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## EDITORIAL

# Musculoskeletal regeneration research network: A global initiative



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## Global impact of musculoskeletal disorders

The World Health Organization (WHO) has identified the four most lethal, noncommunicable diseases affecting the greatest proportion of the world population as cardiovascular diseases, cancer, respiratory diseases, and diabetes. While musculoskeletal (MSK) conditions are the second greatest cause of disability and account for one-third of all work sick leave [1], the WHO does not place the same awareness on MSK conditions. Greater awareness of diseases maintains visibility, which leads to greater funding for research and education, making it more difficult for the under-recognised diseases to gain the necessary resources to make an impact in the field [2].

It is thus imperative for MSK interest groups to appeal to not only the WHO, but also governments, pharmaceutical companies, and regulatory bodies to give greater attention to MSK conditions. For instance, the Bone and Joint Decade (BJD) has contributed to the WHO Global Disability Action Plan, which is a systematic review similar to that of the highlighted noncommunicable diseases. The BJD has also contributed to the WHO report on ageing and health, which will be followed by an action plan [3]. While BJD has done an excellent job in promoting global awareness of MSK conditions, especially with larger organisations, the question about how advantageous this is for individual institutions in making a translational difference remains controversial. For this reason, smaller groups who are able to establish in-depth discussions and co-ordinate themselves around a centralised goal are essential.

Some organisations are already recognising this need to support the study of numerous diseases. Horizon 2020 is the largest European Union Research and Innovation programme, with explicit recognition of MSK conditions. This programme not only funds orthopaedic projects, but encourages cross-disciplinary research, thus allowing for a disease to be holistically studied and treated [4,5], and access to such grants will be greater achieved by groups focused on one goal with multiple fields of expertise.

## Background and launch

The Musculoskeletal Regeneration Research Network (MRN) is an international consortium to promote MSK regeneration and translational research to encourage collaboration to enhance achievement. It was inaugurated on November 13, 2013 during the 3<sup>rd</sup> International Symposium of Stem Cell Biology and Regenerative Medicine (SCRM) (Appendix 1).

With the vision to advocate a strong voice in the field of MSK regenerative research and a collective opinion leader in the field, the MRN is an ideal platform to establish a taskforce to translate the research conducted by participating members into clinical practice. By building a strong network with like-minded teams and institutions, members of this network will gain unique opportunities to enhance their research and clinical practice and outcomes, as well as enabling assistance in applying for grants, through their MRN collaborations. The MRN will also be able to form active relationships with industries, to bring academic research into the clinical realm. Ultimately, such interactions will lead to effective knowledge transfer amongst the MRN members, to ensure projects remain on track and achieve their ultimate goals.

The missions of the MRN are to (1) establish an effective, collaborative platform to facilitate MSK regenerative research; (2) bridge the gap in translation in MSK regenerative research between professional bodies and industries; (3) enhance the academic and professional output of members of the network; and (4) host high-quality meetings in strategic global sites to promulgate the impact of MSK regenerative research.

### MRN: progress update

Based on the Fragility Fracture Network model [6], the MRN aims at bringing together like-minded researchers from global institutions, focusing on MSK regeneration and turning basic science into translatable results. In the past 5 years, the MRN has taken the necessary steps to build a firm foundation and expand to include illustrious institutions, allowing access to new grants, publication of more research, and providing staff and students the opportunity to learn and share expertise and knowledge beneficial to both the host and home institutions [7]. For example, the collaboration between The Chinese University of Hong Kong (CUHK) and Karolinska Institute (KI) has already achieved numerous benefits. KI has access to a large number of human tendinopathy samples for the analysis of microbial presence, while CUHK has cell-culture facilities to study the pathogenesis of microbes on the development of tendinopathy. The project has expanded its collaborative efforts to Uppsala University, by virtue of its bioinformatics facilities. Furthermore, the collaborating institutions were approached by the University Hospital of Trondheim, Norway, supplying additional tendinopathy samples to increase sample and demographic size in the study. A similar

collaborative platform has been established between CUHK and University Medical Centre Utrecht. University Medical Centre Utrecht has developed hydrogel three-dimensional printing technology for regeneration of focal chondral defects, while CUHK is working on injectable products to treat degenerative osteoarthritis, with a shared interest in developing value-added biomaterials for these applications. Recently, CUHK researchers visited the University of Southern Denmark, and held a joint symposium on MSK regeneration. A formal Memorandum of Understanding (MOU) has been signed and a project is being planned for the development of bioactive constructs, wherein both institutions will apply for research grants, establish a joint PhD programme, and share resources and facilities. Delegates from CUHK recently visited Stanford University, CA, USA (Stanford delegates have previously visited CUHK), under the auspices of a signed MOU between the two institutions, to initiate lectures and formulate new research bonds in various MSK fields. A similar, research-focused MOU is also in place between the University of Pittsburgh, PA, USA and CUHK. In addition, opportunities for collaboration in research, education, grants, and publication in both academia and industry are also being developed. Researchers from the AO Foundation, Shanghai Jiao Tong University, and CUHK have formed the European and Chinese RAPIDOS consortium, to collaborate on the project titled "rapid prototyping of custom-made bone-forming tissue engineering constructs," which received funding from the European Commission and the National Natural Science Foundation of China in 2013 [8]. Furthermore, the collaboration between Shanghai Jiao Tong University and CUHK has produced another study on tendinopathy and tendon regeneration, which has resulted in the sharing of resources and facilities, education opportunities, and a number of publications [9–11]. Further collaboration is also under development with Brown University and CUHK, in which a publication studying stromal-cell-derived factor-1 and osteoarthritis has been published [12], as well as facilitating scholars and students from CUHK to visit Brown University.

Through this growing network of international collaborators and promising research opportunities, the 1<sup>st</sup> International Symposium of Musculoskeletal Regeneration Research Network (MRN) (Appendix 1) was held at KI on June 1–2, 2015. The programme timetable is shown in Appendix 2. The aim of the symposium was to encourage member institutions to share recent work, as well as discuss and develop future research opportunities and collaborations, such as acute and chronic inflammation and infection in MSK disease, and tissue regeneration. The participants also discussed how MRN can move forward to accomplish its goals. It is believed that the MRN not only presents opportunities for collaborative ventures amongst similar institutions, but also enables collaboration with pharmaceutical and governmental regulatory bodies to implement systems towards effective translational

activities. The Albert Einstein College of Medicine expressed their excitement for recently joining MRN, emphasising specifically the opportunity of interaction with other international institutions and potential collaborations with other members of the MRN. Following the success of the first MRN meeting, annual meetings are planned for 2016 (Utrecht, The Netherlands) and 2017 (Davos, Switzerland).

The MRN holds a unique position in that it has a diverse group of members who have specialised knowledge, systems, and facilities in place, to bring research from bench-to-bedside. The MRN has the advantage of maintaining a small, tight-knit community to maintain specific, focused

discussions and allowing stronger, effective collaborations. Such collaborations have already shown significant mutual benefits for both MSK investigators and their institutions. The overall outcome of greater access to facilities, knowledge, resources, grants, publications, and technology, enabled by the MRN, will bring about substantive advancements in making bench-to-bedside translational research a reality.

### Conflicts of interest

All authors declare no conflicts of interest.

## Appendix 1 Musculoskeletal Regeneration Research Network group



**Figure 1** Stem Cell Biology and Regenerative Medicine and Musculoskeletal Regeneration Research Network key events: (A) Third Annual International Symposium on Stem Cell Biology and Regenerative Medicine, 11–12 November 2013; (B) launch of Musculoskeletal Regeneration Research Network, 13 November 2013; and (C) 1<sup>st</sup> International Symposium on Musculoskeletal Regeneration Research Network, 1–2 June 2015.

## Appendix 2 Musculoskeletal Regeneration Research Network meeting programme



# 1st International Symposium of Musculoskeletal Regeneration Research Network (MRN)

*An International Consortium  
to promote  
Musculoskeletal Regeneration  
& Translational Research*

**June 1-2, 2015**

Auditorium 4U Solen, Level 4  
Alfred Nobels Allé 8, Campus Huddinge  
Karolinska Institutet, Stockholm

**Programme Chairpersons:**  
Prof. Christer Rolf  
Prof. K.M. Chan

## Participating Members



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