III MTN WORKSHOP MUSCLE INJURIES AND REPAIR: CURRENT TRENDS IN RESEARCH

September, 27th-28th, 2011

Futbol Club Barcelona
Entrance to the stadium - Door 14
Avgda. Arístides Maillol, s/n
08028 Barcelona

ORGANIZERS

muscle tech network

biocat International Center for Scientific Debate

Initiative fostered by:

Welfare Projects
"la Caixa" Foundation

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Introduction

Tissue engineering has been a topic of extensive research over the last years. The ability of human body to regenerate tissue loss such as cartilage, tendon and muscle is limited leading often to chronic injuries. In recent years there have been rapid developments in the use of several novel approaches to muscular and tendinous injuries - growth factors, platelet-rich plasma (PRP) or mesenchymal stem cells (MSCs) to name a few for accelerated healing of injury.The advances made in cellular biology, genetics and recombinant technology has initiated the development of new techniques and new therapeutic strategies allowing treatment of many pathological conditions providing restoration of tissue continuity and function. Those approaches have been used with success and the technology is now being developed for orthopaedics and sports medicine applications for repair of soft tissues such as muscle, tendon and ligament following acute traumatic or overuse injury, and animal studies have demonstrated clear benefits in terms of accelerated healing.

Although, in some of those new techniques and new therapeutic strategies minimal clinical evidence is currently available, their use has increased, given its safety as well as the availability of new techniques many controlled clinical trials are underway. Should we approach tissue engineering cautiously until high-level clinical evidence supporting the new techniques and new therapeutic strategies' efficacy is available?
On another area related to the approaches to muscular and tendinous injuries, we find studies performed using a focused model of injury causation and prevention strictly from a biomechanical perspective. One could argue this model would be equivalent to the failure of a machine or structure - a result from a transfer of energy to the tissue taking into consideration the mechanical properties of human tissue, such as stiffness (stress–strain relation), ultimate strength, and critical stress, and ultimately governing how the body responds to physical loads. Is this approach too simplistic?

Biomechanics, one of the disciplines in the field of Human Movement and Exercise Science from a research perspective may be seen to have a disagreeing approach to muscular and tendinous injuries. Clinical biomechanics involving research in several areas such as neuromuscular control, tissue mechanics, and movement evaluation during rehabilitation from either injury or disease will be discussed, with the primary aim to show the role of biomechanics in sports science and sports medicine. Scientists, medical researchers, biomechanics and practitioners working in the field of sports injury prevention tend to have very tangible objectives and focus on identifying and solving specific injury risks. There is an uncertainty, however, that "solving" one problem may not simply create another or that "solving" one problem may be done with only one approach. As the field of the muscular and tendinous injuries matures, it is worth considering whether theories and models can be developed that have more general application to a range of injury issues. There is a need for an integrated perspective on sports injury that is inclusive of medical and biomechanical factors.

Program

Tuesday, 27th		Wednesday, 28th	
8:45	**Hotel pick up - bus transfer**	8:45	**Hotel pick up - bus transfer**
9:00	**Registration**	9:00	**Update in regenerative therapies in the muscle and tendon** Johnny Huard Richard Lieber Nicola Maffulli Chairs: María José Martínez; Lluís Orozco; Robert Soler Discussion panel:Ramon Cugat; José López Calbet; Mario Marotta; Jordi Puigdellivol; LLuís Til
9:30	**Welcome**		
9:45	**MuscleTech Network, moving forward** Gil Rodas Francesc X. Roca		
10:00	**Key note lectures** Thomas M. Best Johnny Huard Willem van Mechelen		
11:00	Coffee break	11:00	Coffee break
11:30	**Presentation of the magazine FEM** Xavier Gassó **Evaluating strength tests as elements of injury prediction** Thomas M. Best Pierre Portero Chair: Joaquim Chaler Discussion panel: Rosa Angulo-Barroso; Xavier Balius; Angel Sánchez; Antoni Turmo	11:30	**Scientific evidence and clinical validation of the F.C. Barcelona Clinical Practice Guide of tendon injuries** Henning Langberg Nicola Maffulli Per Tesch Chairs: Daniel Medina; Ricard Pruna Discussion panel: Angel Cotorro; Ramon Cugat; Alfons Mascaró, Jordi Puigdellivol
13:00	Lunch	13:00	Lunch
14:00	**Injuries in the adolescent stage** Nikos Malliaropoulos Per Tesch Pierre Portero Chair: Xavier Valle Discussion panel: Manuela González; José Antonio Gutiérrez; Mauricio Mónaco; Jordi Puigdellivol; Lluís Til	14:00	**Update in muscle and tendon injury and repair biomarkers** Walter Herzog Henning Langberg Richard Lieber José López Calbet Chairs: Roser Cussó; Ginés Viscor Discussion panel: Jordi Ardevol; Josep Cadefau; Franchek Drobnic; Xavier Yanguas
15:30	Coffee break		
15:45	**Prognostic value of ultrasound and MRI in muscle and tendon injuries** Carl Askling Nikos Malliaropoulos Xavier Alomar Ramon Balius Chairs: Ramon Balius; Mª Isabel Miguel Discussion panel: Manuela González; Jordi Puigdellivol; Marta Rius; LLuís Til	16:00	**Conslusions and closing remarks of the "3rd MuscleTech Network Workshop on Muscle and Tendon"** Carles Pedret Gil Rodas
18:30	Visit to FCB, Stadium and Museum	16:30	Bus to the FCB sport city
20:00	Dinner at FCB	16:45	Visit to FCB sport city
22:30	Bus to the hotel	18:00	Bus to the Hotel

Program

Tuesday, September 27th

9:00 Registration

9:30 Welcome

9:45 MuscleTech Network, moving forward

Gil Rodas Scientific Director of MuscleTech Network, Senior Researcher and Sports Medicine Specialist at the Medical Services Futbol Club Barcelona
Francesc X. Roca Coordinator Manager of MuscleTech Network and Senior Researcher on Medicinal Chemistry at LEITAT Technological Centre

10:00 Key note lectures

Challenges and Dilemmas in Muscle-Tendon Research and Implementation to Clinical Practice
Thomas M. Best Professor and Pomerene Endowed Chair, Department of Family Medicine, Professor of Biomedical Engineering and Biostatstics, Director, Division of Sports Medicine, Co-Medical Director, The OSU Sports Medicine Center, Team Physician, OSU Athletic Department, The Ohio State University, President, American College of Sports Medicine.

Regenerative Medicine based on Adult Stem Cells for Musculoskeletal Tissue Regeneration & Repair
Johnny Huard Henry J. Mankin Professor and Vice-chair for Musculoskeletal Cellular Therapeutics in the Department of Orthopaedic Surgery and in the Departments of Microbiology and Molecular Genetics, Pathology and Physical Medicine, Bioengineering, and Rehabilitation. Director of the Stem Cell Research Centre of Children's Hospital of Pittsburgh. Deputy Director of the McGowan Institute for Regenerative Medicine, United States of America

Cost-Effective Secondary Prevention of Musculo-skeletal Problems; Myth or Reality?
Willem van Mechelen Head of the Department of Public and Occupational Health of VU University Medical Centre and Co- Director EMGO+ Institute of VU University Medical Centre, Chairman of the Research Centre Body@Work TNO VU University Medical Centre and Director of the spin-off company Evalua Nederland B.V. ('Ltd').

11:00 Coffee break

11:30 Presentation of the magazine FEM – Forum Egarsat del Múscul
Xavier Gassó , Director of Health Management at "Mútua d'accidents EGARSAT"

11:40 Evaluating strength tests as elements of injury prediction
The assessment of muscle strength and especially the knowledge of the relationship between agonist and antagonist muscles allow the analysis of the muscle state. It is postulated that knowledge in this way allows us to understand the risk of muscle-tendinous injuries. In this regard, isokinetic studies have been really important because they study the muscle strength performed in a determined range of motion and velocity, allowing observing the presence of injuries or imbalances between muscle groups. However there is still controversy as to whether it measures the real movement of the athlete when performing their various sporting gestures. Other methods of analysis have emerged in recent years, seeking to be more specific and decisive in finding athletes with a high risk of lesion and who could benefit from prevention programs specifically designed according to their morpho-functional deficits. What we should discuss is which are the best methods for assessing the risk of injury and how can they be applied.

Core Training for Hamstring/Groin Problems – Myths And Evidence For Injury Prediction and Prevention
Thomas M. Best Professor and Pomerene Endowed Chair, Department of Family Medicine, Professor of Biomedical Engineering and Biostatstics, Director, Division of Sports Medicine, Co-Medical Director, The OSU Sports Medicine Center, Team Physician, OSU Athletic Department, The Ohio State University, President, American College of Sports Medicine.

Characterization of the Passive Mechanical Properties of the Muscle-tendon Complex Using Isokinetic Dynamometers
Pierre Portero Service de Rééducation Neuro-Orthopédique Hôpital Rothschild, Paris, France

Chair: Joaquim Chaler Senior Researcher at EGARSAT-SUMA Intermutual and lecturer at the Psychology, Education and Sport Sciences School at Blanquerna, Universitat Ramon Llull, Barcelona, Spain.

Discussion panel members:
Rosa Angulo-Barroso Senior Researcher at the Research Unit of the National Institute of Physical Education (INEF- Catalunya), Barcelona, Spain
Xavier Balius Research Leader at GIRSANE - Performance and Health Research Group for High Level Sports. Head of the Biomechanics Department Representing GIRSANE, Sport Sciences Unit (Olympic Training Centre) and Health Unit (Health Consortium of Terrassa), Barcelona, Spain
Angel Sánchez Senior Researcher and Rehabilitation physician at Eurosport, Barcelona, Spain
Antoni Turmo Director of the Medical School of Physical Education and Sport, Universitat de Barcelona, Barcelona, Spain and Sports Medicine Specialist at the Medical Services RCD Español, Barcelona, Spain

13:00 Lunch

14:00 Injuries in the adolescent stage
It is increasingly difficult to reduce the processing time of muscle and tendon injuries. In sports medicine the tendency is to prevent these injuries. Prevention guidelines should be started at an early age. It is precisely for this reason that is basic to know the epidemiology of the different injuries at the stage of adolescence. This knowledge will allow us to design individualized treatment strategies and adequate preventive protocols. What we should discuss is precisely what are the most common injuries and what should be achieved using certain protocols.

Clinical Prognostic Values in Hamstring Injuries.
Nikos G. Malliaropoulos Sports Medicine Physician-EJU Medical Committee Member, Chair European College of Sports and Exercise Physicians (ECOSEP).

Improving Health Through Better Muscle Health
Per A. Tesch. Professor at the Department of Health Sciences, Mid Sweden University, Östersund and Department of Physiology & Pharmacology, Karolinska Institutet, Stockholm, Sweden.

Passive viscoelastic characteristics of the calf muscle-tendon complex in former international female gymnasts vs. control subjects
Pierre Portero Service de Rééducation Neuro-Orthopédique Hôpital Rothschild, Paris, France

Chair: Xavier Valle Senior Researcher and Lecturer at the Medical School of Physical Education and Sport, Universitat de Barcelona, Barcelona, Spain and Sports Medicine Specialist at the Medical Services Futbol Club Barcelona.

Discussion panel members:
Manuela González Head of Service of the Department of Postural Imaging and Assessment at Centre for Sports Medicine of the Consejo Superior de Deportes (National Sports Council), Madrid, Spain
Jose Antonio Gutierrez Senior Researcher and Sports Medicine Specialist at the Medical Services Futbol Club Barcelona
Mauricio Monaco Paediatrician, Senior Researcher and Sports Medicine Specialist at the Medical Services Futbol Club Barcelona

Jordi Puigdellivol Orthopaedic Surgeon and Senior Researcher and Sports Medicine Specialist at the Medical Services Futbol Club Barcelona
Lluis Til Senior Researcher at the Physiological and Functional Evaluation Department, High Performance Centre - CAR - Sant Cugat del Vallès, Spain and Senior Researcher and Sports Medicine Specialist at the Medical Services Futbol Club Barcelona

15:30 Coffee break

15:45 Prognostic value of ultrasound and MRI in muscle and tendon injuries.
It is well known the high diagnostic value of ultrasound and MRI in muscle and tendon injuries. Similarly we consider these techniques the gold standard for assessing the evolution of these lesions. At present, the improvement in image quality and the processing of the images give us even more possibilities in the world of imaging. So we can speak not only about imaging but also for prognostic assessment and treatment using ultrasound and MRI.

High-speed Running Type or Stretching-type of Hamstring Injuries Makes a Difference to MRI Findings
Carl M. Askling Lecturer at the Swedish School of Sport and Health Sciences, Research Leader at the Orthopaedics and Sports Medicine Group, Department of Molecular Medicine and Surgery at the Karolinska Institutet, Stockholm, Sweden

Cost-effective Prevention of Lateral Ankle Injury
Nikos G. Malliaropoulos Sports Medicine Physician-EJU Medical Committee Member, Chair European College of Sports and Exercise Physicians (ECOSEP)

Longitudinal Studies of Hamstring Muscle Injuries in Athletes
Xavier Alomar Director of the Diagnostic Imaging Department at Creu Blanca Clinic, Barcelona, Spain

Chairs:
Ramon Balius Research Leader at the High Performance Sports Research Centre (CEARE), Catalan Sports Council, Barcelona, Spain
Mª Isabel Miguel Professor at the Department of Pathology and Experimental Therapeutics, Research Unit on Muscle Anatomy and Pathology, School of Medicine (Campus Bellvitge), University of Barcelona, Barcelona, Spain

Discussion panel members:
Manuela González Head of Service of the Department of Postural Imaging and Assessment at Centre for Sports Medicine of the Consejo Superior de Deportes (National Sports Council), Madrid, Spain
Jordi Puigdellivol Orthopaedic Surgeon and Senior Researcher and Sports Medicine Specialist at the Medical Services Futbol Club Barcelona
Marta Rius Sports Medicine Specialist at “Mutualidad de Futbolistas” of the Catalan Football Federation, and Traumatology Institute at Quiron Hospital, Barcelona, Spain and Sports Medicine Specialist at the Medical Services Futbol Club Barcelona
Lluis Til Senior Researcher at the Physiological and Functional Evaluation Department, High Performance Centre - CAR - Sant Cugat del Vallès, Spain and Senior Researcher and Sports Medicine Specialist at the Medical Services Futbol Club Barcelona

18:30 Visit to FCB Stadium and Museum

20:00 Dinner at FCB

Wednesday, September 28th

9:00 Update in regenerative therapies in the muscle and tendon

The reality today is that after decades of treating muscle and tendon injuries with a standard treatment, often with little scientific evidence, the appearance of a treatment with "platelet-rich plasma", stem cells and various tissue engineering techniques had opened to the world a hope to make a treatment that can improve the recovery time of muscle and tendon injuries as well as improving the rate of recurrence associated with this type of injury. While this seems a really important goal, the few published studies do not seem to find scientific evidence yet. Also we want to know the opinion of experts in this field, especially from the clinical experience and analyze the practical aspects of its application and indications.

Biological Approaches to Improve Muscle Healing After Injuries

Johnny Huard Henry J. Mankin Professor and Vice-chair for Musculoskeletal Cellular Therapeutics in the Department of Orthopaedic Surgery and in the Departments of Microbiology and Molecular Genetics, Pathology and Physical Medicine, Bioengineering, and Rehabilitation. Director of the Stem Cell Research Centre of Children's Hospital of Pittsburgh. Deputy Director of the McGowan Institute for Regenerative Medicine, United States of America

Mechanical and Biological Interaction Between Muscle Cells and the Extracellular Matrix

Richard Lieber Professor of Orthopaedics and Bioengineering, Veterans Affairs Medical Centre, and Department of Orthopaedics and Bioengineering, University of California at San Diego, San Diego, United States of America.

Regenerative Therapies in the Muscle and Tendon

Nicola Maffulli Centre Lead and Professor of Sports and Exercise Medicine Consultant Trauma and Orthopaedic Surgeon Queen Mary University of London Barts and The London School of Medicine and Dentistry William Harvey Research Institute Centre for Sports and Exercise Medicine Mile End Hospital.

Chairs:

María José Martínez Specialist in Clinical Pharmacology at the Clinical Epidemiology and Public Health Department of the Iberoamerican Cochrane Centre, Institute for Biomedical Research of the Hospital de la Santa Creu i Sant Pau, Barcelona, Spain.

Lluís Orozco Regenerative Tissue Therapy Institute at the Teknon Medical Centre (ITRT), Barcelona, Spain.

Robert Soler Regenerative Tissue Therapy Institute at the Teknon Medical Centre (ITRT), Barcelona, Spain.

Discussion panel members:

Ramon Cugat Orthopaedic Surgeon, Head of the Orthopaedic Unit at the "Mutua Montañesa", Head of Service of "Mutualidad de Futbolistas" of the Catalan Football Federation at the Trauma Institute Quiron Garcia Cugat Foundation and Senior Researcher and Sports Medicine Specialist at the Medical Services Futbol Club Barcelona.

José A. López Calbet Professor of the Department of Physical Education, University of Las Palmas de Gran Canaria, Las Palmas de Gran Canaria, Spain.

Mario Marotta Researcher at the Paediatric Surgery, Orthopaedics and Bioengineering Laboratory at the Research Institute "Institut de Recerca Hospital Universitari Vall d'Hebron", Barcelona, Spain.

Jordi Puigdellivol Orthopaedic Surgeon and Senior Researcher and Sports Medicine Specialist at the Medical Services Futbol Club Barcelona.

Lluís Til Senior Researcher at the Physiological and Functional Evaluation Department, High Performance Centre - CAR - Sant Cugat del Vallès, Spain and Senior Researcher and Sports Medicine Specialist at the Medical Services Futbol Club Barcelona.

11:00 Coffee break

11:30 Scientific evidence and clinical validation of the F.C.Barcelona Clinical Practice Guide of tendon injuries

F.C. Barcelona is one of the pioneering clubs in medical research and the application of scientifically validated protocols for prevention and treatment of injuries to its athletes. In the 2nd MuscleTech Network, the guide "Clinical practice of muscle injury" published at the journal Apunts Medicina de l'Esport was presented. We are currently in the process of validation of the Clinical Practice Guide of tendon injuries. To do this we have to put into discussion the different sections of the guidance that range control of risk factors, diagnosis, treatment and secondary prevention.

Connective Tissue, Fibroblasts and Myofibroblasts - Structure, Function and Responses to Mechanical and Physiological Stimuli

Henning Langberg Associate Professor and lecturer at the Institute of Sports Medicine, Bispebjerg Hospital, School of Health Sciences, University of Copenhagen, Copenhagen, Denmark.

Prevention and Management of Tendon Injuries

Nicola Maffulli Centre Lead and Professor of Sports and Exercise Medicine Consultant Trauma and Orthopaedic Surgeon Queen Mary University of London Barts and The London School of Medicine and Dentistry William Harvey Research Institute Centre for Sports and Exercise Medicine Mile End Hospital.

Combining Aerobic and Resistance Exercise: Can Muscle Comply?

Per A. Tesch Professor at the Department of Health Sciences, Mid Sweden University, Östersund and Department of Physiology & Pharmacology, Karolinska Institutet, Stockholm, Sweden.

Chairs:

Daniel Medina Senior Researcher and Sports Medicine Specialist at the Medical Services Futbol Club Barcelona.

Ricard Pruna Senior Researcher and Sports Medicine Specialist at the Medical Services Futbol Club Barcelona.

Discussion panel members:

Angel Cotorro Senior Researcher and Medical Director of the Medical Services of the Royal Spanish Tennis Federation. MAPFRE Tennis Medicine Centre, Barcelona, Spain.

Ramon Cugat Orthopaedic Surgeon, Head of the Orthopaedic Unit at the "Mutua Montañesa", Head of Service of "Mutualidad de Futbolistas" of the Catalan Football Federation at the Trauma Institute Quiron Garcia Cugat Foundation and Senior Researcher and Sports Medicine Specialist at the Medical Services Futbol Club Barcelona.

Alfons Mascaró Senior Researcher and Sports Physiotherapist Specialist.

Jordi Puigdellivol Orthopaedic Surgeon and Senior Researcher and Sports Medicine Specialist at the Medical Services Futbol Club Barcelona.

13:00 Lunch

14:00 Update in muscle and tendon injury and repair biomarkers.

The signalling pathway occurring after injuries, the effect of nerve activity in adult skeletal muscle, and specifically the pathways which control muscle growth and fibre type specification will be subjects in the limelight during this session. Amongst them, the study of biological markers of myoconnective injuries can help and be complementary to the imaging studies of muscle and tendon injuries. The determination of serum proteins may have a diagnostic and prognostic value of muscle and tendon injuries. These studies may reveal novel injury recovery protocols and lead to the creation of a glucose reader like device rating the injury grade.

The Mystery of Popping Sarcomeres

Walter Herzog Associate Dean of Research, Faculty of Kinesiology, The University of Calgary and Adjunct Professor, Faculty of Medicine, Department of Surgery, The University of Calgary.

What processes are taking place in the healing tendon?
Henning Langberg Associate Professor and lecturer at the Institute of Sports Medicine, Bispebjerg Hospital, School of Health Sciences, University of Copenhagen, Copenhagen, Denmark.

Cellular and Transcriptional Changes After Muscle Injury
Richard Lieber Professor of Orthopaedics and Bioengineering, Veterans Affairs Medical Centre, and Department of Orthopaedics and Bioengineering, University of California at San Diego, San Diego, United States of America.

In the Search of Human Models of Muscle Damage and Reparation: Repeated Muscle Biopsies
José López Calbet Professor of the Department of Physical Education, University of Las Palmas de Gran Canaria, Las Palmas de Gran Canaria, Spain.

Chairs:
Roser Cussó Professor at the Department of Physiological Sciences I. Biochemistry and Molecular Biology Unit. Metabolic Regulation and Molecular Pathology Group. School of Medicine, University of Barcelona, Barcelona, Spain.
Ginés Viscor Professor at the Physiology Department, School of Biological Sciences, University of Barcelona, Barcelona, Spain.

Discussion panel members:
Jordi Ardevol Senior Researcher and Sports Medicine Specialist, Orthopaedic Surgeon with specialty on Arthroscopic Surgery at the Orthopaedic Surgery and Traumatology Unit of the ASEPEYO Hospital and Clinica Diagonal, Barcelona, Spain.
Josep Cadefau University of Barcelona, Barcelona, Spain.
Franchek Drobnic Research Leader at GIRSANE - Performance and Health Research Group for High Level Sports Department of Sport Physiology, High Performance Centre - CAR - Sant Cugat del Vallès and Senior Researcher and Sports Medicine Specialist at the Medical Services Futbol Club Barcelona.
Xavier Yanguas Senior Researcher and Sports Medicine Specialist at the Medical Services Futbol Club Barcelona

16:00 Conclusions and closing remarks of the *"3rd MuscleTech Network Workshop Muscle Injuries and Repair: Current Trends in Research"*

Carles Pedret Senior researcher at the MAPFRE Medicine Tennis Centre, and Centre for Image Diagnostics, Tarragona, Spain.

Gil Rodas Scientific Director of MuscleTech Network, Senior Researcher and Sports Medicine Specialist at the Medical Services Futbol Club Barcelona.

16:45 Visit to FCB Sports City

Scientific organizers

Francesc Xavier Roca holds a B.Sci.(Hons.)/M.Sci. in Chemical Sciences by the University of Barcelona and a Ph.D. in Organic Asymmetric Catalysis with Medicinal Applications by the University of London, Queen Mary College. Complementing his scientific background pursued a Master in Business Administration, Full Time MBA with focus on marketing and innovation at ESADE Business School. Francesc Roca has a wide international experience on R&D for the pharmaceutical industry being involved in defining, planning monitoring progress, achieving research goals within a tight time frame, presenting results and conclusions to senior management, industrial sponsors and technology transfer units with various multinational companies. Complementing the scientific background, Francesc has had exposure to pharmaceutical market environments as well as assistant product manager for a key performing product interacting with a wide array of departments on this task: business intelligence, business information, reporting, forecast, regulatory, medical and legal.

As coordinator of R+D+i projects Francesc has worked in the evaluation of technical and economic feasibility of projects, strategic approach and elaboration of several project initiatives for EU FP7 and participates and currently organises several international conferences and workshops. Regarding the technology analysis and knowledge evaluation both inside companies and market perspective Francesc has been involved in various technological due diligences, developing strategic alliances with scientific associations, academia & both Catalan and National government, local and international KOL pools (universities, research institutes, scientific associations) to create, develop and manage various, scientific related, international projects.

Gil Rodas Bachelor of Medicine and Surgery from the Autonomous University of Barcelona, Specialist in Sports Medicine from the University of Barcelona in 1989 and Doctor of Medicine from the same university in 2002.Head of Medical Services of the Royal Spanish Hockey Federation Grass and RC Polo de Barcelona He was a doctor in three Olympic Games (Barcelona-92, Atlanta 96 and Sydney 2000) and member of the Spanish Olympic Committee Medical Doctor of Medical Services FC Barcelona. For three seasons was in the first medical team, who won the 2005-06 European Cup. In the 2007-08 season was incorporated into the discipline of the first basketball team, who conquered the Euroleague season 2009-10. From his private practice (Teknon Clinic) monitors and advises athletes of all levels to improve their health, evaluation of sports injuries and sports performance monitoring. He collaborates in several universities (UB, UAB ...) in both training and research. His lines of research and (international) publications have been based mainly related on the adaptation of skeletal muscle and cardiovascular exercise, and aspects related to the genetic control of injury and improvement of sports performance.

Invited speakers

Tuesday, September 27th

Thomas M. Best is Professor and Pomerene Endowed Chair, Department of Family Medicine, Professor of Biomedical Engineering and Biostatstics, Director, Division of Sports Medicine, Co-Medical Director, The OSU Sports Medicine Center, Team Physician, OSU Athletic Department, The Ohio State University, President, American College of Sports Medicine. Dr. Best is the Pomerene Chair of Family Medicine and Co-Medical Director of OSU Sports Medicine. He serves as the Team Physician for the OSU men's ice hockey team as well as a consultant to American and Canadian national hockey teams. Prior to joining the OSU Sports Medicine staff in 2005 Dr. Best spent 10 years on the faculty of the University of Wisconsin College of Medicine as well as team physician for the Wisconsin athletic department.A graduate of The University of Windsor (Canada), Dr. Best attended medical school at The University of Western Ontario. In addition to his medical training Dr. Best holds a master's degree in kinesiology and a doctorate in biomedical engineering (Duke University). Dr. Best's clinical interests include muscle/tendon injuries, osteoarthritis, concussion, endurance athletes and evidence-based medicine. His research on muscle inflammation and repair has been NIH-funded for 15 consecutive years and has resulted in over 100 peer-reviewed publications. He is co-editor of the book 'Evidence-Based Sports Medicine', now in its 2nd edition. Other research areas include; effects of the quadriceps on knee osteoarthritis, benefits of core training on injury prevention, and cytokines and low back pain. An active member in the American College of Sports Medicine (ACSM) for 21 years, Dr. Best is a fellow and the 2010-2011 President of the College. He is the Associate Editor-in-Chief of the journal Medicine and Science in Sports and Exercise, the official journal of the ACSM. He is certified by the American Board of Family Practice and holds a Certificate of Additional Qualification in Sports Medicine. He is a member of The Canadian Academy of Sports Medicine and The American Academy of Family Physicians.

Challenges and Dilemmas in Muscle-Tendon Research and Implementation to Clinical Practice

Muscle-tendon injuries are one of the most common sport-induced injuries. The healing process if defined as a complex and dynamic process ideally resulting in the restoration of anatomic continuity and function. This process is characterized by a cascade of events triggered by the injury itself. It is widely accepted that growth factors play a central role in the healing processes by modulating the recruitment, duplication, activation, and differentiation of different cell types. With techniques in molecular and cell biology and the considerable intensive interest shown by the pharmaceutical companies in developing a treatment for muscle cachexia in a range of diseases and age-related muscle wasting, the potential for increasing muscle mass and strength has attracted considerable interest. This lecture will explore the role of inflammation in muscle injury and repair. Specifically, the role of neutrophils and the respiratory burst will be investigated. The evidence for common clinical agents including non-steroidal anti-inflammatories, actovegin, and sport massage and their efficacy for modulating inflammation and repair will be explored. Studies offering promise for muscle-derived stem cells (MDSCs), as well as their challenges, will be reviewed. Newer approaches such as platelet-rich plasma (PRP) in muscle-tendon healing will also be explored in an effort to characterize future approaches to facilating muscle-tendon healing and reducing the incidence of re-injury.

Core training for hamstring/groin problems: Myths and evidence for injury prediction and prevention

Despite the high injury rate there seems to be no consensus on the management of muscle-tendon injuries, in particular the so-called hamstring strain. Anecdotal data throughout the scientific literature and popular press advocate for improved trunk control for injury treatment and, more importantly, prevention of injury involving the lower extremity as well as low back and upper extremity. Limited evidence exists to determine the specific training components of a trunk-control training program that are measurably effective at improvement of trunk control or a reduction of lower extremity biomechanical loading risk on at-risk musculoskeletal structures. Similarly, our understanding of the optimal duration of training required to elicit improvement in trunk control and biomechanical predictors is also limited. In this lecture we will explore the evidence for trunk control and its improvement through a prospective randomized trial to effect measures of trunk strength and endurance. The relationship between improved trunk control and hamstring injuries will be analyzed based on existing evidence in the literature.

Willem van Mechelen is Head Department of Department of Public and Occupational Health of VU University Medical Centre and Co- Director EMGO+ Institute of VU University Medical Centre. He is the Chairman of the Research Centre Body@Work TNO VU University Medical Centre and Director of the VUmc spin-off company Evalua Nederland B.V. ('Ltd').

Willem van Mechelen (1952) was born and raised in Amsterdam, the Netherlands. After completion of his training as a PE-teacher he worked for 9 years at an Amsterdam high school. He combined this with studying medicine at the University of Amsterdam. After his certification as an MD in 1982 he started working at various out-patient clinics as a sports and occupational physician. He also started in that year his scientific career with a part-time appointment at the Faculty of Human Movement Sciences of the Vrije Universiteit in Amsterdam. He earned his PhD in Human Movement Sciences in 1992. He also is a board certified occupational physician and a registered epidemiologist. Currently, he is employed by the VU University Medical Centre in Amsterdam as a full professor of Occupational and Sports Medicine.

Cost-effective secondary prevention of musculo-skeletal problems; myth or reality?

In current evidence-based medicine there is a need for proven effectiveness of interventions and treatment, also for musculo-skeletal problems. In addition there is, in the light of reduced financial resources, a need for the proven cost-effectiveness of interventions and treatment. Along these lines in this presentation 2 examples will be given of cost-effective secondary prevention. It concerns results of a trial conducted within KLM Royal Dutch Airlines in workers off-work, because of non-specific low-back pain, as well as the results of a trial to prevent recurrent cases of lateral ankle ligament injury in sports. In addition a cost-effective screening tool to prevent work absenteeism will be briefly introduced.

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fem
Forum Egarsat del Músculo

Presentation of the magazine FEM – Forum Egarsat del Múscul

Forum Egarsat del Múscul is an independent platform to disclose and share information, give advice and opinion about the importance of the skeletal muscular system, prevention of possible injuries and muscular well-being. Based on the current improvements, scientific innovations as well as to the experience developed from the elite sport, Forum Egarsat del Múscul is focused to create awareness on the importance of preventing muscular injuries, encourage an open communication between society and research, rise interest in the mechanisms of muscle damage and repair to promote healthier ageing and finally to promote the conscious sport practice.

Forum Egarsat del Múscul is integrated by MuscleTech Network, the Fundació Futbol Club Barcelona and Egarsat. (www.fem.ulled.com)

Pierre Portero is professor and holds a PT degree from the National School of Physiotherapy in Paris (1977) and received his PhD degree in Biomedical Engineering from the University of Technology of Compiègne (1993). He is currently working as a professor at the Sport Science Department of the University Paris-Est Créteil. His research activities take place in the Neuro-Orthopaedic Rehabilitation department at the Rothschild Hospital in Paris where he is in charge of the researches on human movement and muscle biomechanics with specific reference to muscle disease, and cervical spine. He has published over 60 scientific articles, 27 book chapters and over 100 invited conferences (including over 40 at international level). He has been invited as referee by 15 indexed international journals. He has served as visiting or invited professor at Auckland University of Technology (NZ) and University Saint-Joseph in Beirut (Lebanon). He is involved in several scientific organisations (e.g. International Organization for Standardization (ISO), European Neuromuscular Centre). He serves also as expert advisor in many national organisations as the National Agency for Health Accreditation and Evaluation (HAS), the French Association against Neuromuscular Disorders (AFM), the French Ministry for Research, the French Ministry of Defence (Health Department), the University of Teeside (UK), Royal Society of New Zealand (Rutherford Foundation).

Characterization of the passive mechanical properties of the muscle-tendon complex using isokinetic dynamometers

Traditionally, isokinetic dynamometers have been used to measure variables associated with strength, power, and endurance characteristics of muscle. Much less attention has been given to their potential for measuring parameters associated with tissue extensibility. Researchers have commented that there is a need for more information on the prescription of stretching routines to enhance the safety and the results of stretching programs. The use of dynamometers to examine responses to stretching can provide important information allowing a more precise stretching prescription to be instituted. Furthermore, dynamometers can be used as training equipment to facilitate improvements in range of motion. Stretching not only improves range of motion, it also reduces the tension in muscles at any particular muscle length and therefore influences stiffness. These reductions in tension occur in the tendons, contractile elements and the connective tissues that serve as a framework for the muscle. The relative contribution of these tissues to the decrease in tension is not known. Studies have generally found that muscle contractile elements when inactive are less stiff than the tendon, however, when muscle is activated; the tension in the contractile elements can rise to levels similar to those recorded in the tendon. When muscles are stretched past approximately 80 percent of their maximum range of motion, they often become active. It seems likely that much of the early gains in range of motion occur as a result of reduced muscle activity rather than structural changes to the muscle. Structural adaptations are more likely to be observed over weeks of stretching. The ideal prescription for stretching remains unknown. Current evidence suggests that stretches should be held for 20-30 seconds, that the first stretch provides the most gains, and that initial stretches should be undertaken slowly to limit stress in the tissues. There is some evidence that the type of stretch (static or dynamic) can influence the degree to which range of motion increases or stiffness is reduced. Static stretches are more likely to influence range of motion while dynamic stretches are more effective in reducing stiffness. Whether to stretch for sports or not depends upon the type of sport being played and the range of motion and stiffness of the individual. If a person has sufficient range of motion, then the need to undertake stretching is diminished. In sports where there is concentric muscle action primarily and the stretch-shorten cycle is not required, the need to stretch is less compared to sports that require large amounts of jumping and landings.

Passive viscoelastic characteristics of the calf muscle-tendon complex in former international female gymnasts vs. control subjects

The purpose of this study was to examine the difference in passive viscoelastic characteristics of the calf muscle-tendon unit between former international female gymnasts and controls. Gymnasts usually start intensive training from early childhood. The impact of such strenuous training on the musculoskeletal system is not clear and needs to be investigated.Seven former international female gymnasts that have stopped intensive training for 5 to 17 years and 6 sedentary subjects participated to the study.An isokinetic dynamometer was used to passively stretch the right calf muscle-tendon unit from relaxed plantar flexion to the maximal angle of dorsiflexion (ROM) at 5°.s-1. The maximal passive resistive torque was measured and average passive stiffness was calculated between 15 and 25° of dorsiflexion and for the final 10% of ROM. The area under the moment-angle curve was calculated as the average of absorbed passive-elastic energy. In addition, the maximal voluntary torques of the plantar flexors and extensors were also measured. Despite

similar maximal voluntary plantar flexion and dorsiflexion torques, former international gymnasts exhibited significant higher maximal passive dorsiflexion ROM (+35%), maximal passive resistive torque (+48%) and passive-elastic energy (+63%). Furthermore, former gymnasts showed significant lower passive stiffness within the 15-25° of dorsiflexion (-33%) and higher for the last 10% of ROM (+41%). Although speculative, these results suggest that long term loading during childhood have modified passive properties of the calf muscle-tendon unit of former international female gymnasts that persist several years after the cessation of sport practice. Longitudinal follow up will assist in determining whether or not passive properties of plantar flexors is genetically determined and/or able to be modified with further gymnastic training.

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Clinical Prognostic values in Hamstring Injuries.

Muscle injuries are among the most common, most misunderstood, and inadequately treated conditions in sports. According to some studies, muscle injuries account for 10 - 30% of all injuries in sport. Hamstring injuries are the commonest muscle injury in all Sports. Hamstrings function is complex. Depending on leg positioning and relationship to the ground it can serve as a hip extensor, knee flexor, and external rotator of the hip and knee .Long head receives innervations via a tibia portion of the sciatic nerve, the short head receives innervations from the common personal nerve. The mechanism of the injury is very important to know. Contraction injuries occurring during Running at Maximal or Near-Maximal Speed Primary involve biceps femoris, long head and they heal faster comparing to stretching injuries occurring in Dancing or kicking and primary involving Semimembranosus, proximal tendon. Various systems have been used to classify the severity of the injury. They classify them in three grades, as mild .moderate, severe, according to imaging findings, time to walk pain-free. Our Clinical classification is based on estimating the knee active range of motion deficit between the injured and the healthy side. Ultrasound is used to image the muscle lesion. Following a clinical classification we are able to decide for the treatment, to design the rehabilitation protocol to predict the time to full rehabilitation and to assess the reinjure rate. We must always keep in mind to differentiate Common Signs and Symptoms of a Hamstring Strain Injury Compared to Those Referred to the Posterior Thigh from another Source. Rehabilitation is one of the key points dealing with Hamstring injuries .We as clinicians have to prescribe the right clinical application correlated to each healing process phase. Operative intervention is reserved only for severe injuries, such as complete rupture of the hamstring muscles, either at the insertion or at the origin (avulsion). The reinjure rate for hamstring injuries has been found to be 12–31% Early return to sport & poor rehabilitation program met with a high risk of reinjure According to our clinical classification Objective clinical findings can provide an effective clinical tool to assess the risk of re-injury following acute hamstring muscle strains in elite track and field athlete. In terms of Prognosis the following factors have been shown to require a greater convalescent period: injury involving a proximal free tendon, proximity of the injury to the ischial tuberosity, increased length and cross-sectional area of injury. Past history of hamstring injury is the main risk factor for the next injury. Being unable to walk at a normal pacepain-free within 24 h of injury was independent predictor of being unable to return to play in less than 4 weeks from the time of injury. Defining the severity of the injury enable us to assess the expected return to play timescale which is important in guiding rehabilitation and in team planning.

Cost-effective prevention of lateral ankle injury

Injuries to the lateral ankle ligaments constitute 15% to 45% of all sports related Injuries. Underestimating the frequency and the impact of acute ankle ligament Injuries leads to poor diagnosis, unsuitable management, and long-term complications. Earlier studies indicate that 85% of ankle sprains involve forced inversion and plantar flexion [6]. Eighty percent of lateral ankle sprain injuries most commonly involve the anterior talofibular ligament (ATFL). In 20%, more violent inversion force damages the calcaneofibular ligament (CFL) as well. Various systems have been used to classify the severity of the injury. They classify them in three grades, as mild .moderate, severe. In our setting, we plan the initial management of ankle

sprain according to pain, ability to bear weight, range of motion (ROM), oedema (EDE), and stress radiographs. In addition, we routinely measure active ROM, and quantify the presence of EDE by the figure-of-eight method. We had the clinical impression that the grading of ankle sprains in athletes. Could be enriched by further sub grouping.Recently, we proposed a new classification system into 4 categories (I, II, IIIA, IIIB). Our Clinical classification based on estimating the ankle active range of motion deficit between the injured and the healthy side The extent of the acute swelling was measured in cm by using the figure of eight method and AD ankle radiographic stress evaluation. Following a clinical classification we are able to decide for the treatment, to design the rehabilitation protocol to predict the time to full rehabilitation and to assess the reinjure rate. Defining the severity of the injury enable us to assess the expected return to play timescale which is important in guiding rehabilitation and in team planning. Rehabilitation is one of the key points dealing with Ankle Ligament Injuries. Treating ankle sprains in elite athletes is a challenge for both the physician and the patient. The pressing question when managing such an injury is how to shorten the time required for full and safe return to sports. One of the main key points for rehabilitation is to induce the proper application of therapeutic intervention, according to the healing process phases. The reinjure rate for Ankle Ligament Injuries has been found to be 10%–73 % Early return to sport & poor rehabilitation program met with a high risk of reinjure According to our clinical classification Objective clinical findings can provide an effective clinical tool to assess the risk of re-injury following Ankle Ligament Injuries in elite track and field athletes. From our study regarding re injury rate of Ankle Ligament Injuries we conclude that Athletes with a grade I or II lateral ankle sprain are at higher risk of experiencing a re injury. Low-grade acute lateral ankle sprains result in a higher risk of re injury than high-grade acute lateral ankle sprains. The results of our study provide cost-effectiveness and general applicability predictive criteria for the evaluation of patients with acute lateral ankle sprain, and may be useful for further studies on this topic.

Carl Askling is a researcher and lecturer in Sports Medicine at the Swedish School of Sport and Health Sciences and the Section of Orthopaedics and Sports Medicine, Department of Molecular Medicine and Surgery, Karolinska Institutet, Stockholm, Sweden. He defended his Thesis, "Hamstring muscle strain" at Karolinska Institutet 2008. He is supported by The Swedish Centre for Sport Research in his ongoing research that deals with different types of acute hamstring strains in especially soccer/track and how to optimize the rehabilitation period and how to prevent these injuries.

High-speed running type or stretching-type of hamstring injuries makes a difference to MRI findings

Hamstring strains are a heterogeneous group, especially in terms of the different types of injuries, injury location and size. A majority of the strains are located in the proximal part of the hamstring muscles/tendons and the anatomy is complex, characterized by overlapping tendons and structural interrelations between the hamstrings muscles. Different sports put different demands on the hamstrings, for example the elite sprinter probably needs full functional recovery after injury before competing again, but a football player can possibly play again without 100% restored function. Even psychological aspects on an individual level can affect the rehabilitation period. All these parameters make the prognosis after acute hamstring strains in terms of rehabilitation time and safe return to sport difficult to predict.There are at least two distinctly different types of acute hamstring strains, which are best distinguished by the different injury situations. The most common injury type occurs during high-speed running and the other occurs during movements leading to extensive lengthening of the hamstrings, such as; high kicking, sliding tackle and sagittal split. The *high-speed running type* is mainly located to the long head of biceps femoris and typically involves the proximal muscle-tendon junction. In contrast; the *stretching-type* is located close to the ischial tuberosity and typically involves tendon tissue of the semimembranosus. In a prospective randomized ongoing study (Askling CM. et al) dealing with acute hamstring strains in elite football (n=80), track and field (n=50) and other sports (n=40) we have noticed that different injury situations can result in different types of hamstring strains; for example, comparing hamstring strains typically sustained by sprinters versus dancers. The injury situation and the injury location can give important information about the injury prognosis.
In the presently ongoing study (Askling CM. et al) on acute hamstring strains (170 elite athletes included), where the aim is to compare two different rehabilitation protocols, i.e. conventional exercises versus lengthening exercises, with respect to time loss and return to sports, we have observed that the protocol that included lengthening exercises shortens the rehabilitation period significantly in both types of hamstring injuries. Before the athletes are allowed to return to full training and competition they should perform a hamstring test without any remaining symptoms or signs of injury. So far we have only noticed one re-injury in athletes included in the study. Taken together, hamstring injuries are more common than previously anticipated and it has become increasingly known how difficult they are to treat. Recurrences are common, but can probably be avoided to a large degree, provided sound knowledge about the injury type, injury location and size.

Wednesday, September 28th

Johnny Huard PhD, is the Henry J. Mankin Professor in the Department of Orthopaedic Surgery and hold secondary appointment in the departments of Microbiology and Molecular Genetics, Bioengineering, Pathology and Physical Medicine and Rehabilitation. He is the current Director of the Stem Cell Research Center of Children's Hospital of Pittsburgh. Dr. Huard is also a Deputy Director of the McGowan Institute for Regenerative Medicine (MIRM) and an Associate Director of the Pittsburgh Tissue Engineering Initiative (PTEI). Finally, Dr. Huard is co-founder of Cook Myosite, Inc, a biotechnology company.Dr. Huard's main research focus continues to expand the possibilities of regenerative medicine through the use of adult stem cell to improve the healing of various tissue of the musculoskeletal system. He has made significant preclinical advances in the isolation, identification and characterization of post-natal muscle-derived stem cells. He is currently using those findings to explore and develop cutting-edge treatment programs to address Duchenne muscular dystrophy (DMD) and a variety of musculoskeletal conditions including skeletal and cardiac muscle injuries as well as the regeneration of bone and articular cartilage. Clinical trial using muscle derived stem cells has been initiated for the treatment of patients suffering from urinary incontinence and this stem cell technology is also being explored to treat patients suffering from cardiac injury. Dr. Huard's research program is funded by a variety of sources including the National Institutes of Health, the Department of Defense, Muscular Dystrophy Association, as well as other private and public foundations. He has published over 200 manuscripts in peer reviewed journals. In 2003, Dr. Huard was recognized by University of Pittsburgh Chancellor Mark A. Nordenberg, as a recipient of the Chancellor's Distinguished Research Award. He was also the recipient of the Orthopaedic Society's prestigious Kappa Delta Award in 2004.

Regenerative Medicine based on Adult Stem Cells for Musculoskeletal Tissue Regeneration & Repair

Members of my laboratory have isolated various populations of myogenic cells from the postnatal skeletal muscle of normal mice on the basis of the cells' adhesion characteristics, proliferation behavior, and myogenic and stem cell marker expression profiles. Although most of these cell populations have displayed characteristics similar to those of satellite cells, we also have identified a unique population of muscle-derived stem cells (MDSCs). MDSCs exhibit long-term proliferation and high self-renewal rates and can differentiate toward various lineages, both in vitro and in vivo. The transplantation of MDSCs, in contrast to that of other myogenic cells, can improve tissue regeneration mainly through their ability to highly survive the microenvironment they are transplanted into. This survivability appears to be due to their increased resistance to oxidative and inflammatory stress and their ability to secrete paracrine factors in response to local environmental cues. I will discuss the use of MDSCs in gene therapy and tissue engineering applications designed to improve peripheral nerve, bone and articular cartilage healing. Further, I will discuss the genetic modification of MDSCs to express osteogenic proteins (BMP2 and -4), angiogenic factor VEGF and anti-angiogenic factors and how these types of modifications can enhance the cells ability to regenerate these various tissues. I will also outline in my presentation new results obtained with adult stem cell technology to delay aging in an animal model of accelerated aging (progeria). Finally, I will present new results on human muscle derived stem cells, which we believe will open new avenues for the use of muscle stem cell-based gene therapy and tissue engineering to improve tissue regeneration

Biological Approaches to Improve Muscle Healing after Injuries

Muscle injuries are extremely common and have a high tendency to reoccur. Both limitations in force production and re-injury frequently are attributed to the development of regeneration-restrictive fibrotic tissue at the original site of injury. Gene therapy may prove useful for the development of techniques to improve the healing of muscle injuries. Transforming growth factor-beta 1 (TGF-β1) plays a key role in inducing the formation of fibrotic tissue that limits muscle healing after severe injury. Muscle Stem Cells have exhibited the capacity to differentiate into a myofibroblast-like lineage *in vitro* and can contribute to scar formation after muscle injury *in vivo*. Various inhibitors of TGF- β1, including relaxin, decorin, gamma-interferon, suramin and losartan can improve muscle regeneration and force production by limiting muscle fibrosis. Relaxin and decorin are molecules that can be expressed by cells and delivered to muscle via gene therapy techniques. Gamma-interferon, suramin and losartan represent drugs with other clinical indications and are potentially

available for clinical use. However, due to the potential side-effects of some of these agents, further research must be performed in order to determine clinical safety. *Ex vivo* gene therapy techniques may provide a method to deliver inhibitors of TGF-β1 to injured muscle. The proteoglycan, decorin, appears to be beneficial, not only for reducing fibrosis, but also for improving muscle regeneration. Delivery of MDSCs expressing decorin or a viral vector carrying decorin to injured muscle may help to improve long-term outcomes by reducing muscle fibrosis and hence the recurrence of injury. The protein, myostatin has been shown to inhibit muscle growth and enhance the deposition of fibrosis. Follistatin has been shown to inhibit myostatin and produces muscle hypertrophy and improves muscle strength. In this talk, we will review the current knowledge concerning the use of gene therapy and tissue engineering applications based on muscle stem cells to improve the recovery of skeletal muscle after injuries and disease.

Richard Lieber Professor of Orthopaedics and Bioengineering, Veterans Affairs Medical Centre, and Department of Orthopaedics and Bioengineering, University of California at San Diego, San Diego, United States of America. Rick Lieber earned his Ph.D. in Biophysics from U.C. Davis in 1982 developing a theory of light diffraction that was applied to mechanical studies of single muscle cells. He joined the faculty of U.C. San Diego in 1985 where he has spent his entire academic career and is now Vice-Chair of the Department of Orthopaedic Surgery. Dr. Lieber's work is characterized by its interdisciplinary nature—an approach that is relevant to those who study biomechanics and Orthopaedic Surgery. He has published almost 200 articles in journals ranging from the very basic such as The Biophysical Journal and The Journal of Cell Biology to those more applied such as The Journal of Hand Surgery and Clinical Orthopaedics and Related Research. More recently, he has implemented molecular biology tools to understand gene expression patterns in muscles subjected to high stress and in performing mechanistic studies of muscles in which genes are introduced to muscles in an attempt to change their mechanical function. In recognition of the clinical impact of his basic science studies, Dr. Lieber has been honored by the American Academy of Orthopaedic Surgeons (Kappa Delta Award), the American Bone and Joint Surgeons (Nicolas Andry Award) the American College of Sports Medicine (Fellow), and the Council for the International Exchange of Scholars (Fulbright Fellowship) and the American Society for Biomechanics (Borelli Award). His research laboratory is supported primarily by grants from the Department of Veterans Affairs and National Institutes of Health.

Mechanical and Biological Interaction Between Muscle Cells and the Extracellular Matrix

Skeletal muscle is a composite tissue of muscle cells embedded in the extracellular matrix (ECM). Recent studies suggest that injury to muscle is largely a result of the mechanical and biological interactions between cells and ECM based on the tremendous shear stresses that exist at that interface. Unfortunately, attempts to understand muscle cell-ECM interactions are hampered by the fact that the precise structural features that characterize this region. We have begun a series of biomechanical and structural studies of cell-ECM interactions that demonstrate that this interface can remodel dynamically and mount a systematic biological response. These studies are based on quantitative electron microscopy and simultaneous biomechanical and confocal microscopy.

Cellular and Transcriptional Changes After Muscle Injury

Forced lengthening of skeletal muscles (i.e., "eccentric contractions") produce injury and, ultimately, muscle strengthening. Such contractions are common in everyday movements as well as sports activities. Because they are mechanically unique and have dramatic biological consequences, it is becoming increasingly popular to study the mechanics and biology of eccentric contraction-induced muscle injury. Current data suggests that the earliest events associated with injury are mechanical in nature and are based primarily on sarcomere strain. Such strain results in relatively rapid breakdown or reorganization of cytoskeletal elements within the muscle cell can causes waves of muscle-specific gene expression. We have developed models of muscle injury that mimic the effects seen in humans. In addition, the use of muscles with "knocked out" or modified cytoskeletal proteins give insights into load bearing and transmission in skeletal muscle. Ultimately, an improved understanding of the damage mechanism may improve our ability to provide rehabilitative and strengthening prescriptions that have a rational scientific basis.

Nicola Maffulli, MD, MS, PhD, FRCS (Orth) and Professor. Centre Lead and Professor of Sports and Exercise Medicine Consultant Trauma and Orthopaedic Surgeon Queen Mary University of London Barts and The London School of Medicine and Dentistry William Harvey Research Institute Centre for Sports and Exercise Medicine Mile End Hospital. Dr. Nicola Maffulli has particular interest in Foot and ankle surgery, Sports trauma, Deformity correction and Complex trauma, knee and ankle arthroscopy, minimally invasive surgery. He has written, been editor of or has contributed to well over 600 published works. He is now Centre Lead and Professor of Sports and Exercise Medicine Consultant Trauma and Orthopaedic Surgeon at Queen Mary University of London Barts and The London School of Medicine and Dentistry Institute of Health Sciences Education and Centre for Sports and Exercise Medicine Mile End Hospital.

Regenerative therapies in the muscle and tendon

New regenerative therapies have been recently developed to manage muscle and tendon injuries. For example, scaffolds to bridge massive rotator cuff tears and adjuvant biologic modalities including growth factors and tenocyte-seeded scaffolds to augment tendon-to-bone healing have been used. Biomechanical constructs for rotator cuff repairs have been also used to bridge large gap in tendon injuries. The success of the repair depends on biologic healing at the tendon-to-bone junction. Platelet Reach Plasma (PRP) is considered to accelerate muscle and tendon healing and allow early return to elite competition, and it is often recommend as best practice for management of musculoskeletal injuries. Even though several growth factors abundant in PRPs have been extensively studied in tissue regeneration, the key factors are yet unknown. Given our rudimentary knowledge of the mechanism of action of the PRPs, it is challenging to use this technology to promote early healing, and produce improved and accelerated functional recovery. We prompt researchers to undertake appropriately powered level I studies with adequate and relevant outcome measures and clinically appropriate follow up. Therefore, major issues, including standardization of formulations and application procedures, need to be addressed to inform clinical studies before recommending best practice guidelines.

Prevention and management of tendon injuries

Tendon injuries can be acute or chronic and caused by intrinsic or extrinsic factors, either alone or in combination. Tendinopathy is essentially a failed healing response with haphazard proliferation of tenocytes, abnormalities in tenocytes with disruption of collagen fibers, and subsequent increase in non-collagenous matrix. The scientific evidence base for managing tendinopathies is limited. Minimally invasive techniques in orthopaedic surgery minimize the problems posed by open surgery, reducing complications and postsurgical recovery. Minimally invasive surgery represents new options for the management of tendinopathy. Open surgery aims to excise fibrotic adhesions, remove areas of failed healing, and make multiple longitudinal incisions in the tendon to detect intratendinous lesions and to restore vascularity and possibly stimulate the remaining viable cells to initiate cell matrix response and healing. New surgical techniques aim to disrupt the abnormal neoinnervation to interfere with the pain sensation caused by tendinopathy. These procedures are intrinsically different from the classical ones in present use as they do not attempt to directly address the pathological lesion, but act only to denervate them. They include endoscopy, electrocoagulation, and minimally invasive stripping. Percutaneous longitudinal tenotomy is simple, requires only local anaesthesia, and can be performed without a tourniquet. If post-operative mobilisation is carried out early, preventing the formation of adhesions, this will allow the return to high levels of activity in the majority.

Henning Langberg, DMSc, Ph.D. PT, is associate professor of the Institute of Sports Medicine – Copenhagen, Bispebjerg Hospital and Centre for Healthy Ageing, Faculty of Health Sciences, University of Copenhagen, Denmark. Henning Langberg holds a MSc and a PhD from the University of Copenhagen, Denmark and a DMSc on tendinopathy. He is a specialist in Sports Medicine and the co-Found of the Institute of Sports Medicine – Copenhagen, Denmark. He is head of the research group on "Tendionpathy – from basic science to evidence based rehabilitation" and in charge of research on adaptation of connective tissue to exercise and loading. He is a highly used lecturer at national and international conferences and has more than 60 invited key-note lectures, and published more than 100 scientific peer-review articles and several book chapters in the area of sports medicine, basic science and related areas. He has served in many international and national scientific and professional organisations including as a board member for the International Federation of Sports Physiotherapy. He is recipient of several international and national awards including the Research Award of the International Federation of Sports Physiotherapy.

Connective tissue, fibroblasts and myofibroblasts - structure, function and responses to mechanical and physiological stimuli

Tendons are fibrous, tension-bearing elements interposed between the muscles and bones designed to transmit the forces generated by the muscles to the skeleton effecting limb movement. It is well established that skeletal muscle can adapt to changes in functional requirements and to increases in loading e.g. with exercise through quantitative mechanism based on changes in muscle mass and fibre size through satellite cell activation, muscle hypertrophy, and a qualitative mechanism based on a change in fibre type distribution. The change in muscle power increases the forces distributed from the muscles through the tendons [5] and increases the stress on the connective tissue within the muscle as well as on the tendons in series with the muscles fibers. This may lead to a situation where the forces on the tendons exceed the strength of the tissue with the risk of sustaining injuries. It may thus be essential for the tendons to precede the potential to adapt to these changed by increases in fibroblast activation, increases in strength and vascularisation to avoid injury. This is supported by data indicating a close relationship between cross-sectional areas of muscles and their tendons. In order to maintain this relationship and withstand the increase in load the tendons need to adapt to the new situation by increasing tissue strength either by increased collagen synthesis by the fibroblasts leading to hypertrophy, increased cross-links or increased tissue density. Overuse of tendon tissue resulting in pain and malfunction represents a major problem within sports and ergonomics stressing that adaptation of the tendon tissue is not always sufficient to withstand the increase in loading on the connective tissue during physical activity. However in spite of the high incidence of tendon overuse injuries and compared with muscle tissue, only little is known about the adaptive response of tendons to changes in loading. A new perspective of the research is that we have been able to form new tendons (constructs) which will allow us to test the effect of various interventions or growth factors on tissue quality and functional parameters. Though no conclusive data exists but hypothesis with relevance for clinical practice will be presented.

What processes are taking place in the healing tendon?

Despite a high and increasing incidence of patients with Achilles tendon problems the underlying etiology of Achilles tendinopathy as well as the pathology leading to the disease is still largely unknown.
The collagen structure in the tendinopathic area has been found to have a significantly increased number of small diameter fibrils per $\mu m2$. In addition an increased volume fraction of cells in the tendinopathic part of the tendons has been determined. Overall collagen turnover is increased with increased mRNA levels for markers of collagen synthesis (Collagen 1, Collagen 3, Fibronectin, Tenascin C, TGF-b and Fibromodulin) and markers of collagen breakdown (MMP-2, MMP-9 and TIMP 2). No signs of increased wound healing or pain producing mediators has been found. IN summery this indicates that an increased turnover of connective tissue takes place in tendinopathic tendons, associated with an increased number of cells and a higher expression of related structural proteins and factors involved in controlling the formation of fibrils. No signs of fibrillogenesis, inflammation or wound healing can be determined supporting the notion of tendinopathy being an ongoing degenerative process with increased tissue turnover.

Per A. Tesch Professor at the Department of Health Sciences, Mid Sweden University Östersund and Department of Physiology & Pharmacology, Karolinska Institute, Stockholm, Sweden, adjunct Professor at Ball State University, Muncie, IN and the Texas A&M University, College Station, TX. Per Tesch (1950) borned and raised in Stockholm, Sweden, received a PhD in Physiology from the Karolinska Institute, Stockholm in 1980. He completed his Post-Doc training at the US Army Research Institute of Environmental Medicine at Natick, MA., and held positions at NASA's Kennedy Space Center, FL., and the University of Arkansas for Medical Sciences. While Dr. Tesch's early research dealt with classical sports performance and physiology issues and muscle metabolism, over more recent years his research focuses on skeletal muscle adaptations to resistance exercise, muscle disuse and methods to counteract muscle loss. Dr. Tesch is also founder of the Tesch-Övermo Foundation (www.teschovermo.se)

Improving Health through better Muscle Health

Skeletal muscle is by far the largest organ of the human body. As such its role is critical in maintaining vital hormonal and metabolic functions. Thus, a significant loss in muscle size resulting from disuse, inactivity, disease or aging may have profound effects on health. Exercise countermeasures, based on space research, have proven efficacy in maintaining muscle size and performance under these conditions. Methods to maintain or improve "muscle health" as well as results from studies of athletes still competing at age 90 will be discussed.

Combining aerobic and resistance exercise: Can muscle comply?

Chronic aerobic and resistance exercise result in contrasting skeletal muscle adaptations. While many athletes are required to incorporate both exercise modalities in their training routines, the compatibility of these two exercise modes has been scrutinized. In particular, if preceded by aerobic exercise, it appears skeletal muscle adaptations promoted by resistance training, might be attenuated. Research exploring skeletal muscle responses to concurrent aerobic and resistance exercise will be presented.

Walter Herzog is Associate Dean of Research, Faculty of Kinesiology, The University of Calgary and Adjunct Professor, Faculty of Medicine, Department of Surgery, The University of Calgary.Walter Herzog received his BSc degree in Physical Education from the Federal Technical Institute in Zurich, his combined MSc/PhD in Biomechanics from the University of Iowa, and did postdoctoral training in Biomechanics and Neuroscience at the University of Calgary. Presently, he is a Professor in Kinesiology, Engineering and Medicine at the University of Calgary; he is the Killam Memorial Chair at Calgary and a Canada Research Chair in Molecular and Cellular Biomechanics. His research interests are in muscle mechanics, joint biomechanics and the clinical application of musculoskeletal biomechanics.

The Mystery of Popping Sarcomeres

AV Hill introduced the notion that muscles are unstable on the so-called descending limb of the force-length relationship. This notion has been based on the fact that connecting the statically observed maximal forces at different muscle lengths gave a negative slope, that is, maximal isometric forces decreased with increasing muscle lengths. Needless to say that any material with such properties would be highly unstable, if this was not only a static but also a dynamic property. The notion of instability was adopted by many without checking the dynamic properties of muscles. Furthermore, support for such instability was provided by experiments using single muscle fibre testing and relating findings to individual sarcomeres. This led to the notion that a muscle that is actively stretched on the descending limb of the force-length relationship becomes injured because of sarcomere instability, the associated differences in sarcomere forces, and the corresponding stretch of the weakest sarcomeres to length beyond actin-myosin filament overlap; the so-called popping sarcomere hypothesis. Popped sarcomeres are thought to be indicative of structural damage and to be responsible for the loss of force associated with active stretching of muscles.

In order to address questions of muscle injury on the sarcomere level, and tackle the ideas of instability and sarcomere popping, we developed approaches for the testing of single myofibrils (a sub-cellular organelle of serially arranged sarcomeres), and, for the first time ever, the testing of mechanically isolated sarcomeres. Three main results that will be discussed and that relate to the notion of eccentric muscle injuries are (i) that sarcomeres are stable (not unstable) on the descending limb of the force-length relationship, (ii) that sarcomeres' passive forces increase dramatically when a muscle is activated, and (iii) that popping of sarcomeres protects against injury and loss of force, rather than cause loss of force in eccentrically damaged muscles.

José Antonio López Calbet is professor of Exercise Physiology, University of Las Palmas de Gran Canaria. Canary Islands, Spain. Master in Sports Sciences at the University of Barcelona Medical doctor (Hospital Clinic Barcelona) University of Barcelona. Specialty in Sports Medicine at the University of Montpellier (France) and University of Barcelona Specialty in Rheumatology PhD at the University of Barcelona. Postdoctoral appointments: The Copenhagen Muscle Research Centre, Rigshospitalet, Copenhagen, Denmark. Main topics of research: cardiovascular response to exercise; obesity and exercise, with emphasis on the molecular mechanism by which leptin and insulin act on human skeletal muscle. More than 120 papers in peer reviewed journals.Thirty six book chapters. About 120 invited lectures in Spain and other countries.More than 25 research grants at national and international level.Member of the editorial board of: Journal of Applied Physiology; Scandinavian Journal of Medicine and Science in Sports, European Journal of Applied Physiology, PLoS One and The Journal of Physical Activity and Health. Member of the Scientific Board of the European College.

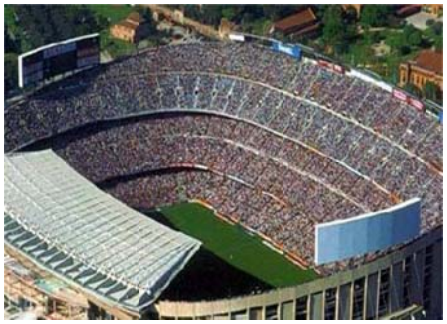
In the search of human models of muscle damage and reparation: repeated muscle biopsies

Prevention of muscle or tendon injuries is a major focus in the preparation of athletes. However, very little sound scientific knowledge is available on the effectiveness of preventive treatments. It seems that eccentric training can be applied successfully to prevent muscle and tendon injuries, but the mechanism through which this is achieve remains unknown. Little is also known about pharmacologic of nutritional strategies to prevent these injuries. However, much more is known about how to reduce ischemic damage in the heart, which shares some similitude with the skeletal muscles. To increase our knowledge on how to prevent and treat muscle or tendon injuries, new experimental models will be needed to explore the specific signaling pathways involved in: a) enhancing the neuro-mechanical competence of muscles and tendons and b) initiating the process of reparation. In this presentation we will shown how repeated muscle biopsies could be used to both cause a muscle injury and then study the signaling involved in the process of reparation directly in humans. We have recently shown that an early event after muscle damage is the activation of the STAT3 signaling pathway, likely mediated by interleukin 6 (IL-6). By understanding the molecular mechanism involved in muscle reparation it will be easiest to elaborate strategies pharmacological (or other type) strategies to prevent muscle damage and accelerate reparation and functional recovery.

Practical information

VENUE OF THE MEETING

Futbol Club Barcelona
c/ Arístides Maillol, s/n. Barcelona



SPEAKER'S HOTEL

Hotel Catalonia Barcelona 505
c/ Muntaner, 505. Barcelona. Phone:+34 932128012

VISIT TO FUTBOL CLUB BARCELONA

Tuesday, 27th
c/ Arístides Maillol, s/n. Barcelona

VISIT TO SPORT CITY FROM FCB

Wednesday, 28th
Esplugues de Llobregat

CONTACT PEOPLE DURING THE EVENT

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Organizers:

biocat International Center for Scientific Debate

Initiative fostered by: Welfare Projects "la Caixa" Foundation

The **International Center for Scientific Debate** (ICSD) is an initiative of Biocat, fostered by Welfare Projects "la Caixa" Foundation, which aims to drive top-notch international scientific meetings promoting dialogue, collaboration and open exchange of knowledge among experts of renowned prestige and the Catalan Scientific community. The meetings are global, integrative and multidisciplinary focused helping to tackle social needs in the field of life sciences and health, taking into consideration the complexity and constantly changing conditions of the world. The ISCD also aims to collaborate in the dissemination of knowledge, approaching science to society and contributing to position Barcelona and Catalonia as a city and a country of scientific excellence.
More information: www.biocat.cat/en/icsd

muscle tech network

Muscletech Network is a knowledge network in muscle and tendon. The positive effects of sport and physical activity on health and personal welfare of the general population are well known. However, the promotion of healthy practices in sport, the correct application of treatment protocols in injuries, the practices of sports medicine and exercise to maintain and improve health and quality of life are issues that must be substantially strengthened in a world with changing habits.
More information: www.muscletechnetwork.org

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Fundació Futbol Club Barcelona was constituted in 1994, the Fundació FC Barcelona has been an eternal source of civilian participation through the numerous social, cultural and sporting activities that the club has organised, and which reflect the advanced society in which the club is located and the way that the Foundation is such an ideal vehicle for promoting them. In 2006 FC Barcelona joined the United Nations Millennium Development Goals and donated of 0.7% of the club's ordinary income to the Foundation to support its programmes and projects. This has led to the strengthening of our early alliances with Unicef, UNESCO and UNHCR/ACNUR, and was culminated with Futbol Club Barcelona being awarded a position as a member of the ECOSOC (Economic and Social Council of the United Nations).
More information: www.fcbarcelona.com/web/Fundacio/english/fundacio/missio.html

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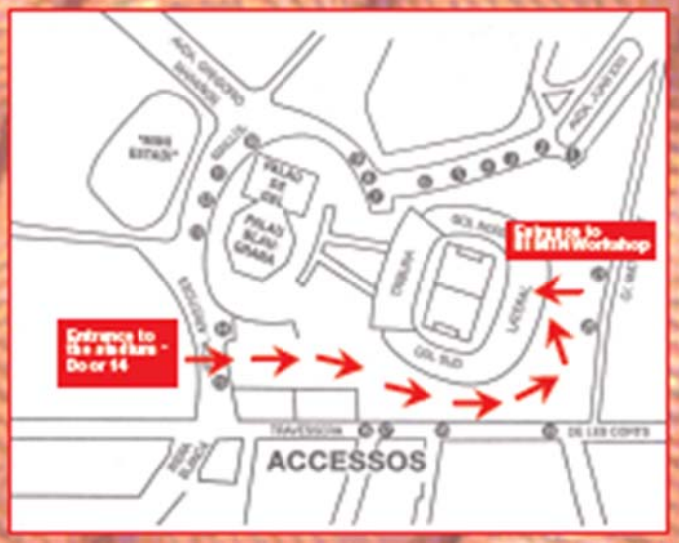
More information: www.egarsat.es

With the support of:

The **General Secretariat of Sports** developed the exclusive powers of the Generalitat of Catalonia in the field of sport and leisure. It is the body director of sports administration of the Generalitat of Catalonia, attached to the Department of the Presidency, which has assigned the powers of sport. The General Secretariat for Sport said the duties which the law of sport in Catalonia and also directed by the Catalan Council for Sport, implementation and management of the Government's sports policy is developed according to the following areas to increase in the practice of physical activity, sports, leisure and competition and encourage local authorities promote and organize sports clubs and federations, sports councils, the universities, school associations, schools sports and other commercial entities and to improve levels of quantitative and qualitative areas of teaching, technical, legal, medical and other sciences that support the sport and the network of facilities and sports facilities for both youth sport and for sport performance.
More information: http://www20.gencat.cat/portal/site/sge/

Venue

Futbol Club Barcelona
Entrance to the stadium - Door 14
Avgda. Arístides Maillol, s/n
08028 Barcelona



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