invasive monitoring of TE constructs in bioreactors.

Sessions on cardiovascular systems, bone engineering, cartilage, central and peripheral nervous systems and skin were particularly encouraging and highlighted the huge advances made in a few short years with a wealth of data on in vitro and in vivo work using various animal models, sophisticated

methods of monitoring constructs once implanted (highlighted in a keynote lecture by Prof. R Cancedda) as well as some products already on the market as interims to TE therapies.

Vivek Mudera
UCL

TCES & BSMB Conference September 2004

CELL BASED THERAPIES

Wills Memorial Building, University of Bristol
13th & 14th September 2004

The Autumn meeting of the TCES is joint with the BSMB and will be held at the Wills Memorial Building in the Great Hall, University of Bristol, on Monday 13th September and Tuesday 14th September 2004. The meeting is organised by Anthony Hollander (University of Bristol; 0117 9595918; A.Hollander@bristol.ac.uk) and John Tarlton (University of Bristol; john.tarlton@bris.ac.uk), who can be contacted for any further details. The meeting will include invited speakers from the USA, Europe and the UK, details are given in the programme.

The deadline for abstract submissions has now past. For full details, programme and registration forms see our website (www.tces.org) and follow the link to the BSMB website.

Forthcoming Tissue Engineering Meetings

06.09.04 – 08.09.04
Polymer in Medicine and Surgery
Cambridge, UK
University of Brighton

http://www.brighton.ac.uk/pharmacy/conferences/pims.htm

28.09.04 – 01.10.04
Materials For Tissue Engineering: Chemistry and microstructure: the role for ceramics
Faenza (Ravenna), Italy
Banca di Romagna Congress Hall

http://www.istec.cnr.it/eventi.htm

10.10.04 – 13.10.04
Joint Meeting of the Tissue Engineering Society International and the European Tissue Engineering Society
Lausanne Switzerland

http://www.hospvd.ch/tesi-etes-2004/

18.11.04 – 19.11.04
Commercialisation of Tissue Engineering and Regenerative Medicine
Marcus Evans conference
London, UK

http://www.marcusevans.com/events/CFEventinfo.asp?EventID=8813#1

08.12.04 – 12.12.04
17th Annual Meeting of International Society for Ceramics in Medicine (ISCM)
New Orleans, Louisiana, USA
Wyndham New Orleans Hotel at Canal Place

http://www.bioceramics17.com/

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We look forward to hearing from you!

Your input is appreciated, please email us at
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