23rd international workshop

QMSKI 2022

SCIENTIFIC PROGRAM

📅 June 13 - June 17

23RD INTERNATIONAL WORKSHOP ON QUANTITATIVE MUSCULOSKELETAL IMAGING (QMSKI)

9TH INTERNATIONAL SYMPOSIUM ON ULTRASONIC CHARACTERIZATION OF BONE (ISUCB)

qmski.org

WELCOME FROM THE ORGANIZERS

" We warmly welcome you to the 23rd international workshop on Quantitative Musculoskeletal Imaging (QMSKI) in conjunction with the 9th International Symposium on Ultrasonic Characterization of Bone (ISUCB)!

We are very happy we can now welcome you to this meeting, as these were not great times for organizing a scientific meeting... Originally planned for 2021, we had to postpone the meeting by over a year due to the covid restrictions we were facing in many countries world-wide. And when covid finally started to diminish, at least in Europe, we got confronted with a horrendous war in Europe. At that point in time our thoughts were with the people in Ukraine rather than with organizing a scientific meeting. But postponing our meeting would not help ending this war; rather, this situation encouraged us to share our scientific and democratic values on equality for all. This has motivated us to continue with the organization of this meeting for this year, and this decision was well supported by you! We were happy to receive so many good quality abstracts, which made it possible to organize a high-standard meeting with presentation on state-of-the-art techniques and topics.

This will be the first 'Bone densitometry' meeting without Harry Genant. He founded the workshop in 1979 (you can read more about this in some of the next sections), and as far as we know, he never missed one. We owe him great respect for his energetic progression of this research field, which he continued even up to when he died in January 2021, at the age of 78.

We hope you will find this an inspiring meeting, and that it will foster new collaborations, new ideas and new contacts. And that you will enjoy your time in the Netherlands.

Bert van Rietbergen

Eindhoven University of Technology

Harry van Lenthe

KU Leuven

Quentin Grimal

Sorbonne University, Paris

PROGRAM OVERVIEW

QMSKI/ISUCB | Program Overview

	Sunday June 12	Monday June 13	Tuesday June 14	Wednesday June 15	Thursday June 16	Friday June 17
8:00		Breakfast	Breakfast	Breakfast	Breakfast	Breakfast
9:00		Opening remarks				
		Advanced radiograph and DXA analysis	Clinical MRI / Ultrasound propagation in bone	Micro- and synchrotron CT imaging	Finite element and ultrasound for bone strength determination	Skeletal adaptation
10:30		Coffee break	Coffee break	Coffee break	Coffee break	Coffee break
11:00		Invited lecture				
		Quantitative ultrasound: new developments	Ultrasound backscatter and imaging	Machine learning and artificial intelligence	Quantitative ultrasound: applications and therapy	Advanced morphometry and segmentation
12:30						Closing remarks
		Lunch and optional MSK activities	Lunch and optional MSK activities	Lunch	Lunch and optional MSK activities	Lunch and farewell
14:00						
14:30		Invited lecture	Invited lecture		Invited lecture	
		Analysis of fractured bone	Harry Genant Recongnition I Clinical applications: osteoporosis	Networking activities	Harry Genant Recongnition II Clinical CT	
15:30						
16:00		Poster I and coffee break	Poster II and coffee break		Coffee break	
16:30					Machine learning for segmentation	
		Clinical applications: osteoarthritis	Imaging of muscle structure and function			
17:30						
18:00						
18:30						
		Dinner	Dinner			
19:30	Welcome reception				Banquet dinner	
20:00		Workshop I / Workshop II	Workshop III / Workshop IV			
21:30						

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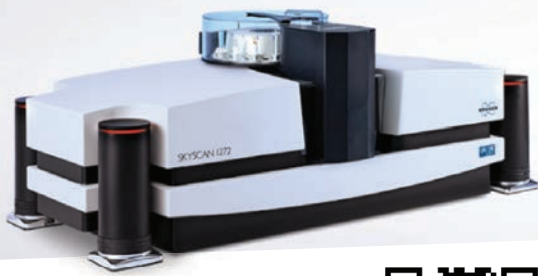## EXHIBITOR SPONSORS

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SKYSCAN 1272 CMOS
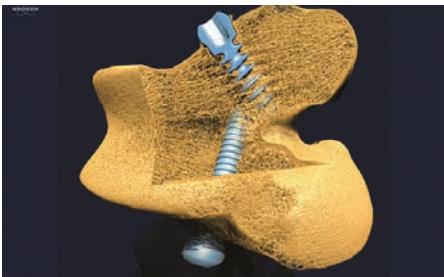The benchmark for high resolution with high throughput and ease of use
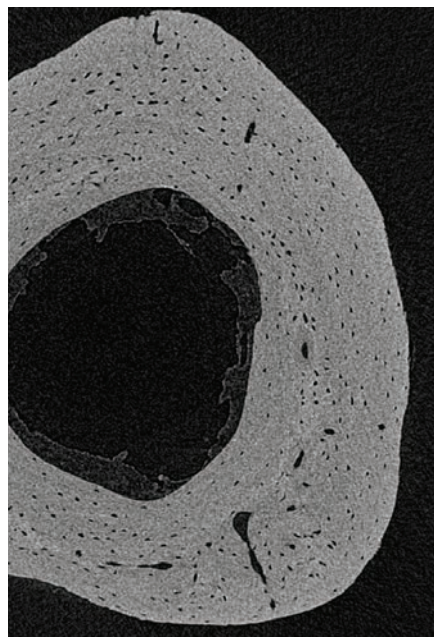
SKYSCAN 1276 CMOS
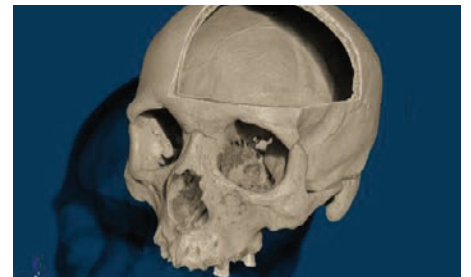The leading in vivo microCT bone solution

Examples of microCT Bone Application
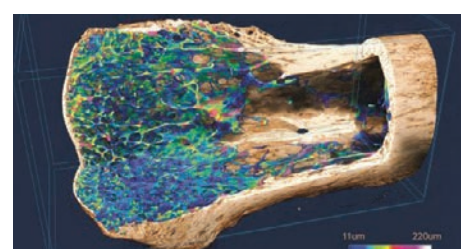

3D model of a sheep bone

Cross-section through a mouse tibia, showing the osteocyte lacunae

3D model of a medieval human skull (Sample from the Friedrich-Schiller University Jena, Germany).

3D model of the mouse vasculature and skeleton after contrast agent injection

3D model of a mouse bone showing the trabecular network color-coded for local thickness

Innovation with Integrity

QMSKI CONFERENCE HISTORY

The 23rd International Workshop on Quantitative Musculoskeletal Imaging (QMSKI) is a seamless continuation of the longstanding International Bone Densitometry Workshop that has been running since 1979. The new name was introduced in 2019 and reflects the changing scope of MSK research. It is carrying the torch to what has been a fantastically successful workshop that over the past decades has spanned the development of many new technologies and scientific findings related to skeletal health. These specifically include technologies such as SPA/SXA, DPA/DXA/VXA, QCT/vQCT/HRCT, pQCT/HRpQCT, μCT, QUS, MRI/QMR, FEA/μFEA. These applications have been established to measure BMD, BMC, bone macrostructure, microstructure, and strength, all towards improving the skeletal health of people.

	Location	Country	Year	Host
1st	San Francisco	USA	1979	H.K. Genant
2nd	Zuoz	Switzerland	1981	P. Rügsegger
3rd	Banff	Canada	1982	T.N. Hangartner, T.R. Overton
4th	Fontevraud	France	1984	A.M. Laval-Jeantet
5th	Bretton Woods	USA	1985	F.S. Kaplan
6th	Buxton	UK	1987	J.E. Adams
7th	Rancho Mirage	USA	1989	B. Ettinger
8th	Bad Reichenhall	W Germany	1991	D. Felsenberg, W.A. Kalender
9th	Traverse City	USA	1992	D.D. Cody, B.J. Richmond
10th	Venezia Lido	Italy	1994	S. Ortolani, M.L. Bianchi
11th	Glenedon Beach	USA	1995	K.G. Faulkner, M.R. McClung
12th	Crieff	Scotland	1997	D.M. Reid
13th	Delavan	USA	1998	C.R. Wilson
14th	Warnemünde	Germany	2000	C.C. Glüer
15th	Monterey	USA	2002	S. Majumdar, J. Shepherd
16th	Annecy	France	2004	D. Hans, P. Laugier
17th	Kyoto	Japan	2006	A. Itabashi, M. Ito, M. Fukunaga
18th	Pugnochiuso	Italy	2009	G. Guglielmi
19th	Breckenridge	USA	2012	P. Miller
20th	Hong Kong	Hong Kong	2014	L. Qin, J. Griffith
21st	Monastery Banz	Germany	2017	K. Engelke, K. Raum, T. Bäuerle
22nd	Lake Louise	Canada	2019	S. Boyd, A. Cheung

ISUCB CONFERENCE HISTORY

The International Symposium on the Ultrasonic Characterization of Bone (ISUCB) conference series is the biennial meeting of the International Bone Ultrasound Society (BoneUS, https://bone-ultrasound.org/). It brings together academic and industrial researchers interested in the physics of ultrasound propagation in bone and clinical applications such as ultrasound bone densitometry and quantitative bone imaging. Formerly entitled "European Symposium on the Ultrasonic Characterization of Bone" (ESUCB), it was created in 2006. This 9th meeting follows the tradition set in the 2017 meeting in Banz (Germany) when QMSKI and ISUCB communities first organized a joint meeting.

BoneUS is a non-profit association established in 2017 regrouping scientists, engineers, and clinicians interested in the application of quantitative ultrasound (QUS) methods to investigate bone and other hard biological tissues. BoneUS promotes the development and progress of bone QUS in its different aspects, its technologies and applications.

	Location	Country	Year	Host
1st	Paris	France	2006	F. Padilla, P Laugier
2nd	Halle	Germany	2007	K. Raum
3rd	Bydgoszcz	Poland	2009	M. Pakula
4th	Jyväskylä	Finland	2011	P. Moilanen
5th	Granada	Spain	2013	G. Rus
6th	Corfu	Greece	2015	D.I. Fotiadis
7th	Banz (with IBDW)	Germany	2017	K. Engelke, T. Bäuerle, K. Raum
8th	Fréjus	France	2019	C. Baron, P. Lasaygues

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Helping to improve **lives every day**

Osteoporosis prevalence is increasing, yet it remains severely underdiagnosed and undertreated. Even following major fracture, most patients are not treated for underlying osteoporosis.[1]

UCB provides treatment and management options in order to improve patient care whilst reducing the risk of future fractures in osteoporosis patients. We are working to further develop an AI-based fracture identification tool based on UCB's BoneBot AI technology to help improve fracture detection.

To learn more about how UCB supports fracture prevention, go to **www.ucb.com**.

1. Cooper C, *et al.* International Osteoporosis Foundation. Capture the Fracture® partnership: guidance for policy shaping. 2020. Available at: https://www.osteoporosis.foundation/sites/iofbonehealth/files/2021-03/Guidance%20for%20Policy%20Shaping_Toolkit_10032021.pdf (Accessed May 2022)

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Driven by **science.**

23rd international workshop
QMSKI 2022

GENERAL INFO

Covid restrictions

At the time of printing this book there were no covid restrictions in the Netherlands. Face masks are not obligatory anywhere.

If you need to do a covid test before returning home, you can do so at several locations. The one nearest to the hotel is at 'Langelaan 3 Noordwijkerhout', which is about a 50 min walk from the hotel. You can also take a bus there (bus 90, direction Lisse, get off at 'Noordwijkerhout, Langelaan', takes about 15 min). You can book your test here: https://spoedtest.nl/en/ and as location select 'Noordwijk Conference Centre Leeuwenhorst in Noordwijkerhout'. Alternatively, you can do this test in Leiden at a location (Breestraat 65) that is a 10 min walk from the central station.

Travel

If you want to use public transport in the Netherlands frequently, the best option is to buy an anonymous OV chipcard that is valid in trains, buses and metros. You can buy these at public transport service desks, from ticket vending machines in stations, at tobacco shops (such as Primera), and in several supermarkets. OV-chipcard points of sale carry the pink OV-chipcard logo. The OV-chipcard costs 7.50 euros and remains valid for five years. When traveling by train, make sure you have at least 20 euros worth of credit on your anonymous OV-chipcard. More information can be found online (e.g. at https://www.holland.com).

If you travel only to/from the meeting location, it is best to buy a single-use digital train ticket that allows you to travel without a chipcard. Such tickets should be bought online before you enter the railway station at: https://www.ns.nl/producten/en/losse-kaartjes-toeslagen or through the Dutch Railways (NS) mobile app (search for 'NS train app'). Note that with this ticket you can only get through the gates at the entrance of the station when using a gate equipped with a barcode reader (these have a small circular-shaped glass window with QR symbol, see picture to the left). You can also buy a single-use chipcard that is valid only for a specific trip at a vending machine at the railway station at an extra cost of 1 euro that will work on any gate. You can pay for the bus trip in the bus, but only when using a debit (PIN) card. There are also apps that allow you to book the full trip (train + bus), search for '9292ov'.

To Schiphol (Amsterdam) airport

– Taxi:
You can book your taxi ahead on different sites (e.g. https://sneleentaxi.nl/en) and specify "Koningin Astrid Boulevard, Noordwijk" as the pickup destination and "Schiphol airport" as the destination.
Costs will be 50€ – 60€.

– Public transport:
Take one of the following buses to Leiden Central station:
- Line 20, direction Leiden CS (30 min, leaves every 20 min, 2.80€)
- Line 21, direction Leiden CS (37 min, leaves every 20 min, 3.25€).

The bus stop is close to the hotel at the Picképlein.

From Leiden Central Station you can take a train to Schiphol airport (15 – 22 min, 6.50€).

To other locations

Take the bus to Leiden Central Station and take the train to any other destination in the Netherlands.
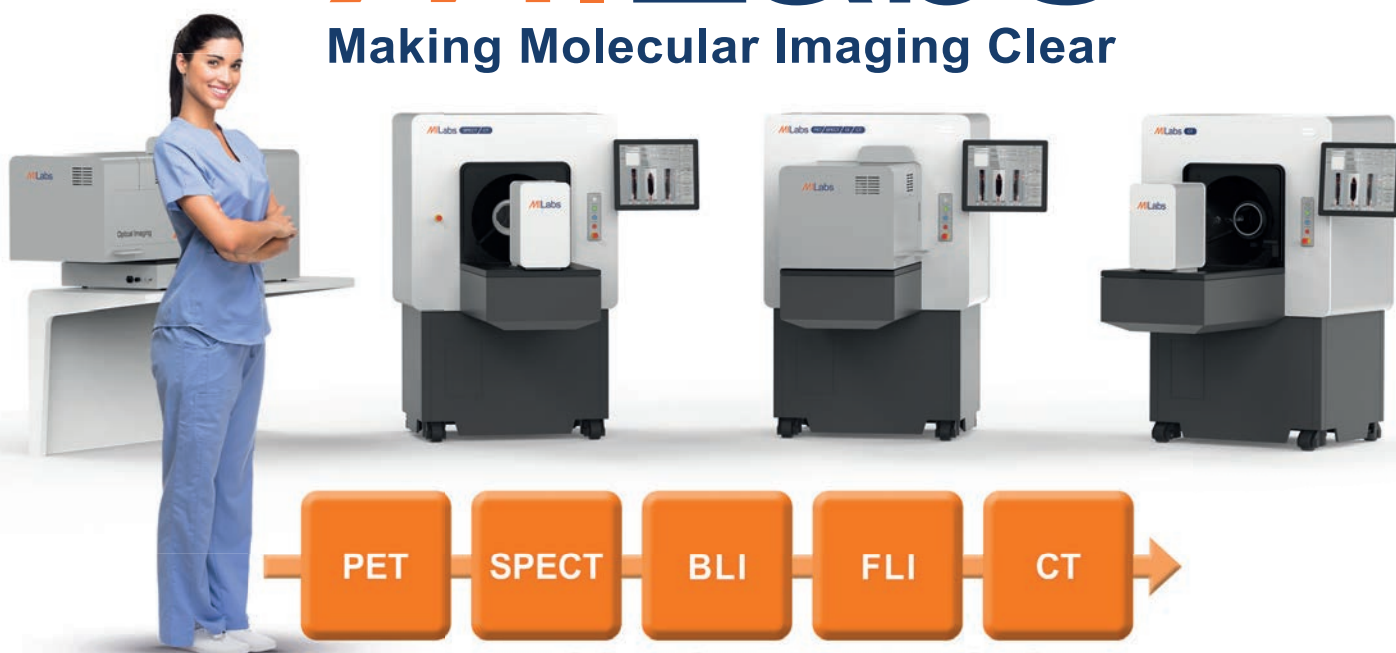
IN MEMORIAM HARRY GENANT

"Harry Genant, San Francisco" are familiar words to many of us who have attended the International Bone Densitometry Workshops, the predecessor of this current International Workshop on Quantitative Musculoskeletal Imaging (QMSKI). Sadly, that introduction and the insightful questions, edifying comments, or genuine compliments that followed it, will be heard no more. Harry K. Genant, MD, Professor Emeritus of Radiology, Medicine, Epidemiology and Orthopaedic Surgery, University of California San Francisco and Senior Consultant to Bioclinica (Synarc), died unexpectedly at age 78 years on January 14, 2021, at his home in Napa, CA.

Many of you will remember Harry for his ubiquitous presence at conferences in the osteoporosis and arthritis fields. Strategically seated at the front of convention halls, Harry's quickness to the microphone was matched by the quickness of his intellect to digest the research just presented. His questions struck to the heart of the presentation. His comments brought context and relevance to the findings reported. His suggestions moved the research into new territory. His criticisms were delivered with compassion and genuine interest to advance the presenter's topic to its full potential, as well as the career of the young investigator.

One of Harry's most influential actions was the creation of the International Bone Densitometry Workshop, first held in 1979 in San Francisco. It was hosted biennially by leading research groups in North America, Europe, and Asia. As founder, Harry informally presided over each of these workshops assisting with the selection of subsequent presidents, forming the scientific program and invited speaker list, securing sponsorship, and inspiring the scientific discussions. This meeting series is remarkable in several ways. First, it combines technical and clinical expertise and fosters translational research critical to advancing this field that relies so heavily on imaging physics, biomechanics, bone biology, pharmacology, and epidemiology. Second, the workshop is a small meeting with 120–150 attendees and a meeting duration of 5–6 days. This creates an intimate setting that allows in-depth exchange both on a scientific and a personal level. In the meeting young investigators share the podium with world renowned experts, developing the knowledge, skills, and confidence to become leaders themselves. The scientific and social activities were instrumental in creating a worldwide community of specialists in musculoskeletal imaging that has driven innovation for four decades and continues to do so today.

To a large degree this workshop series is a cumulative reflection of Harry's vision paired with his exceptional radiological expertise, technical knowledge and curiosity and pragmatic guidance to differentiate relevant from less relevant topics.

Although Harry will not be stepping up to the podium at this QMSKI, his spirit and legacy are omnipresent as evidenced by this strong network of international scientists and their families who have all become friends over the last four decades. Goodbye dear friend, you are sorely missed.

Sharmila Majumdar, Claus Glüer, Klaus Engelke

SCIENTIFIC PROGRAM

Monday, June 13th

Opening remarks

8:45 – 9:00   Bert van Rietbergen, Harry van Lenthe and Quentin Grimal

Advanced Radiograph & DXA analysis   chair: Klaus Engelke

9:00 – 9:15   (O1) Nguyen H. C., Gielis W. P., Arbabi V., Custers R. J. H., van Egmond N., Kloppenburg M., Blanco F. J., Haugen I. K., Berenbaum F., Lafeber F. P. J. G., Lindner C., Cootes T. F., Weinans H.
2D Statistical Shape Model of Osteoarthritis Knees

9:15 – 9:30   (O2) Vogl F., Schütz P., Alavi H., Taylor B.
A dataset to learn 2D–3D knee joint pose estimation from x-ray images based on natural movement with precision ground truth

9:30 – 9:45   (O3) Rahmatian S., Vogl F.
Estimating the 3D pose of the natural knee from single-plane moving fluoro-scope images using personalized deep learning

9:45 – 10:00   (O4) Bennett J. P., Leong L. T., Liu Y. E., Kelly N. N., Glaser Y., Sadowski P., Shepherd J. A.
Use of Artificial Intelligence Regional Hallucinations to Correct Body Compo-sition Predictions in Individuals with Metal Implants and Poor Positioning

10:00 – 10:15   (O5) Qasim M., Wills C. R., Winzenrieth R., Rio L. D., Gregorio S. D., Humbert L., Noailly J.
Effects of osteoporosis pharmacological treatments on bone strength using 3D-Shaper based finite element analyses

10:15 – 10:30   (O6) Wong M. C., Leong L. T., Liu Y. E., Kelly N. N., Glaser Y., Sadowski P., Heymsfield S. B., Shepherd J. A.
Artificial Intelligence Predicts Spine and Hip BMD from Whole-Body Dual Energy X-ray Absorptiometry Scans

Keynote lecture 1   chair: Quentin Grimal

11:00 – 11:30   Wiendelt Steenbergen
Photoacoustic imaging: a rheumatoid arthritis exploration

Quantitative ultrasound: new developments chair: Yi-Xian Qin

11:30 – 11:45   (O7) Morris R. F., Feng T., Wang X. D., Kozloff K. M.
PAQUS – A Novel Photoacoustic Quantitative Bone Ultrasonometer

11:45 – 12:00   (O8) Pisani P., Natale A., Conversano F., Lombardi F. A., Ciardo D., Casciaro S.
Radiofrequency Echographic Multi Spectrometry (REMS) technology in a nutshell: the state-of-the-art

12:00 – 12:15   (O9) Nguyen Minh H., Massmann J., Armbrecht G., Raum K.
Fracture discrimination in postmenopausal women with low bone mineral density by multiparametric bone ultrasound imaging

12:15 – 12:30   (O10) Salles S., Lucidarme O., Renaud G.
Mapping pulsatile blood flow direction and velocity in the human tibial cortex with ultrasound

Keynote lecture 2 chair: Harry van Lenthe

14:00 – 14:30   Hilde Bosmans
Photon counting CT: a new generation CT scanner?

Analysis of fractured bone chair: Steven Boyd

14:30 – 14:45   (O11) Gehweiler D., Mys K., van Knegsel K., Pastor T., Visscher L., Dauwe J., Bashardoust A., Knill A., Gueorguiev B., Windolf M., Nijs S., Lambert S., Varga P.
Statistical Analysis of Complex Proximal Humeral Fractures

14:45 – 15:00   (O12) Yilmaz E. B., Laue J. L., Fricke T., Glüer C. C., Meyer. C.
Deep Learning-Based Vertebral Fracture Grade Classification

15:00 – 15:15   (O13) Bevers M. S. A. M., Heyer F. L., Wyers C. E., Geusens P. P. M. M., Janzing H. M. J., Kaarsemaker S., Poeze M., van den Bergh J. P., van Rietbergen B.
The role of low-mineralized tissue in the stabilization of fractured distal radii during healing

15:15 – 15:30   (O14) Dejea H., Raina D. B., Silva Barreto I., Liu Y., Johansson U., Isaksson H.
Elemental and structural characterization of bone fracture healing at the nanometer scale

Poster session 1: QMSKI

15:30 – 16:30

(P1) Glaser Y., Shepherd J., Leong L., Wolfgruber T., Lui L., Sadowski P., Cummings S.R.
Deep-learning-derived all-cause mortality predictor significantly correlated with bone mineral density in males.

(P2) Van Duijnhoven H., Nguyen H.C., Van Roermund P., Custers R.J.H., Van Egmond N., Tümer N., Weinans H.
Mechanical loading during knee joint distraction as treatment for knee osteoarthritis

(P3) Sennhauser T., Stephan A., Baumann G., Preiss S., Stadelmann V. A.
Association Of Bone Microstructure And 6-Weeks Radiographic Outcomes In Unicompartmental Knee Arthroplasty

(P4) Bedding M., Johnston R., Jeerawan T., Green N. H., Zhao F.
Image-based modelling and simulation of the micro-mechanical environment within PGSm scaffold for tissue engineering application

(P5) Yan J., Liu C., Ta D.
Cortical bone and bone cracks imaging based on ultrasonic full-waveform inversion

(P6) van der Weijde R. J., Custers R. J. H., van Egmond N., Nguyen H. C., Magré J., Weinans H.
Medial open wedge distal femoral osteotomy, a valid option or not?

(P7) Schileo E., Fraterrigo G., Taddei F., Erani P., Rota G., Berni M, Baleani M.
Finite Element Strain Prediction in Vertebral Bodies: a New Validation Experiment

(P8) Emerzian S. R., Johannesdottir F., Coulombe J. C., Wu I., Gauthier J., Jangolla S. V. T., Yu M. G., Shah H. S., King G. L., Yu E. W., Bouxsein M. L.
Older Women with Longstanding Type 1 Diabetes Have Region-Specific Reductions in Bone Density in the Femoral Neck

Clinical applications: osteoarthritis   chair: Kathryn Stok

| 16:30 – 16:45 | (O15) Garcelon C., Olivier C., Abascal J., Douek P., Peyrin F., Chappard C. |
| | *Interest of Cartilage Thickness Measurements from Photo-counting Spectral computed Tomography Images* |

16:45 – 17:00   (O16) Espinosa Hernandez M. A., Liu S., Anwari V., Ha E., Yanzdankhah N., Johnston J. D., Mohankumar R., Naraghi A., Veit-Haibach P., Mackay C., Rozenberg D., Wong A. K. O.
Association between infrapatellar fat pad and knee bone density in postmenopausal women with osteoarthritis: the PoKIMP study

17:00 – 17:15   (O17) Espinosa Hernandez M. A., Whyte R., Liu S., Anwari V., Ha E., Yanzdankhah N., Johnston J. D., Mohankumar R., Naraghi A., Wong A. K. O.
Reproducibility of pQCT knee compartment-specific scans in postmenopausal women with osteoarthritis: the PoKIMP study

17:15 – 17:30   (O18) Kuczynski M. T., Adham H., Chishti S., Tse J. J., Hiscox C., Dhaliwal G., White N. J., Manske S. L.
Assessing hand osteoarthritis using HR-pQCT: A pilot study

17:30 – 17:45   (O19) Kuczynski M. T., Wang K., Tse J. J., Manske S. L.
Measuring trapeziometacarpal joint proximity using dynamic computed tomography

17:45 – 18:00   (O20) Tse J. J., Contreras D., Salat P., Barber C. E., Hazlewood G. S., Barnabe C., Penney C., Mosher D., Manske S. L.
Comparing Joint Space Parameters Between Rheumatoid Arthritic and Age- and Sex-Matched Control Metacarpophalangeal Joints

Workshop 1A: MRI for muscle and bone imaging

20:00 – 20:20   Klaus Engelke
Quantitative muscle imaging using MRI

20:25 – 20:45   Peter Seevinck
BoneMRI: Quantitative bone imaging using MRI

Workshop 1B: Updates from the IWOAI community

21:00 – 21:05   Edwin Oei
Introduction

21:05 – 21:20   Jos Runhaar
Evaluating the tibial spines as imaging biomarker for incident knee OA

21:20 – 21:35   Mylène Jansen
Subchondral bone normalization after joint distraction treatment for knee OA

21:35 – 21:50   Jukka Hirvasniemi
Bone radiomics for assessment of osteoarthritis

Workshop 2A: Open-source imaging   – Panorama room

20:00 – 20:45   Serena Bonaretti and Enrico Schileo
Introducing the Open and Reproducible Musculoskeletal Research (ORMR) community

Workshop 2B: Update from the SPECTRA collaboration   – Panorama room

21:00 – 21:45   Sarah Manske , Ralph Müller, Andy Kin On Won, Klaus Engelke
and Danielle Whittier
Are open and reproducible workflows necessary for CT in clinical trials and research?

Tuesday, June 14th

Clinical MRI
chair: Sharmila Majumdar

9:00 – 9:15   (O21) Cummings J. A., Gao K. T., Chen V., Morales Martinez A., Majumdar S., Pedoia V.
The Knee Connectome: Studying Localized Synchrony in 8-year Cartilage Thickness Changes

9:15 – 9:30   (O22) Bhattacharjee R., Thaha R., Han M., Souza R., Pedoia V., Majumdar S.
Quantitative MR of Bilateral Hip and Knee with automated post processing: An AI-enabled pipeline towards understanding inter-intra joint OA biomarkers

9:30 – 9:45   (O23) Lee J. J., Namiri N. K., Astuto B., Link T. M., Majumdar S., Pedoia V.
MRI-based Structural Phenotypes and Time to Incidence of Radiographic Osteoarthritis

9:45 – 10:00   (O24) Han M., Larson P. E., Link T. M., Lansdown D. A., Feeley B. T., Majumdar S.
Quantitative Ultrashort Echo-Time MRI to Assess Rotator Cuff Tendon Degeneration

10:00 – 10:15   (O25) Tolpadi A. A., Han M., Calivà F., Pedoia V., Majumdar S.
Tissue-Specific Loss Functions Yield Strong Reconstructions for Ultrafast T2 Mapping

10:15 – 10:30   (O26) Hess M., Allaire B., Gao K. T., Tibrewala R., Han M., Bahroos E., Inamdar G., Bharadwaj U., Chin C. T., Pedoia V., Bouxsein M. L., Anderson D., Majumdar S.
Towards Efficient and Effective MRI-based Personalized Biomechanical Modeling of the Spine

Ultrasound propagation in bone — Panorama room
chair: Guillaume Renaud

9:00 – 9:15   (O27) McCandless B. A., Muller M.
Exploring the source of attenuation in cortical bone: the respective and dependent effects of scattering and absorption.

9:15 – 9:30   (O28) Pakula M.
What kind of waves are measured in cancellous bone?

9:30 – 9:45   (O29) Talmant M., Renaud G., Grimal Q.
Ultrasonic attenuation of longitudinal waves in human cortical bone: measurements along and transverse to the osteons

9:45 – 10:00   (O30) Aróstica R., Aguilera A., Osses A., Minonzio J. G.
A simplified homogenization model applied to viscoelastic behavior of cortical bone at ultrasonic frequencies

10:00 – 10:15   (O31) Tatarinov A., Sisojevs A., Chaplinska A., Glushkov E. V., Glushkova N. V.
Identification of Osteoporosis Diagnostic Signs in Cortical Bone Models Examined by Axial Transmission Ultrasound

10:15 – 10:30   (O32) Aróstica R., Castro F., Miranda D., Osses A., Minonzio J. G.
Finite Elements simulations applied to Bi-Directional Axial Transmission

Ultrasound Backscatter and imaging   chair: Kay Raum

11:00 – 11:15   (O33) White R., Alexanderian A., Talmant M., Grimal Q., Muller M.
An inverse problem to infer cortical porosity from ultrasound attenuation data

11:15 – 11:30   (O34) Dia A. S., Renaud G., Chappard C., Grimal Q.
Assessing the performance of ultrasound imaging of the cortex in osteoporotic bones

11:30 – 11:45   (O35) Sultan H., Grisan E., Peralta L., Harput S.
Multi-frequency ultrasound characterization of bone porosity and thickness: A feasibility study

11:45 – 12:00   (O36) Conversano F., Maggio M., De Marco T., Pisani P., Franchini R., Casciaro S.
Echographic diagnosis of osteoporosis on proximal femur through a dedicated Artificial Intelligence approach

12:00 – 12:30   (P10, P11, P13, P15) Poster video presentations

Keynote lecture 3   chair: Bert van Rietbergen

14:00 – 14:30   Sharmila Majumdar
The Explosion of Artificial Intelligence Armamentarium in Musculoskeletal Imaging

Harry Genant Recognition 1 – Clinical applications: osteoporosis chair: Bert van Rietbergen

14:30 – 14:45   (O37) Glüer C. C., Engelke K., Kistler M., Thomasius F., Hadji P., Schweikert B., Libanati C., Moayyeri A.
Association of Clinical Risk Factors with Risk of Vertebral and Hip Fractures: Real-World Databases Provide Information for Personalized Risk Assessment

14:45 – 15:00   (O38) Whittier D. E., Samelson E. J., Hannan M. T., Burt L. A., Hanley D. A., Biver E., Szulc P., Sornay-Rendu E., Merle B., Chapurlat R., Lespessailles E., Wong A. K. O., Goltzman D., Khosla S., Ferrari S., Bouxsein M. L., Kiel D. P., Boyd S. K.
A fracture risk assessment tool for high resolution peripheral quantitative computed tomography: The Bone Microarchitecture International Consortium (BoMIC)

15:00 – 15:15   (O39) Ha E., Reitsma S., Gillick H., Fyfe C., Papaioannou A., Adachi J. D., Wong A. K. O.
Higher mid-tibia bone marrow and muscle adiposity are associated with an increased risk of incident fractures over 5-years:
Findings from the AMBERS Cohort Study

15:15 – 15:30   (O40) Van den Bemt J. R., Bevers M. S. A. M., van Rietbergen B., van den Bergh J. P., Wyers C. E.
Identifying Risk Factors for Imminent Fracture in a Fracture Liaison Service Cohort using Machine Learning

Poster session 2: ISUCB

15:30 – 16:30

(P9) Dia A. S., Renaud G., Grimal Q.
The influence of cortical microstructure on ultrasound images of the bone cortex: a numerical study

(P10) Bi D., Liu C., Li B., Le L. H., Li Y., Shi L., Ta D.
Ultrasonic Transmission Measurements of Human BMD, Muscle and Fat Properties

(P11) Hattori T., Maekawa Y., Matsukawa M.
Effect of glycation on photoacoustic properties of bovine cortical bone

(P12) Hosokawa A.
Effect of Trabecular Structure on Piezoelectric Signal Generated in Cancellous Bone by Ultrasound Irradiation: A Numerical Study

(P13) Haneda Y., Maekawa Y., Shirai K., Yano K., Ikegawa M., Haïat G., Matsukawa M.
Longitudinal wave velocity in bones of streptozotocin-induced diabetic rats

(P14) Nagatani Y., Hoshi T.
A Preliminary Study of the Two-Dimensional Acoustic Imaging using a Single-Channel Transducer with an Asymmetric Reflector

(P15) Maehara K., Haneda Y., Yano K., Matsukawa M.
Piezoelectric response of rat cortical bone by ultrasound irradiation

(P16) Wu M., van Teeffelen B. C. J., Ito K., Janssen R. P. A., van Donkelaar C. C., Lopata R. G. P.
Spectroscopic Photoacoustic Imaging of Osteoarthritis

(P17) Nicolaes J.1, Skjødt M. K., Libanati C., Smith C. D., Olsen K. R., Cooper C., Abrahamsen B.
Automated Detection of Vertebral Fractures in Routine CT Scans of the Chest and Abdomen: External Validation of a Deep Learning Algorithm

(P18) Kawafi1 A., Yang Y., Tong Q., Royall C. P., Kague E., Hammond C.
Machine learning for the analysis of zebrafish osteoarthritis and osteoporosis genetics using micro-QCT and super-resolution microscopy

(P19) Burghardt A. J., Long J., Aye T., Kent K., Strickland A., Leonard M. B.
Contribution of local density variation to micro-finite element analysis in pediatric HR-pQCT

Imaging of muscle structure & function   chair: Klaus Engelke

16:30 – 16:45   (O41) Cataldi D., Leong L. T., Bennett J. P., Shepherd J. A.
                          Muscular Function and Strength Predictions Using DXA

16:45 – 17:00   (O42) Bartenschlager S., Chaudry O., Pograrell T., Engelke K.
                          Calibration of muscle density with CT

17:00 – 17:15   (O43) Wong A. K. O., Kennedy C., Tam K., Liu S., Reitsma S., Gillick H.,
                          Pickard L., Papaioannou A., Adachi J. D.
                          Higher muscle adiposity and lower muscle mass are associated with a trajectory towards faster frailty development over 5 years in postmenopausal women: the AMBERS prospective cohort study

17:15 – 17:30   (O44) Chaudry O., Ghasemikaram M., Bartenschlager S., Nagel A. M.,
                          Kemmler W., Engelke K.
                          Associations of Muscle Texture of the Thigh with Leg Extension Strength

17:30 – 17:45   (O45) Huysmans L. H., De Wel B. D. W, Claeys K. C, Maes F.
                          Automatic segmentation using a convolutional neural network of the muscles of the upper leg in healthy subjects and patients with Limb Girdle Muscular Dystrophy

17:45 – 18:00   (O46) Casciaro S., De Marco T., Aventaggiato M., Antelmi L., Lombardi F. A.,
                          Conversano F.
                          A dedicated REMS approach for the assessment of muscle health status

Workshop 3A ShapeWorks: Opensource Software for Musculoskeletal Tissues: part 1

20:00 – 20:20   Andrew Anderson and Penny Atkins
                          Intro to statistical shape modeling and ShapeWorks

20:25 – 20:45   Andrew Anderson and Penny Atkins
                          Application of ShapeWorks to the study of musculoskeletal anatomy

Workshop 3B ShapeWorks: Opensource Software for Musculoskeletal Tissues: part 2

21:00 – 21:20   Andrew Anderson and Penny Atkins
                          Working with the ShapeWorks software (live demo)

21:25 – 21:45   Andrew Anderson and Penny Atkins
                          Installing and opening ShapeWorks (for those interested in doing so onsite)

Workshop 4A: Bone Ultrasound Imaging: part 1   – Panorama room

20:00 – 20:45   Amadou Dia, Quentin Grimal and Guillaume Renaud
                          Image formation

Workshop 4B: Bone Ultrasound Imaging: part 2   – Panorama room

21:00 – 21:45   Jonas Massmann, Jennifer Hartwigs and Kay Raum
                          Quantitative backscatter analysis in cortical bone

Wednesday, June 15th

Micro- and Synchrotron CT imaging   chair: Ralph Müller

9:00 – 9:15   (O47) Sharma K., Silva Barreto I., Dejea H., Pierantoni M., Hammerman M., Eliasson P., Isaksson H.
Multimodal imaging of heterotopic ossification during Achilles tendon healing in the rat

9:15 – 9:30   (O48) Tits A., Blouin S., Rummler M., Kaux J. F., Drion P., van Lenthe G. H., Weinkamer R., Hartmann M. A., Ruffoni D.
Combining high-resolution imaging techniques to reveal the structure and function of fibrocartilage at the tendon-bone insertion

9:30 – 9:45   (O49) Whittier D. E., Yilmaz D., Wehrle E., Kuhn G., Müller R.
Quantification of bone marrow adipose tissue in vivo using single- and dual-energy micro-computed tomography

9:45 – 10:00   (O50) Sieverts M., Obata Y., Rosenberg J. L., Woolley W., Parkinson D. Y., Barnard H. S., Pelt D. M., Acevedo C.
Imaging how collagen molecular denaturation affect bone toughness using a new combination of in situ synchrotron micro-tomography and Mixed-Scale Dense network

10:00 – 10:15 (O51) Kok J., Törnquist E., Lohéac O., Le Cann S., Raina D. B., Tägil M., Novak V., Engqvist J., Isaksson H.
Analysis of Bone-Implant Integration with Synchrotron X-ray Tomography

10:15 – 10:30 (O52) Pierantoni M., Silva Barreto I., Hammerman M., Novak V., Eliasson P., Isaksson H.
A synchrotron phase contrast micro-tomography approach to study Achilles tendon microstructure and uncover the effect of in vivo loading at the microscale

Machine learning and artificial intelligence   chair: Sharmila Majumdar

11:00 – 11:15 (O53) Leong L. T., Wong M. C., Liu Y. E., Kelly N. N., Glaser Y., Sadowski P., Heymsfield S. B., Shepherd J. A.
Artificial Intelligence Generates Real Analyzable Dual Energy X-ray Absorptiometry Scans from Three-Dimensional Body Scans

11:15 – 11:30 (O54) Birdsong T., Paniagua B., Cole J. H., Cox J. M., Marron J. S., Zukić D., Vicory J., McCormick M.
Femur Atlas Generation And Shape Analysis With Deformable Surface Registration

11:30 – 11:45   (O55) Folle L., Meinderink T., Simon D., Liphardt A. M., Thies M., Krönke G., Schett G., Kleyer A., Maier A.
Automated Bone Density Measurements using Deep Learning

11:45 – 12:00   (O56) Pedoia V., Calivà F., Kamat S., Morales Martinez A., Majumdar S.
Virtual Knee Aging: Towards a Personalized Trajectory of Bone Shape Changes

12:00 – 12:15   (O57) Sahu P., Greer T. H., Xu Z., Shen Z., Bonaretti S., McCormick M., Neithammer M.
Reproducible Workflow for Visualization and Analysis of OsteoArthritis Abnormality Progression

12:15 – 12:30   (O58) De Marco T., Aventaggiato M., Maggio M., Bellone M., Pisani P., Conversano F., Casciaro S.
Semi-supervised learning applied to femoral neck echographic scans for osteoporosis diagnosis

Thursday, June 16th

Finite element and ultrasound for bone strength determination
chair: Steven Boyd

9:00 – 9:15   (O59) Eggermont F., Westhoff P. G., van der Geest I. C. M., Dierselhuis E. F., Verdonschot N., Ligthert S., van der Linden Y. M., Tanck E.
A Patient-specific Finite Element Model for Fracture Risk Assessment of Femurs with Bone Metastases is Helpful in Clinical Practice

9:15 – 9:30   (O60) Allard V., Confavreux C., Bermond F., Stadelmann M., Alkalay R., Zysset P., Mitton D., Follet H.
Comparison of two finite element analyses to assess metastatic vertebral failure load

9:30 – 9:45   (O61) van Rietbergen B., Biver E., Chevalley T., Chapurlat R., Ferrari S., Ito K.
Comparison of the reproducibility and sensitivity of micro- Finite Element results at the distal radius in-vivo for non-registered and cropped 3D registered models

9:45 – 10:00   (O62) Miranda D., Olivares R., Muñoz R. , Minonzio J. G.
Improvement of patient classification using optimized feature selection of clinical parameters and bone fragility-related features obtained with Bi-Directional Axial Transmission

10:00 – 10:15   (O63) Qin Y. X., Lin L., Lin W.
Quantitative Ultrasound Imaging Reconstruction in Peripheral Skeletal Quality Measurement

10:15 – 10:30   (O64) Pisani P., Lombardi F. A., Natale A., Franchini R., Muratore M., Conversano F., Casciaro S.
Bone frailty evaluation: the REMS-based Fragility Score is a predictor for fragility fractures

Quantitative ultrasound: application
chair: Sergio Casciaro

11:00 – 11:15   (O65) Bi D., Liu C., Li B., Le L. H., Li Y., Shi L., Ta D.
Ultrasonic Backscatter Technique Evaluates BMD, Muscle and Fat Properties

11:15 – 11:30   (O66) Salles S., Renaud G.
Blood flow estimation techniques in cortical bone: a simulation study

11:30 – 11:45   (O67) Lombardi F. A., Natale A., Conversano F., Pisani P., Di Paola M., Franchini R., Casciaro S.
Radiofrequency Echographic Multi Spectrometry (REMS) for osteoporosis diagnosis in men

11:45 – 12:00   (O68) Behforootan S., Thorniley M., Minonzio J. G., Abel R. L.
Bi-Directionnal Axial Transmission applied to osteoarthritis and osteoporosis patients

12:00 – 12:15   (O69) Natale A., Conversano F., Lombardi F. A., Antelmi L., Pisani P., Casciaro E. , Muratore M.
Radiofrequency Echographic Multi Spectrometry (REMS) as alternative to bioelectrical impedance analysis (BIA) for the assessment of body composition in postmenopausal women

12:15 – 12:30   (O70) Massmann J., Raum K.
Impacts of intracortical pore size distribution on backscatter coefficient and frequency dependent attenuation

Keynote lecture 4   chair: Harry van Lenthe

14:00 – 14:30   Klaus Engelke
Opportunistic screening using routine clinical CT scans to identify subjects at high risk for osteoporotic fracture – Clinical promises and technical challenges

Harry Genant Recognition 2 – Clinical CT   chair: Harry van Lenthe

14:30 – 14:45   (O71) du Mont S., Barkmann R., Damm T., Peña J. A., Reinhold S., Both M., Mainusch M., Glüer C. C.
Long-term reproducibility of BMD-measurements with clinical QCT using simultaneous and asynchronous calibration methods and different measurement and reconstruction protocols

14:45 – 15:00   (O72) Peña J. A., Shaul J. L., Damm T., Barkmann R., Müller M., Kurz B., Glüer C. C.
Spectral-CT Application to Assess Separability of a Calcium-based Implant from Bone

15:00 – 15:15   (O73) Quintiens J., van Lenthe G. H.
Using Photon Counting CT for Trabecular Microstructure Quantification: A Pilot Study

15:15 – 15:30   (O74) Booij R.
Photon Counting CT: A New Revolution in Clinical CT!?

Machine learning for segmentation   chair: Claus Glüer

16:00 – 16:15   (O75) Hempe H., Heinrich M. P.
Addressing domain shift across different CT datasets for deep learning based localisation of vertebrae

16:15 – 16:30   (O76) Krekiehn N. R., Yilmaz E. B., Backhauß J. C., Glüer C. C.
Deep Learning-Based Localisation of Vertebra Body Centres: Input for Classification of Fracture and Curvature Status of the Spine

16:30 – 16:45   (O77) Bussod S., Ducros N., Abascal J., Douek P., Chappard C., Peyrin F.
Evaluation of deep learning material decomposition networks for spectral photon counting CT of the knee joint.

16:45 – 17:00   (O78) Vicory J., Retrouvey J. M., Paniagua B.
Toward Automatic Path Planning for Correction of Impacted Teeth

17:00 – 17:15   (O79) Neeteson N. J., Besler B. A., Whittier D. E., Boyd S. K.
HR-pQCT Images Can be Accurately, Precisely, and Automatically Segmented Using a Fully Convolutional Neural Network and Morphological Post-processing

17:15 – 17:30   (O80) Gao K. T., Tibrewala R., Hess M., Bharadwaj U. U., Inamdar G., Link T. M., Chin C. T., Pedoia V., Majumdar S.
Automatic detection and voxel-wise mapping of lumbar spine Modic changes with deep learning

Friday, June 17th

Skeletal adaptation chair: Harry van Lenthe

9:00 – 9:15   (O81) Gabel L., Liphardt A. M., Heer M., Zwart S. R., Sibonga J. D., Smith S. M., Boyd S. K.
Bone Microarchitecture Does Not Recover Within One Year After Long-Duration Spaceflight Aboard the International Space Station

9:15 – 9:30   (O82) Fernandez P., Gordienko K., Locrelle H., Linossier M., Lau P., Rittweger J., Vassilieva G., Vico L.
A Glimpse Into Spaceflight Induced Bone Loss Over 18-Months

9:30 – 9:45   (O83) Walle M., Whittier D. E., Weidlich C., Windisch D. O., Atkins P. R., Christen P., Blauth M., Lippuner K., Müller R., Collins C. J.
Time-lapsed HR-pQCT allows monitoring local bone remodelling events at various follow-up time-points in vivo

9:45 – 10:00   (O84) Hosseinitabatabaei S., Vitienes I., Rummler M., Birkhold A., Rauch F., Willie B. M.
Parametric analysis of a method to non-invasively quantify bone remodeling using time-lapse high-resolution peripheral quantitative computed tomography imaging from individuals with OI

10:00 – 10:15   (O85) Ghasem-Zadeh A., Galea P. M., Nunn A., Panisset M., Wang X. F., Iuliano S., Boyd S. K., Forwood M., Seeman E.
Heterogeneity in microstructural deterioration following spinal cord injury

10:15 – 10:30   (O86) Ghasem-Zadeh A., Minh Bui M., Seeman E., Boyd S. K., Iuliano S., Jaipurwala R., Mount P. F., Toussaint N. D., Cherie Chiang C.
Bone microarchitecture and estimated failure load are deteriorated whether patients with chronic kidney disease have normal bone mineral density, osteopenia or osteoporosis

Advanced morphometry & segmentation
chair: Ralph Müller

11:00 – 11:15   (O87) Ghasem-Zadeh A., Firouzi N., Salmon P., McGregor N. E., Hardiman R., Sims N. A., Seeman E.
The Macro- and Micro-structure of Bone is Assembled by Varying Void Volume, not Bone Volume

11:15 – 11:30   (O88) Tümer N., Hiemstra O., Schreurs Y., Kraan G. A., van der Stok J., Zadpoor A. A.
The shape symmetry of the lunate: implications for the design of 3D printed patient-specific implants

11:30 – 11:45   (O89) Krug J., Wölfel E. M., Bartsch B., Busse B., Hemmatian H.
3D Assessment and Automated Segmentation of Cracks and Vascular Canals in Cortical Bone using High-resolution Microcomputed Tomography and Deep Learning Convolutional Neural Networks

11:45 – 12:00   (O90) Durongbhan P., Davey C. E., Stok K. S.
Quantification of cortical bone surface remodelling of the tibio-femoral joint in a rat osteoarthritis model

12:00 – 12:15   (O91) Zukić D., Cox J. M., Kovach L., Cole J. H., Marron J. S., Birdsong T., McCormick M.
Bone Morphometry of Atlas-Segmented Mouse Femurs and Tibias

12:15 – 12:30   (O92) Damm T., Will O., Kraas J., Gerle M., Peña J. A., Barkmann R., Glüer C. C.
Segmentation Methods for Monitoring Bone Implant Degradation and Bone Apposition In-Vivo using µCT

Closing remarks

12:30 – 12:45   Bert van Rietbergen, Harry van Lenthe and Quentin Grimal

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KEYNOTE LECTURES

Wiendelt Steenbergen
University of Twente, Netherlands
Monday June 13th 11:00 – 11:30

Photoacoustic imaging: a rheumatoid arthritis exploration

Photoacoustic imaging makes use of the phenomenon that absorption of short optical pulses in tissue creates ultrasound. This allows for 3D imaging tissue absorption, for instance by blood. I will introduce the technology, and present first results in imaging finger joints in the context of rheumatoid arthritis, using a tomographic device and a more familiar handheld probe with a built-in light source. Finally I will give a brief outlook on potential future developments.

Hilde Bosmans
KU Leuven, Belgium
Monday June 13th 14:00 – 14:30

Photon Counting CT: a new generation CT scanner?

During this lecture, we will explain the basic principles of a just released whole body photon counting CT scanner (Naeotom CT, Siemens, Forchheim, Germany). Photon counting detectors are new for CT applications and are now being used in conjunction with conventional CT x-ray tubes and using similar geometries. The detector has 4 channels that can potentially be used to exploit information on the energy of the photons, or to increase spatial resolution. These properties are especially useful for applications in bone imaging. We will illustrate typical applications and the first experience with such a device.

Sharmila Majumdar
University of California, San Francisco, USA
Tuesday June 14th 14:00 – 14:30

The Explosion of Artificial Intelligence Armamentarium in Musculoskeletal Imaging

In this talk dedicated to the memory of Dr. Harry Genant, the recent developments in the use of Artificial Intelligence (AI) in musculoskeletal imaging. Applications in different conditions such as osteoporosis, fracture prediction, osteoarthritis, lower back pain, etc. will be discussed. Different modalities used in musculoskeletal imaging including x-rays, CT and MRI will be presented.

Klaus Engelke
University of Erlangen–Nürnberg, Germany
Thursday June 16th 14:00 – 14:30

Opportunistic screening using routine clinical CT scans to identify subjects at high risk for osteoporotic fracture – Clinical promises and technical challenges

Despite an increasing variety of treatment options, osteoporotic fractures are still underdiagnosed and undertreated. Therefore, the identification of subjects for high risk of fracture is of high importance. One potential strategy based on so-called opportunistic screening, the simultaneous use of clinical CT scans performed for indications other than osteoporosis to identify prevalent fractures and to determine BMD of the spine or hip. However, a routine clinical workflow faces several hurdles, not only integration into CT scanner software and potentially hardware – Ideally an automatic detection of existing osteoporotic fractures in particular in the spine should be implemented and latest AI based solutions show promising results.
Further the quantification of BMD without a calibration phantom included in the patient scan in QCT, requires the use of asynchronous or internal calibration approaches, that will be reviewed in this keynote.

EVENING WORKSHOPS

Workshop 1A: MRI for muscle and bone imaging
Klaus Engelke & Peter Seevinck
Monday June 13th 20:00 – 20:45

Quantitative muscle imaging using MRI – Klaus Engelke (University of Erlangen–Nürnberg)

Quantitative MRI methods are increasingly used in research and clinical routine to assess atrophy, fat infiltration and inflammation of skeletal muscle. Such information is not only required for diagnosis and treatment monitoring of muscle myopathies but also to better understand decrease of muscle function with increasing age, a highly relevant topic in sarcopenia and frailty. As recently shown (mostly using CT data), there is also a BMD independent contribution of muscle density to risk of hip fracture. This part of the workshop will introduce and discuss techniques and performance characteristics of MR spectroscopy, chemical shift imaging such as Dixon sequences and T2 mapping. Dedicated image processing and analysis techniques will also be covered.

Quantitative bone imaging using MRI – Peter Seevinck (mriguidance)

MRI is the superior imaging modality for 3D visualization of soft tissues, both structurally and well as functionally. For evaluation of bone structures, however, CT is the preferred modality, causing the need for multiple radiological exams. An additional CT scan is often requested by surgeons or radiologists, despite the radiation burden. New MRI sequences make it now possible to see the bone structures better visualized with MRI. The most advanced technology is bone MRI technology, which is a machine learning technique based on artificial intelligence, which facilitates the reconstruction of synthetic CT scans from MRI data. In this lecture the basics of the technology will be explained, and use cases will be presented. For more information, go to mriguidance.com
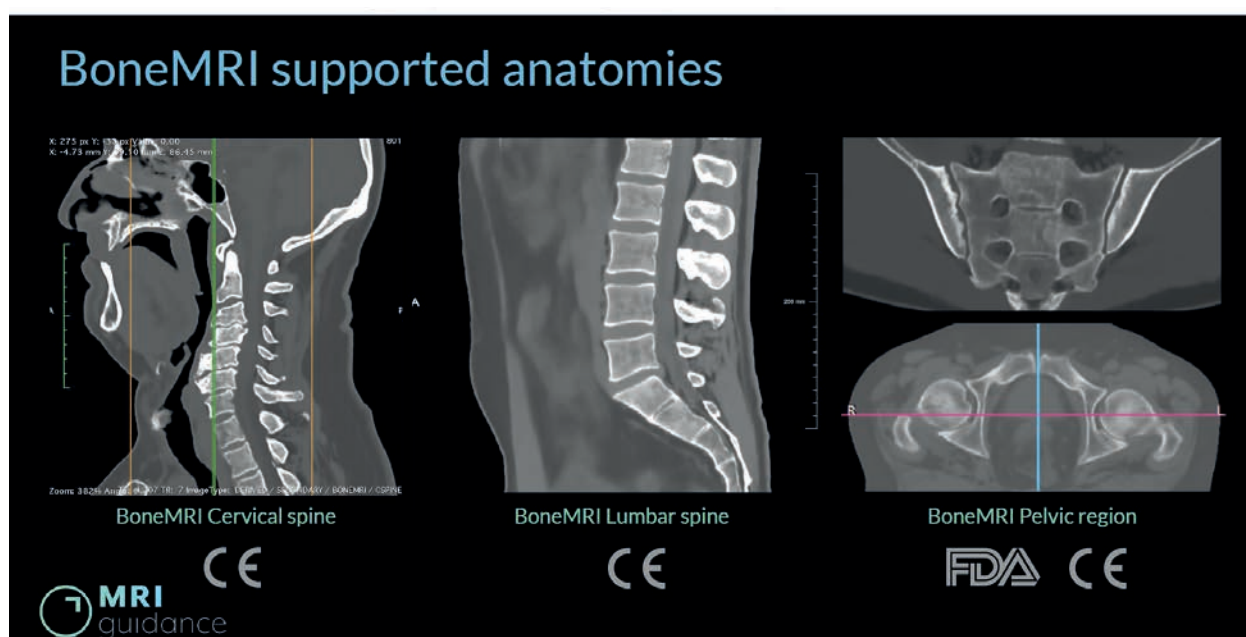
Workshop 1B: Updates from the IWOAI community
Edwin Oei
Monday June 13th 21:00 – 21:45

The International Workshop on Osteoarthritis Imaging started in 2007. It provides an interactive environment for those interested in osteoarthritis imaging to learn and network. Participants represent the diverse scope of the field and include professionals from specialties including medicine, surgery, radiology, medical physics and physiotherapists, as well as a broad array of professional backgrounds including academia, industry, government and regulatory agencies. Imaging is critical in both the diagnosis and management of osteoarthritis. Clinical and epidemiological studies characteristically utilize imaging–derived inclusion/exclusion criteria as well imaging based outcome measures. This Workshop was established to offer opportunities for osteoarthritis investigators to discuss issues related to imaging of osteoarthritis. The topics of discussion may include new lessons learned about osteoarthritis pathophysiology by using imaging modalities, recent advances in imaging techniques and appropriate analytic methods of imaging derived data.

Speakers:
- Edwin Oei (Department of Radiology & Nuclear Medicine, Erasmus MC Rotterdam)
- Jos Runhaar (Department of General Practice, Erasmus MC Rotterdam)
- Mylène Jansen (Department of Rheumatology & Clinical Immunology, UMC Utrecht)
- Jukka Hirvasniemi (Department of Radiology & Nuclear Medicine, Erasmus MC Rotterdam)

For more information, go to https://www.isoai.org/annualconferenceiwoai .

Workshop 2A: Open–source imaging
Serena Bonaretti and Enrico Schileo
Monday June 13th 20:00 – 20:45

Introducing the Open and Reproducible Musculoskeletal Research (ORMR) community

Open and reproducible research are movements that have progressively gained attention across scientific disciplines. They aim to provide knowledge and tools to support researchers in sharing data and code, collaborating with others, and contributing to greater field advancements. During QMSKI 2020, we started a discussion on how to create and use tools to incentivize open and reproducible research in musculoskeletal imaging and biomechanics. A few months later, we established the Open and Reproducible Musculoskeletal Research (ORMR) community (previously Jupyter Community in MSK Imaging Research). Our task is to create software for open and reproducible workflows, infrastructures for shared data, and learning material for new contributors.

In this workshop, we will introduce the ORMR community to the larger QMSKI community. We will share our aims and values, data and computational tools, and future directions. We will also engage in a conversation with the audience and provide guidelines to researchers interested in joining and contributing.

Workshop 2B: Update from the SPECTRA collaboration
Sarah Manske
Monday June 13th 21:00 – 21:45

The Study grouP for x–trEme Computed Tomography in Rheumatoid Arthritis (SPECTRA) was formed in 2011 by Dr. Cheryl Barnabe to facilitate world-wide collaboration in developing advanced imaging tools to better understand and treat arthritis.

Since its inception, the collaboration has published guidelines for standard image acquisition, and reached consensus on defining bone erosions as well as measuring joint space. The collaboration now has grown to include members from five continents, and is an interdisciplinary team, including rheumatologists, immunologists, radiologists, biomedical engineers, and physicists.

Our goal is to expand the use of HR–pQCT as an imaging biomarker for rheumatic diseases affecting the small joints of the hands and feet. Since the original meeting, SPECTRA has hosted regular study groups at the American College of Rheumatology (ACR) and European League Against Rheumatism (EULAR) Annual Meetings since 2013, and was twice (2016 and 2018) selected as a Special Interest Group for the Outcome Measures in Rheumatology (OMERACT) consensus conference aimed at improving outcome measures in rheumatology.

SPECTRA has also been invited to present regularly at the XtremeCT User Meeting held in conjunction with the American Society for Bone and Mineral Research Annual Meeting. Including the original Calgary meeting, SPECTRA has held stand-alone meetings 5 times.

This will be a debate related to the question *"Are open and reproducible workflows necessary for CT in clinical trials and research?"*

Debate panel "For":
- Ralph Müller (ETH Zurich)
- Andy Kin On Wong (University Health Network)

Debate panel "Against":
- Klaus Engelke (FAU University Erlangen-Nürnberg and Universitätsklinikum Erlangen)
- Danielle Whittier (ETH Zürich)

Workshop 3 ShapeWorks: Open–source Software for Musculoskeletal Tissues
Andrew Anderson and Penny Atkins
Tuesday June 14th 20:00 – 21:45

ShapeWorks: An Integrated, Opensource Software for Shape Analysis of Musculoskeletal Tissues Researchers in biology, engineering, and medicine commonly use form (i.e., shape) to understand function. In these fields, it is understood that abnormal morphology of the underlying anatomy often leads to impaired function – this is certainly true of the musculoskeletal system. While analysis of tissue shape from medical imaging is central in diagnosis and treatment planning, clinical observations of shape are often qualitative since quantitative description of shape requires the application of mathematics, statistics, and computing to parse the shape into a numerical representation. ShapeWorks is an opensource software that enables learning population-level shape representation derived from imaging data, such as CT or MRI, and the associated 3D models of anatomy generated from them. ShapeWorks has the potential to transform the way researchers approach studies of anatomical form and beyond. The utility of ShapeWorks has been demonstrated in a range of biomedical applications,

including orthopaedics, cardiology, psychology, and biological phenotyping. The goal of this workshop is to introduce the community to ShapeWorks, an integrative, user-friendly, and scalable computational solution for constructing statistical shape models. The workshop will be led by Professor Andrew Anderson and Dr. Penny Atkins from the University of Utah. They will introduce theoretical applications of statistical shape modeling, highlight the robust utility of ShapeWorks, and present applications that link physics, form, and function of population-based modeling of anatomical variation through exemplary use cases of musculoskeletal tissues. Ongoing research and development efforts that aim to increase the efficiency and broaden the application of shape analyses through machine learning and statistical parametric mapping will also be discussed.

For those interested in the software:
- Software link: https://github.com/SCIInstitute/ShapeWorks
- Documentation link: http://sciinstitute.github.io/ShapeWorks/

Speakers:
- Andrew E. Anderson (Department of Orthopaedics and Scientific Computing and Imaging Institute, University of Utah, aea4@utah.edu)
- Penny R. Atkins, (Department of Orthopaedics and Scientific Computing and Imaging Institute, University of Utah, penny.atkins@utah.edu)

Workshop 4: Bone Ultrasound Imaging
Quentin Grimal,
Tuesday June 14th 20:00 – 21:45

The objective of the workshop is to present the latest developments in quantitative ultrasound imaging of cortical bone. Ultrasound scanners equipped with array transducers are used to collect raw frequency echo signals which can be processed to 1) reconstruct an image of the cortex and 2) provide quantitative information on bone macro- and microstructural, and viscoelastic properties.

After the presentation of the physical and technical principles of bone ultrasound imaging, several examples of data acquisition and processing, and live demonstrations will be given.

Speakers:
- Jonas Massmann, Jennifer Hartwigs, Kay Raum (Charité-Universitätsmedizin Berlin, Germany)
- Amadou Dia and Quentin Grimal (Sorbonne Université, Paris, France)
- Guillaume Renaud (Sorbonne Université, Paris, France and Delft University of Technology, The Netherlands)

SOCIAL PROGRAM AND NETWORKING

Social program

Sunday, June 12th
Starting 18:30, a welcome reception, including food and drinks, will be held in the "Breakers Beach House" at Hotel Huis Ter Duin.

Monday, June 13th
At 18:30, dinner will be served in the "Keizerzaal" at Hotel Huis Ter Duin,

Tuesday, June 14th
At 18:30, dinner will be served in the "Keizerzaal" at Hotel Huis Ter Duin,

Wednesday, June 15th
After lunch busses will leave from the hotel to Leiden and to Amsterdam. The departure and return times and locations will be announced during the meeting.

Thursday, June 16th
At 18:00 busses will leave for the conference dinner. The conference dinner will be in 'Kasteel Oud-Wassenaar' (location: Park Oud Wassenaar 1, 2243 BX Wassenaar).

At that location you can enjoy dinner and afterwards there will be a party. Return busses will leave around 23:00.

Networking

We have created a slack workspace named QMSKI_2022. If you registered in time, you should have received an invitation for this. For others: please send an email to info@qmski.org to get the invitation

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ECHOLIGHT

REMS TECHNOLOGY
Radiofrequency Echographic Multi Spectrometry

Radiation-free bone microarchitecture characterization on the axial sites using radio frequency signals acquired during an ultrasound scan. The method overcomes all the main limitations of DXA (Dual-Energy X-ray Absorptiometry) and QUS (Quantitative Bone Ultrasound).
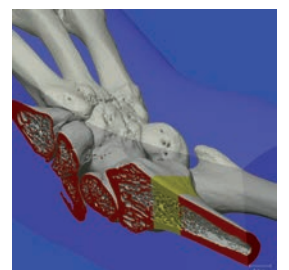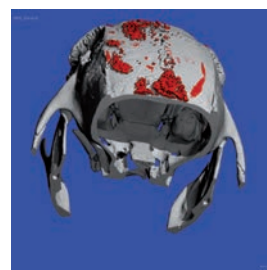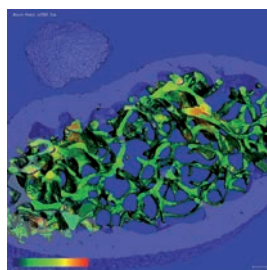
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