NEDERLANDSE VERENIGING VOOR MATRIX BIOLOGIE

NVMB

Dutch Society For Matrix Biology

Newsletter of the Dutch Society for Matrix Biology
Autumn 2014

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Preface

The end of an era

This fall the NVMB Dutch Matrix Biology Association will organise a special meeting on the occasion of the retirement of Vincent Everts, professor of Oral Cell Biology at the Academic Centre for Dentistry (ACTA) in Amsterdam (see for official announcement and details further on in this newsletter). The retirement of Vincent marks the end of an era for the Association. Vincent is a former board member of the NVMB, but is far more than that. My memories go back to the old days when the NVMB met as a small group in the very cosy, but not too professional, setting in very rural Loenen. Vincent was already there and he had been in the meetings for ages before, long before I even knew what science was or should be. Vincent is in your perception the type of person like the Queen of England: somebody who's always been there and who will remain forever. Vincent not only was present, he managed to ask one or more questions after virtually all talks. And they were, regardless whether the presentations were in his own area of research or not, always to-the-point. Vincent was to a certain extent feared by many PhD students because of these sharp and critical questions that always, based on his vast knowledge and scientific skills, faultlessly pinpointed the weak points in methodology or discussion. However, he always remained friendly and helpful towards the young researchers. He was a kind of role model for the young academic: knowledgeable, critical, sharp and a master in logical thinking, but at the same time amiable and often witty. One of the last major achievements of Vincent in his formal academic career was heading the scientific committee of the 1st Matrix Biology Europe (MBE) Conference that was organised, formally by the NVMB, in Rotterdam in July this year. The MBE is the successor of the meetings organised by the Federation of European Connective Tissue Societies (FECTS), and was in fact the (now renamed) 24th FECTS meeting. The (4-yearly) FECTS meetings had been in steady decline over the past years with the 2010 meeting in Katowice (Poland) having a historically low in number of attendants. Fortunately the MBE organising committee, headed by Ruud Bank (also a former NVMB board member) and with help of Vincent and others, has succeeded in reversing the tide. The MBE meeting in Rotterdam was, as evidenced by comments during the meeting and by the results of the survey that was sent out directly

after it, a great success and serves as a good starting point for the 2nd MBE meeting that will be held in Greece in 2018.
For myself there will also be an end to an era as I shall be stepping down as president of the NVMB at the autumn meeting after completing my 3rd (and regulatory last) 3-year term as a member of the board. It has been an honour and a great pleasure to be a member of the board of the Association. I really think the NVMB is a good and effective organisation for the promotion of matrix biology and to help the scientists in this area to keep in contact. I'd like to thank the members of the Association and especially the fellow-members of the board for the confidence they gave me and above all for the excellent and often very joyful collaboration. I certainly plan to follow Vincent Everts's foot prints and to continue attending the MBE meetings (possibly asking tricky questions….)

René van Weeren

Board mutations

René van Weeren has come to the end of his 3rd three-year turn in 2014 and cannot be re-elected according to our constitution. Consequently, he will lay down his position as chairman. Marco Harmsen is proposed by the board as his successor. He will stand for election for this position during the 2014 general assembly. Other propositions from the membership can be sent to info@matrixbiology.nl. Yvonne Bastiaansen-Jenniskens and Lucienne Vonk are stepping down too, but will stand for re-election. Since Lucas Falke left the board last year and René van Weeren will leave us this year, we have a vacancy for 1 or 2 board members. Everyone involved in matrix biology research and interested in management of a scientific society, please step forward by sending a mail to info@matrixbiology.nl.

NVMB one-day meeting

Due to the MBE2014 meeting, there was no traditional annual meeting of the NVMB in May. Instead, we will organise a one-day meeting on **December 12** at 'De Eenhoorn' in Amersfoort. In the morning, presentations will be given by junior scientists on their work as during regular NVMB annual meetings. During lunch time the yearly General Assembly of the Association will take place. In the afternoon a symposium will take place to honour Vincent Everts on the occasion of his retirement under the title: **A story of young and old, the Maturation of a Matrix biology in Person (MMP)**. The exact program will be announced soon on the website.
We would like to invite you all to be part of this exciting informative day.

Presentations

For the (oral) presentations we would like to ask only junior scientists to submit an abstract. The abstract format can be found on our website. Please send in your **abstract before November 21**. Due to time constraints, we might not be able to give oral presentations to all abstract submitters. If we need to make a selection of the abstracts, presenters will be notified on **November 28**.

Registration

You can register via our website. Registration fees for our members will be € 75,-, for non-members € 85,-. Please note that onsite registration will cost €90,- which has to be paid in cash.

PhD defences

July 3, 2014
Michiel Beekhuizen, UMC Utrecht, Dept. of Orthopaedics & Erasmus MC Rotterdam, Dept. of Orthopaedics
"Inflammatory mediators in osteoarthritis"

December 1, 2014
Samaneh Ghazanfari, TU Eindhoven
"Collagen orientation evolution in native and engineered cardiovascular tissues"

Collagen is the major load-bearing component and the major determinant of the function and mechanical behavior of cardiovascular tissues, such as blood vessels. In order to engineer a functional tissue to meet in vivo mechanical demands, a complete understanding of the mechanism that causes the three dimensional (3D) arrangement of the collagen fibers is required. In this thesis, we explored the collagen orientation evolution of tissue engineered (TE) constructs and native arteries and based on our findings; we designed a study to understand the mechanism. To study collagen orientation, several techniques are in use, such as polarized light microscopy and X-ray diffraction. All these techniques have limitations and the main drawback is limited imaging depth. To overcome this problem, diffusion tensor imaging (DTI) was explored as a promising fiber orientation imaging technique to study the overall collagen orientation. Collagen fiber orientation in both native and TE constructs was evaluated using DTI. For detailed information on collagen orientation evolution, Second Harmonic Generation (SHG) and Confocal Laser Scanning Microscopy (CLSM) were used. *In vivo* collagen orientation evolution in native and TE stented valvular wall as a response to the strain and contact guidance (stent struts) was studied. Based on the information obtained from the previous studies, a study was performed with the hypothesis that collagen fibers align in the direction where the degradation is minimum.

First, collagen orientation evolution insight is important to understand and mimic the native tissue architecture. Study of collagen orientation in cardiovascular tissues requires time-consuming and destructive methods. Therefore, a fast and non-destructive method is needed. DTI as a well feasible method was used to study the collagen orientation of the native artery and showed that collagen fibers were mainly oriented circumferentially in the outer adventitia and media. Uniaxially constrained TE strips were cultured to investigate the evolution of the collagen orientation with time. Moreover, a comparison of the collagen orientation in high and low aspect ratio (length/width) was made. Collagen fibers in the high aspect ratio samples were mostly aligned in the constraint direction, while the collagen fibers in low aspect ratio strips were mainly oriented in the oblique direction. DTI captured the collagen orientation differences between low and high aspect ratio samples and with time.

Then, for more detailed collagen orientation evolution, SHG and CLSM, as unique methods to provide detailed information, were used to study the collagen matrix evolution in engineered valvular wall tissues and in the stented native arteries. Ovine native pulmonary arteries were harvested 8, 16 and 24 weeks after trans-apical implantation of self-expandable stented heart valves. We hypothesize that in the outer region, collagen fibers straighten in response to arterial stretch. However, the collagen patterns in the inner surface suggest that stent induced remodeling could be conducted by a directional mechanism, that is not stretch driven, such as contact guidance. SHG microscopy revealed wavy collagen fibers oriented in the circumferential direction, becoming more straightened towards the proximity to the stent, in the outer region of the artery. In the luminal side, collagen fibers were aligned in the direction of the struts, randomly oriented between the struts and axially oriented above the stent. Furthermore, TE heart valves, based on rapidly degrading scaffolds, were cultured in bioreactors and decellularized. Collagen remodeling in-vivo was evaluated by quantifying

collagen orientation of the explants obtained after 8, 16 and 24 weeks. Collagen tortuosity was quantified using Gabor wavelet method. Results show that at the luminal side of the vessel wall, fibers were aligned in the circumferential direction and the tortuosity was increased with implantation time. In the outer region, where the tissue was in contact with the stent, collagen fibers were aligned in the direction of the struts near the struts and randomly orientated in between the struts. The amount of elastin was increased with implantation time and was mostly presented at the luminal side. The amount of collagen type I and III was decreased with time.

Lastly, to understand the observed collagen orientation evolution, *in vitro* experiments were performed in which collagen orientation was imaged and quantified as a response to straining with the hypothesis that collagen fibers align in the direction in which degradation is minimal. Pericardial tissues as isotropic collagen matrices were decellularized and collagenase was used to degrade the collagen fibers. By obtaining the degradation-strain curve we expect to predict the collagen fibers orientation when the tissue is subjected to different biaxial loading

In conclusion, this thesis shows that, DTI is a reliable tool to study the overall collagen orientation of both native and TE constructs. Detailed collagen orientation analysis revealed that collagen remodeling is not induced by strain, but contact guidance in stented native arteries. Moreover, in vivo collagen remodeling of TE valvular wall toward native like tissue demonstrates the potential of TE constructs to repair, remodel and accommodate growth after implantation.

Grants

Roberto Narcisi (Erasmus MC Rotterdam, Dept. of Orthopaedics) was awarded a VENI-grant for his research: “developing new strategies to obtain a purified population of chondroprogenitor cells for cartilage reconstruction”.

Lucienne Vonk (UMC Utrecht, Dept. of Orthopaedics) was awarded a Reumafonds grant: ”Arthroscopic airbrushing for cartilage repair”.

René van Weeren (Department of Equine Sciences, University of Utrecht) was awarded a Reumafonds grant “Generating durable and resilient repair of cartilage defects – a systematic, therapeutic approach” (collaboration with Dept. of Orthopaedics UMCU (Jos Malda) and Swansea University (Charles Archer), combined call of Arthritis UK and Reumafonds NL).

Congratulations

We would like to congratulate Yvonne Bastiaansen-Jenniskens with the birth of her second daughter “Amber”