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**In Memoriam** 

# The Passing of the Baton—In Memory of Professor Harry Genant MD

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### Abstract

With Dr Harry K. Genant's untimely passing, we note the contributions he made to the field of osteoporosis and bone densitometry including the clinical introduction of quantitative computed tomography, bone densitometry systems validations, universal standards for bone measurement, vertebral fracture assessment, and as a mentor and colleague to countless current clinical and research leaders in the field of osteoporosis. His full biographical sketch is included with remembrances by many of his friends and colleagues on how these innovations came about and shaped the field as it is today.

Key Words: Bone densitometry workshop; osteoporosis; QCT; standardized BMD; vertebral fracture assessment.

It is with sadness that we report the passing of Professor Harry Genant MD, one of the most influential contributors to the field of musculoskeletal imaging including osteoporosis. Dr Genant died suddenly on January 14, 2021. Dr Genant was more than just a friend and colleague. He was an inspiration to many of us through his research papers, leadership roles, and mentorships. He knew how to extract the best of each of us but not for his own benefit as humanity and humility were his leitmotif. Many, including ourselves, consider Dr Genant responsible for the successes we have had in our professional endeavors and even being in bone research at all. He was an intelligent, creative, and energetic researcher and leader, with a quick grasp of the complexities of performing research in academia and in a competitive business environment. Dr Genant's expertise in musculoskeletal imaging was tremendous with key

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\*Address correspondence to: John Shepherd, PhD, CCD, Department of Epidemiology and Population Sciences, University of Hawaii Cancer Center, Honolulu, HI 96822. E-mail: johnshep@hawaii.edu achievements throughout his never-ending career. Particularly, his influence in the field of bone densitometry and the ISCD goes back many years at the dawning of quantitative computed tomography (QCT) and then dual-energy X-ray absorptiometry (DXA).

The impressive number and quality of completed abstracts, presentations, and publications have made him globally renowned from the early days. According to Scopus, Dr Genant generated 811 publications and 83,968 citations at the time of this writing. His h-index is 138, meaning that he has had 138 papers with over 138 citations, putting him in the ranks of the 900 most cited scientists on record across all fields. Harry's paper on the clinical use of QCT was one of, if not, the first paper on measuring bone density when CT was a new technology (1). This paper was published only 5 yr after the very first theoretical papers on CT imaging were presented. Harry was an early technology adopter from the start of his career and knew how to be surrounded by future promising talents from all around the globe, full of energy and positivism like him. He was a one-man social network! Always eager to go further, Harry immediately started a

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workshop to further study and understand the quantitative and qualitative bone measures. The first workshop was in San Francisco, CA, USA, in 1979 and was called the First International Workshop on Bone and Soft Tissue Densitometry, where technical and quality issues of measuring bone density in people were discussed, predating the first ISCD meeting by 16 yr. In 1987, Harry had just heard that Hologic was developing a new type of bone densitometer using an X-ray source instead of a radio-isotope to do what is now called DXA. He invited one of its inventors, Jay Stein PhD out to his workshop that year. Jay said that was the first time he met Harry. Jay said,

"In his characteristic magnanimous way, Harry called me and said he wanted to squeeze me into the agenda of a symposium he was hosting at UCSF in one week. Harry was the type of person whom we all know was completely involved in and interested in any new development in his field."

It has always been hard to say no to Harry because as Jay says, "he was simultaneously both gracious and irresistible." Jay continues,

"In hindsight, Harry was the person responsible for the first public presentation of DXA and he told me many years later that he was proud of having done it. I am proud of the fact that it was Harry himself who was the first person in the field to recognize and promote DXA to the world."

#### As Peter Steiger remembers,

"[Dr Genant] secured a device from Hologic and worked with Steve Cummings to add DXA to the Study of Fractures (2). The rest is history – proximal femur bone density using DXA emerged as the strongest predictor of future osteoporotic fracture out of SOF."

The workshop series continues to this day under the name the International Workshop on Quantitative Musculoskeletal Imaging (QMSKI).

The last meeting, its 22nd, was held in Lake Louise Ontario, Canada. The workshop hosts leaders in the field alternating biennially between North America, Europe, and the Asia-Pacific, where Dr Genant created a sense of scientific continuity to every workshop.

When Lunar (known as the inventor of the first bone densitometry using radio-isotope, namely, dual-photon absorptiometry (DPA) system developed by R. Mazess and colleagues) and Norland Corporations came to market with their version of a DXA system, it was soon learned that each of the 3 companies had used different definitions for determining bone area, and bone mass. Bone density in terms of  $g/cm^2$  did not match between

makes of systems. Further bone density in these units was hard to explain to patients. In a landmark paper from 1994, a WHO study group stated that osteoporosis classification should be defined using a score we now refer to as the T-score which eliminated the problem of absolute calibration differences between makes but soon it was learned that T-scores did not agree sufficiently either. So, Harry, with experts from around the world representing academia in America and abroad and 5 companies (Stratec and Aloka in addition to the 3 above) with interests in bone density measures formed a committee called the International Committee for Standards in Bone Measurement (ICSBM). Ultimately, this group was responsible for the universal standardization equations for spine, hip, forearm, and whole body bone mineral density (3-5), a phantom now called the European Spine Phantom created to field-calibrate DXA and QCT systems (6), the approach to standardize T-scores for spine (7), and including the use of the NHANES reference data for hip T-score calculations (8). All of the above work of the ICSBM is still in use today, more than 20 yr later.

Ken Faulkner remembers the early years of bone density with Dr Genant's University of California San Francisco research group fondly,

"For each question, research projects were proposed, studies were performed, and papers were published. Hundreds of scientific publications that were central to the foundation of clinical bone densitometry and osteoporosis treatment were published during those days in the early 1990s. If there was a way to measure bone densitv. Harrv was involved: SPA. DPA. SXA. DXA. OCT, OUS, MRI.... there were various makes and models of bone densitometry equipment scattered around the UCSF campus. In addition to collecting densitometry equipment, Harry also collected osteoporosis researchers. Many of the leaders in the field spent time at the Osteoporosis Research Group (ORG) [ORG was the forerunner to OARG] and launched their careers under Harry's mentorship (including two former ISCD presidents). His work formed the foundation of many of the ISCD training modules and position statements in use today. As a radiologist, he was the literal "gold standard" for evaluating vertebral fractures in clinical trials."

To those who did not know Dr Genant personally, he is probably most known for the measures and scores that are known by his name, the Genant Scores for osteoporotic spine fractures and the Sharp-Genant Scores of rheumatoid arthritic hands (9,10). Both scores are still broadly used in each field maybe without you knowing it. In fact, the Genant spine fracture scores are the suggested way to report spine fractures by the ISCD as stated in the ISCD official positions as well as many other societies from around the world. Dr Genant developed the

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semiquantitative fracture scores with Dr Chun Wu while he was a visiting researcher from China in 1990. Dr Wu remembers,

One of my first projects was working with Harry to develop the semiquantitative vertebral fracture scoring system, which would later come be called Genant SQ grading. Nearly every day for weeks, I would go to Harry's office at 5:00 or 6:00 pm and review cases, pulling films from envelopes and mounting them on the lightbox. It was a rare opportunity to learn from a master, but at the same time I had the feeling we were figuring things out together, defining the features of a fracture and the severity grades. When it came time to publish, Harry said "We need a figure to show the different fracture grades." So I found a drawing of a normal vertebra and using MacPaint, I painstakingly edited the black and white image to show each grade, going back and forth with Harry until he was satisfied. While Harry might have seen the importance, I had no idea how widely reproduced those images would become.

That figure as originally drawn is incorporated into the Hologic and GEHC-Lunar DXA software and is seen on a daily basis by those using DXA vertebral fracture assessment software. Nelson Watts MD remembers,

"Approval of medications to reduce fracture risk might have occurred without Harry's contributions, but to say he was a key part would not be overstating his contribution. The "Genant" semi-quantitative method for grading vertebral fractures (9) was used in the etidronate study that I was part of (11) and many trials that followed. Harry read the radiographs in the early trials in the reports, he was referred to as the "single blinded radiologist," although happily married to Gail and with excellent vision! Harry was always the gentleman. I had the pleasure of revisiting the history of etidronate for a recent paper and was delighted that Harry was able to contribute (12)"

Another continuing theme of Dr Genant's life is how he remained accessible either as a busy professor or the chairman of a multinational corporation. Harry was never one to tell you to set up an appointment to share a thought. He always took Didier's and my calls as all the others' call. Once there was something I needed his input on and so I just called his cell phone. He picked up and we talked for about 45 min. Then he said, "John, do you mind if we continue this conversation tomorrow, it is 3 am here in China." I had no idea he was out of the country or would have never called, but he picked up. That is just the way he was. Tom Fuerst PhD remembers,

"In 27 years, I think I can count on one hand the number of times I left voicemail for Harry. He seemed



**Fig. 1.** Dr Genant at the evening off at the 22nd Quantitative Musculoskeletal Imaging (QMSKI), Banff, Alberta, Canada, 2019 (photo by Andres Kroker).

always available and ready to help, regardless of the time zone his phone might be ringing in. Or the setting...in one of the last phone calls I had with Harry, as we said our partings, I distinctly heard the sound of water dripping from his swimming trunks onto flagstones as he stepped out of his hot tub on a cool December evening.... that's accessibility!"

Lastly, Dr Genant was more than the sum of his accomplishments. He was a true friend and genuine person (Figs. 1-5).



**Fig. 2.** International Bone Density Workshop, 1998, Delevan, WI, USA. Thomas Hangartner (left), Charles Wilson (center), Harry Genant (right).

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**Fig. 3.** Dr Genant's Osteoporosis and Arthritis Research Group (OARG) at the University of California San Francisco, December 2001, San Francisco, CA.

I never heard him say negative things about anyone or repeat what others had said. Bill Leslie reflects from about 15 yr ago at an ASBMR meeting,

"I blazed through  $\sim 40$  slides in 10 minutes, speaking faster than an auctioneer. Harry slowly approached the microphone and—without a hint of sarcasm—smiled and simply commented "That was a lot of data" and proceeded with his typical insightful comment and question. In the many years that have followed I never once saw him belittle a speaker. He was always a powerful positive role model for trainees and experienced researchers alike."

John Kanis MD also remembers 2 endearing moments between them,

"I first met Harry in 1987 at one of Claus Christiansen's osteoporosis meetings in Denmark. Harry presented



**Fig. 4.** International Bone Densitometry Workshop past presidents, 2004, Annecy, France.



**Fig. 5.** The authors, Didier Hans (left) and John Shepherd (center), with Harry Genant (right) at the 2012 European Congress on Osteoporosis & Osteoarthrosis, Bordeaux, France.

'The effects of etidronate in postmenopausal osteoporotic women: Preliminary results'. I gave him a very hard time in the Q and A session which he probably deserved, and he never forgot, and we became respectful acquaintances thereafter. In March 2002, I got caught in a rip tide off the coast of Honolulu on a boogie board and was rescued by Harry. Ever the gentleman, Harry never discussed this incident (nor I the Danish incident) but we became good friends."

Mike McClung MD remembers back to the 1987 bone density workshop,

"His legacy in [the consolidation of the osteoporosis field] is continued by his many trainees. An important aside—I made a special connection with an osteoporosis nurse, Betsy Love, at that meeting, leading me to thank Harry often for organizing it."

Mike and Betsy were married 5 yr later.

As a mentor and teacher to many researchers and clinicians (locally, nationally, and internationally), teaching them about osteoporosis and the radiological tools available for its diagnosis, many remember Harry's graciousness to young investigators, his example set as a leader in the field. He has been highly effective in this role of educator and has received high accolades from those he has instructed building subsequently a huge network of disciples. Ken Faulkner states what many of us think,

"As I have mentored others during my career, I often would ask "what would Harry do?" when faced with the chance to give advice or direction. As a result, his

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legacy lives on in a generation of people who he never knew or never met but have been influenced by him just the same."

### and Didier to add,

"At my early steps in the field of Osteoporosis early 90s, Harry kept teasing me every time we meet in in conference saying... "you should come to work for me some day"; I thought he meant to be polite...always the same statement... which evolved in "when are you coming to work for me"... until 1995 where Harry sat down in front of me during one of the IBDW evening at Gleneden beach, OR, USA. "Didier, I really want you to work for me – let's discuss." That night changed my life forever as I joined his OARG group 6 months after, cofounded later one with few others Synarc etc. and I stayed a close disciple of him since then, learning continuously day after day all aspects of my careers but also basic human values too often forgotten "...remember Didier you should always keep the human equation in the center of any decision." It is our duty to move forward his legacy, "to take the baton" hoping he would be proud of all of us for the little contribution we hope to still add."

Dr Genant has conducted himself with dignity and selfless dedication toward his profession, which has earned his utmost respect from the whole scientific and medical communities. Rest in Pease Harry, you will always be there in our hearts and souls.

#### **Biographical Sketch**

Harry K. Genant, MD, is Professor Emeritus of the University of California San Francisco, and Chairman Emeritus of the Board of Directors of Synarc, Inc. He received his medical degree from Northwestern University in Chicago, Illinois and completed his internship on the Osler Service at Johns Hopkins University in Baltimore, Maryland. He received residency training in Medicine and in Radiology at the University of Chicago and was Chief Resident and Assistant Professor in Radiology. In 1974 he joined the faculty of the University of California, San Francisco, as Chief of Musculoskeletal Radiology. He remained at UCSF for over 30 yr, becoming Professor of Radiology, Medicine, Epidemiology, and Orthopaedic Surgery. He founded the Osteoporosis and Arthritis Research Group (OARG) in the Department of Radiology, UCSF, and served as its Executive Director. This group, once numbering over 130 physicians, scientists and research associates, was recognized as a leading source of research on the development and assessment of noninvasive and quantitative imaging methods for osteoporosis, arthritis, and orthopedics. In 1998 he co-founded Synarc, Inc, a global, contract research organization (CRO) specializing in management of quantitative imaging and biomarkers in large, multicenter, multinational, pharmaceutical drug trials. He served as a Member of the Board of Directors from 1998 to 2013 and was a current Senior Consultant for Synarc/BioClinica.

Dr Genant has been editor or co-editor of more than 40 books and author or co-author of more than 300 chapters or invited articles, over 600 articles in peer-reviewed scientific and medical journals, and over 1500 abstracts presented at national and international scientific and professional gatherings. He is past Associate Editor of Bone, and Current Associate Editor of *Journal of Orthopaedic Translation*, and was a current Editorial Board Member of *Osteoporosis International* and the *Journal of Clinical Densitometry*.

Among the numerous awards and honors Dr Genant has received honorary lifetime memberships for the American Academy of Orthopaedic Surgeons and for the International Society for the Study of the Lumbar Spine. He is an honorary member of the Italian Radiolologic Society, the Chinese Osteoporosis Society, the Chilean Society of Osteology, the Hungarian Society of Osteology, and the European Society of Skeletal Radiology. He is a Fellow of the American College of Radiology and an Honorary Fellow of the Royal College of Radiologists, United Kingdom. He was named The Outstanding Physician of the Year in 1998 and the recipient of The Paul D. Miller ISCD Service Award in 2013, by the International Society for Clinical Densitometry. He was designated The Annual Orator in 2004, by the Radiologic Society of North America, and The Louis Avioli Annual Lecturer in 2012, by the American Society of Bone and Mineral Disease. He was elected by the American College of Rheumatology as an ACR Master in 2012 and was named the Olof Johnell Science Awardee at the ECCEO/IOF Congress in 2013.

Dr Genant has served as President of the Association of University Radiologists, President of the International Skeletal Society, First President and Founder of the International Bone Density Workshop series, Scientific Chair of the First through Sixth International Congresses on Osteoporosis in China, Co-Chair of the Second International Conference on Osteoporosis in Japan, Chair of the WHO Task Force on Osteoporosis, Chair of the International Steering Committee for Artificial Gravity for the joint US, German, and Russia Space Programs, Member of the Radiologic Devices Panel of the US Food and Drug Agency, Member of the Board of Directors of the International Osteoporosis Foundation and Co-Chairman of the IOF Global Initiative on Vertebral Fracture Assessment and Co-Chairman of the IOF Bone Quality Working Group.

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Bill Leslie MD, MSc, FRCPC, 2015 ISCD President, Professor, Department of Medicine (Endocrinology), Department of Radiology (Nuclear Medicine), University of Manitoba, Winnipeg, MB, Canada.

Michael McClung MD, Founding Director, Oregon Osteoporosis Center, Portland, OR, USA.

Peter Steiger PhD, Chief Scientific Officer, CALYX, Boston, MA, USA.

Jay Stein PhD, Co-founder, Chairman Emeritus, Senior Vice President and Chief Technical Officer, Hologic, Inc. Marlborough, MA, USA.

Nelson Watts MD, 1999 ISCD President; Professor, University of Cincinnati, Cincinnati, OH, USA.

Chun Y. Wu MD, Radiologist, Bioclinica Inc, San Francisco, CA, USA.

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