Bone and Mineral Diseases Fellowship Program

This one-year, clinically-oriented training program is designed to allow the fellow to become expert in the diagnosis and management of metabolic disorders affecting the skeleton, and to engage in skeletal research. This program is managed by the Division of Bone and Mineral Diseases under the aegis of the Skeletal Disorders Training Program (SDTP); and it is based on 5 fundamental components: 1) Clinic Rotations; 2) Diagnostic Procedures; 3) Research Training; 4) Core Curriculum Coursework; and 5) Enrichment Activities.

Clinic Rotations are the cornerstone of this fellowship program, as they expose the trainee to a full spectrum of clinical conditions affecting the skeleton, thus providing the fundamental skills required for a specialist in metabolic bone diseases and for developing clinically-oriented research hypotheses. These clinics are attended by one faculty mentor, and the trainee will follow a weekly schedule set for the entire year of training.

The Bone Health Program, directed by Dr. Kathryn Diemer, a clinician with 20-year experience with bone densitometry and osteoporosis, is attended by all clinical faculty of the Division of Bone and Mineral Diseases, including Drs. Civitelli, Whyte and Yalla. A wide spectrum of adult metabolic bone diseases are seen at the Bone Health Program, including osteoporosis, Paget's disease of bone, calcium and parathyroid hormone disorders, vitamin D deficiency and osteomalacia, hypophosphatemia and high bone mass syndromes. Duration: 4 blocks of 2-month rotations (6-7 half-day sessions per week).

The Center for Metabolic Bone Disease and Molecular Research of Shriners' Hospital for Children, located in newly built facility within the WU Medical Center, and directed by Dr. Michael Whyte. The disease mix of patients seen in this unit include hypophosphatasia, osteogenesis imperfecta, hypophosphatemic rickets, osteopetrosis, juvenile Paget's disease, fibrous dysplasia, and many other dysplastic skeletal disorders whose genetic basis are still under investigation. Duration: 2 blocks of 3-month rotations (one half-day session per week).

The Bone Metastasis and Breast Cancer Clinic directed by Dr. Kathrine Weilbaecher, a physician-scientist expert in bone oncology. Patients with primary and metastatic breast cancer and other solid tumors on different forms of chemo- and/or endocrine therapy, with bone loss and/or fractures represent the main patient population in this clinic. Opportunities for clinical research projects would be available. Duration: 2 blocks of 3 months (one half-day session per month).

The Secondary Fracture Prevention Service, attended by Dr. Yalla and other faculty of the Endocrinology, Diabetes and Lipid Research Division. Patients admitted with a hip fracture are seen after orthopedic surgery and followed up as outpatients to ensure appropriate treatment for secondary fracture prevention is implemented. Duration: 2 blocks of 2 months.

Diagnostic Procedures that are used for the diagnosis of metabolic bone disorders are integral part of the skills required for a specialist in bone and mineral disorders. Working under the tutorship of expert clinicians and pathologists, the fellow will receive specific education and hands-on training in bone densitometry and bone histomorphometry.

Dual-energy X-ray Absorptiometry (DXA) is the main tool for assessing bone density and estimating fracture risk. In addition to mentor-driven teaching about the appropriate application and interpretation of DXA during the different clinical rotations, the fellow will receive hands-on training on how to correctly perform a DXA scan, with case-based examples of pitfalls and limitations. The tutor is Dr. Kathy Diemer, an expert bone densitometrist, aided by one senior DXA technologist. Duration: 2-3 1-hour hands-on sessions. Furthermore, the fellow will be
required to become Certified Clinical Densitometrist by the International Society for Clinical Densitometry, which recognizes medical practitioners who meet specified knowledge requirements measured through a standardized testing process.

The Bone Biopsy Service is directed by Drs. Steven Teitelbaum and Deborah Novack. Fellows will learn the indications for metabolic bone biopsy and appropriate tetracycline labeling regimens; they will be instructed in the technique of transiliac trochar biopsy used to obtain specimens for the diagnosis of metabolic skeletal disorders. He/she will also participate in the histological assessment of the specimens and presentation of the data at Metabolic Bone Disease Case Conference. Duration: 2 1-hour instruction sessions with Drs. Teitelbaum or Novack, plus case presentations, based on availability.

Research training is supervised by a faculty research mentor, member of the SDTP, who may be engaged in basic, translational or clinical research. Selection of a research mentor from the pool of qualified faculty members is primarily the responsibility of each fellow. This is coordinated with the Division Chief, Dr. Roberto Civitelli. Time to be dedicated to this component of the fellowship is individualized to each fellow, and should not interfere with the other components of the training program and related clinical duties.

Core Curriculum Coursework is composed of lecture series, conferences and courses designed to provide in-depth education on topics that are fundamental for the formation of a specialist in skeletal disorders. While the main focus is on biology and pathophysiology, some lectures are clinically-oriented, and one case discussion conference is also included. The goal is to provide a comprehensive didactical program that encourages basic-clinical research interactions and creates a culture that promotes the translational aspects of skeletal research.

Metabolic Bone Disease Case Conference (CME Certified – JME04) represent a key component of this training program. These weekly conferences comprise an interdisciplinary group of clinicians, pathologists, radiologists and geneticists, as well as adult and pediatric endocrine fellows, residents and medical students during elective rotations. Typically, 2-3 patients are presented by faculty or fellows. In most circumstances, trans-illic bone biopsies are presented, reviewed and discussed. Cases are chosen based on their educational ramifications and/or patient management questions; topics range from rare or poorly characterized skeletal disorders to challenging presentations of more common conditions of skeletal fragility. The Fellow will present at least 1 case per month during the year of training. Meets on Fridays, 8:00 am; BJC Institute of Health, 11th Floor, Conference Room AB. Attendance is mandatory.

Skeletal Pathophysiology Mini-Course is a series of 5-6 lectures per year (typically in August-September), designed to complement courses available through graduate and postgraduate training programs, focusing on mineral homeostasis, bone, cartilage and tendon biology, bone biomechanics and biomineralization. Topics also include biostatistical approaches, fundamental methodologies for skeletal phenotype analysis in vivo and models for in vitro assessment of cartilage and bone cell function. Pathophysiology of osteoporosis, inflammatory arthritis, osteoarthritis, bone metastasis, and disuse bone loss are discussed in the context of available model systems and current clinical practice. Attendance is mandatory.

Elective Seminars and Conferences: Metabolism, Obesity, and Diabetes Seminar Series – This conference begins with a clinical presentation and discussion each week. These include metabolic bone disease cases that may be presented by Endocrine fellows. There is a Journal Club presentation or a Research Seminar on alternating weeks. Research seminars are assigned to senior faculty (with the option of having their fellows present their work). Meets on Thursdays, 10:00 am – 11:30 am; Schwarz Auditorium (1st Floor, Maternity Hospital).
**Postgraduate Clinical Endocrinology Course** – This is a clinical lecture series targeted to postdoctoral fellows in endocrinology, diabetes and metabolism, but open to students, residents and faculty. Its speakers include faculty from many Departments and Divisions, including Bone and Mineral Disease faculty, who present a series of 4-5 lectures every year on skeletal disorders as an integral component of this course. Meets on Thursdays, 12:00-1:00 pm; Southwest Tower, Room 728. **MRC Educational Seminars** are a series of 4-5 lectures, typically held in June-July, meant to provide in-depth information on the methodological tools and resources relevant to musculoskeletal researchers.

**Enrichment Activities** include research seminars, journal clubs, workshops and one annual meeting. These venues are designed to enrich and broaden a trainee’s fund of knowledge, interact with faculty and peers in informal and more formal settings, and hone reporting and presentations skills.

**Louis V. Avioli Musculoskeletal Research Seminars** – Named for the founder of our Division, Dr. Louis V. Avioli, this high profile lecture series is attended by all Division faculty mentors and their trainees, and it is ongoing from September through to May. These seminars provide a key didactic opportunity to expose trainees to the latest developments in skeletal and related research and facilitate their interaction with prominent investigators. They also offer a venue for exchange of information among WU faculty members and with guest speakers. Speakers include faculty or trainees, as well as visiting professors with internationally recognized expertise in skeletal disorders. The Fellow will present at least once during the year of training. Meets on Fridays, 9:00am; BJC Institute of Health, 11th Floor, Conference Room AB. Attendance is mandatory.

The **Experimental Skeletal Biology Journal/Data Club** focuses on the molecular and cellular biology of bone. Both faculty and trainees present on a rotation basis. Trainee’s presentations alternate between discussion of a published article and presentation of their own research project. Meets on Tuesdays, 12:00pm; BJC Institute of Health, 11th Floor, Conference Room AB. Attendance is recommended.

Other journal clubs available to the fellow are a **Musculoskeletal Mechanobiology Journal Club**, where articles are discussed pertaining to the biological response and adaptation to mechanical signals in skeletal tissues; and a **Developmental Biology Research Forum**, which offers a venue for discussions on general developmental biology, with emphasis on skeletal development. Attendance is elective.

The **Annual MRC Winter Symposium** represents a venue for scientific exchange and interactions among the entire WU musculoskeletal research community. This half-day gathering is held in the WU Medical Center campus, and it is organized around 4-5 oral presentations selected among abstracts solicited from MRC and other WU researchers in areas pertinent to skeletal biology, a poster session for MRC faculty and trainees, and a keynote lecture by an external, prominent investigator in the musculoskeletal field. In this setting, the fellow has the opportunity to present his/her research project, and of interacting with the invited speaker and other faculty and trainees of the WU musculoskeletal community at large. Attendance is recommended.