Research Overview: The Department of Orthopaedic Surgery's Bone and Joint Center

Gary Gibson, PhD

January 9, 2012

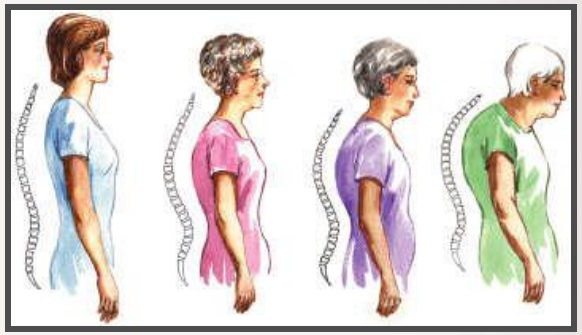
Bone and Joint Center

- Research division of the Dept of Orthop Surgery
- Founded in 1990 under Dr. Eric Radin
  - chair, 1989-1995
  - established research center covering the range of disciplines needed to thoroughly investigate skeletal diseases.
  - interested in understanding the development and treatment of osteoarthritis

Henry Ford Health System

Research Interests

- Osteoarthritis
- Osteoporosis
- Ligament injuries
  - anterior cruciate ligament (ACL) rupture
- Tendon injuries
  - rotator cuff tears
- Spine function

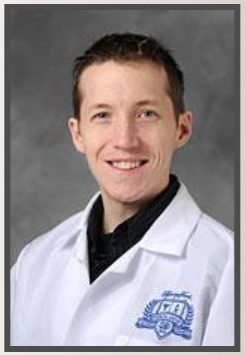


Multi-Disciplinary Research Team

- Cell Biology
- Biochemistry
- Anatomy / Histology
- Biomechanics
- Motion Analysis





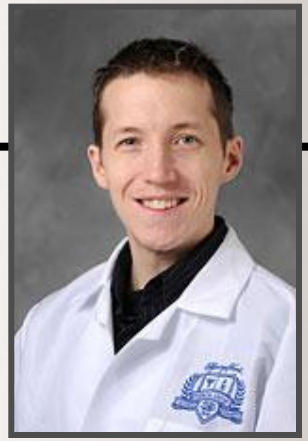



Personnel

- Additional Personnel
  - scientific editor (1)
  - emeritus scientist (1)
  - post-doctoral fellows (2)
  - instructors (2)
  - research engineers (3)
  - research assistants (3)
  - research coordinators (2)
  - research students (4)
  - grants/contract specialist (1)

Motion Analysis

- In-vivo joint function
  - shoulder

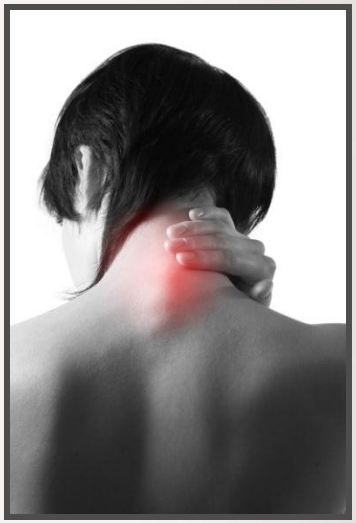


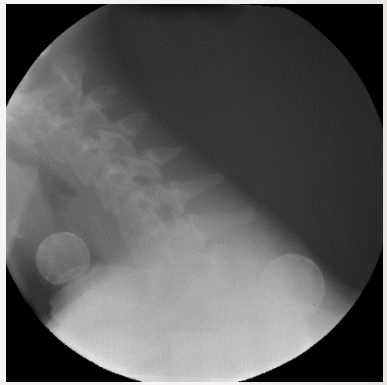
C. McDonald

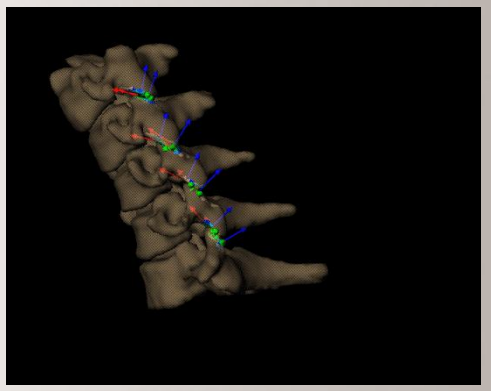
M. Bey

Motion Analysis

- In-vivo joint function
  - shoulder
  - cervical spine
  - knee
  - elbow
  - foot/ankle
- In-vivo tendon function
  - augmenting tendon repair/healing







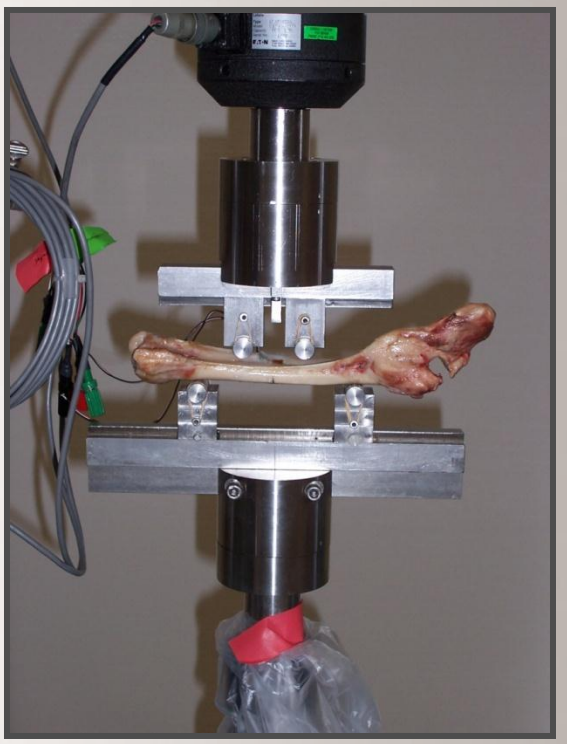
Anatomy/Histology

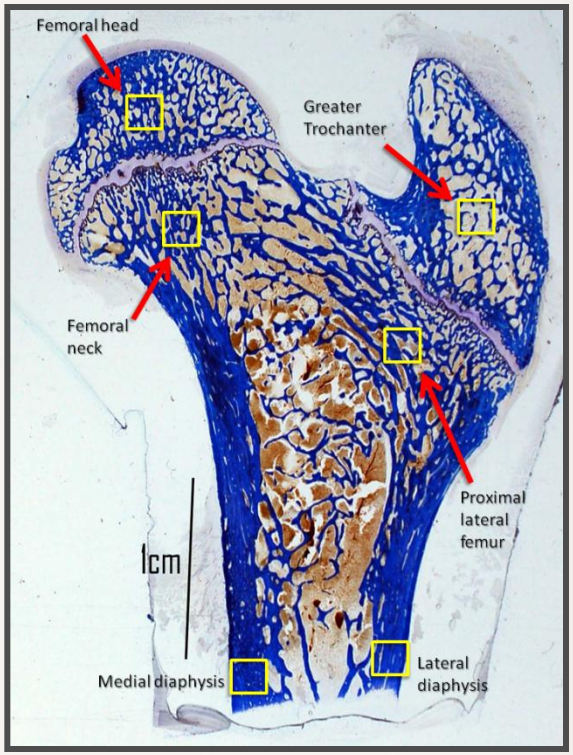
C. Les

- Understanding the mechanisms behind changes in bone mechanical properties due to:
  - estrogen depletion
  - diet
  - changes in mechanical loading
  - chronic alcoholism

Anatomy/Histology

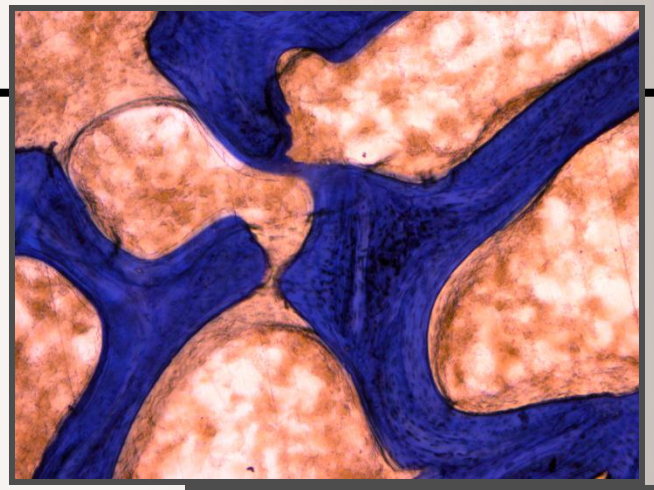
- Characterization of materials (bone) by:
  - mechanical testing
  - histology

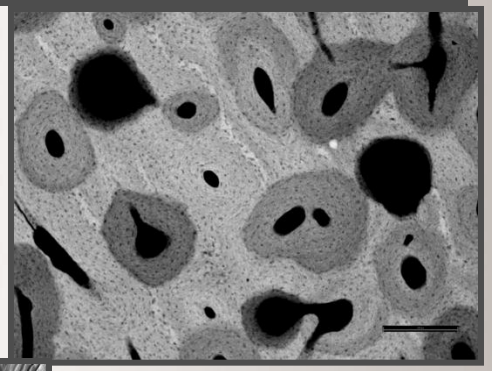


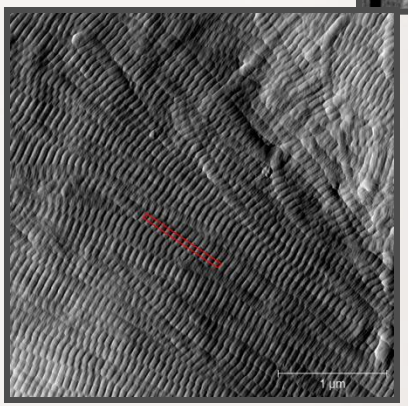


Anatomy/Histology

- Characterization of materials (bone) by:
  - mechanical testing
  - histology
  - histomorphometry
  - quantitative microradiography
  - collagen imaging using surface demineralization and AFM



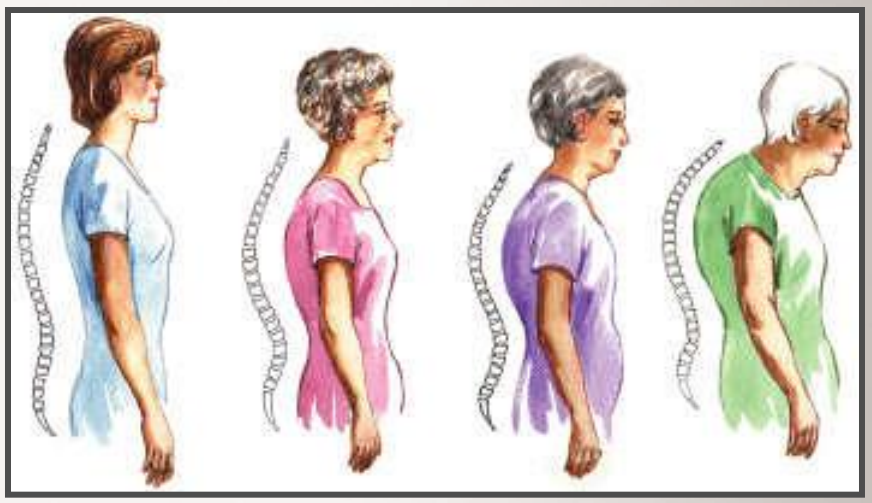




Biomechanics

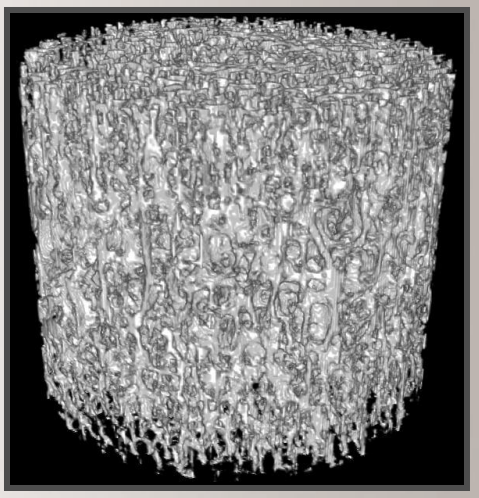
Y. Yeni

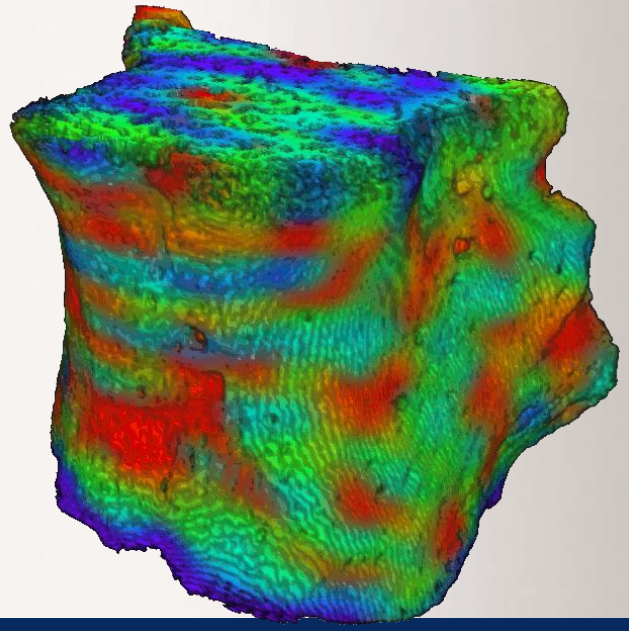
- Bone fractures
  - improving the diagnosis of fracture risk associated with osteoporosis
  - improving techniques for preventing and treating fractures



Biomechanics

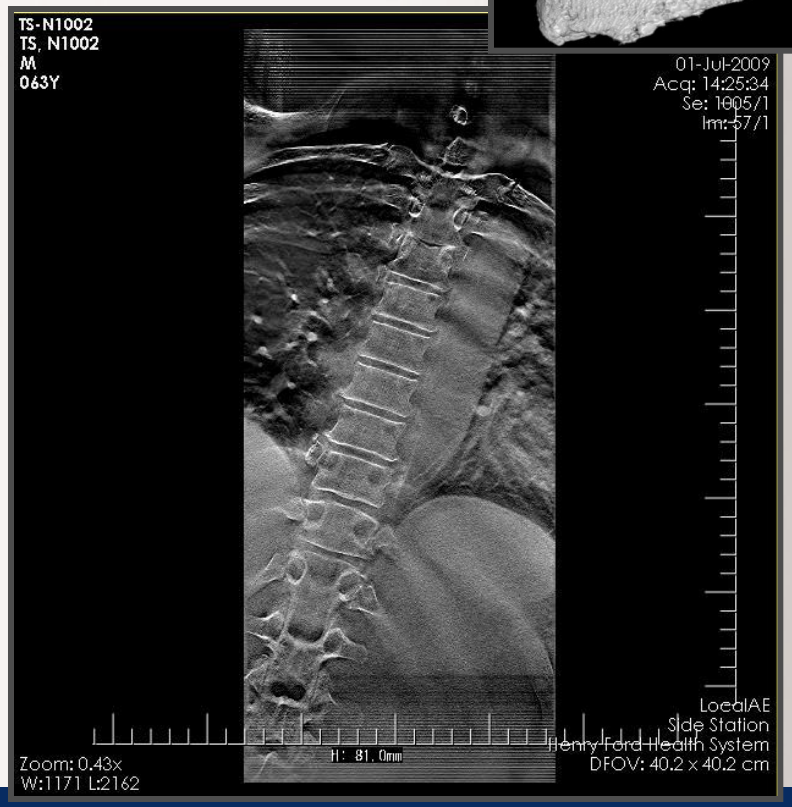
- Estimating how mechanical strain is distributed in bone: the relationship between microstructural and strain heterogeneity and fracture.
  - high-resolution imaging
  - computer simulation
  - mechanical testing





Biomechanics

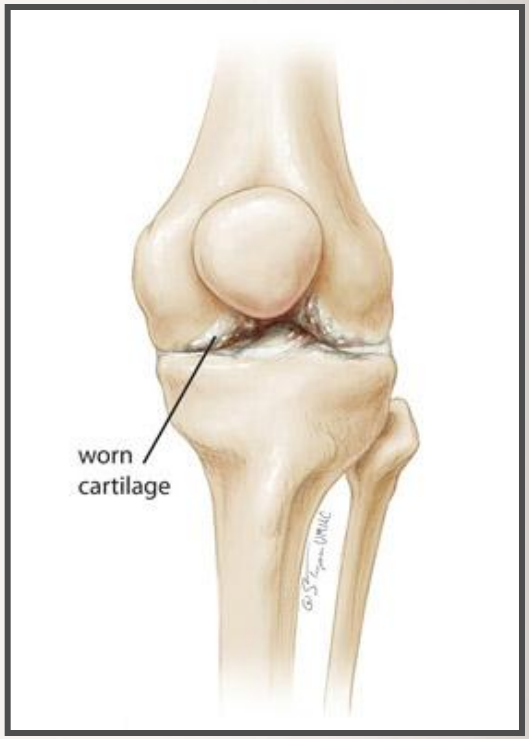
- Estimating how mechanical strain is distributed in bone
  - high-resolution imaging
    - micro-CT
    - tomosynthesis



Biochemistry

W. Wu

- Cartilage Breakdown
  - using OA cartilage, synovium, synovial fluid from patients to identify:
    - protein markers of cartilage breakdown
    - changes in cartilage matrix homeostasis



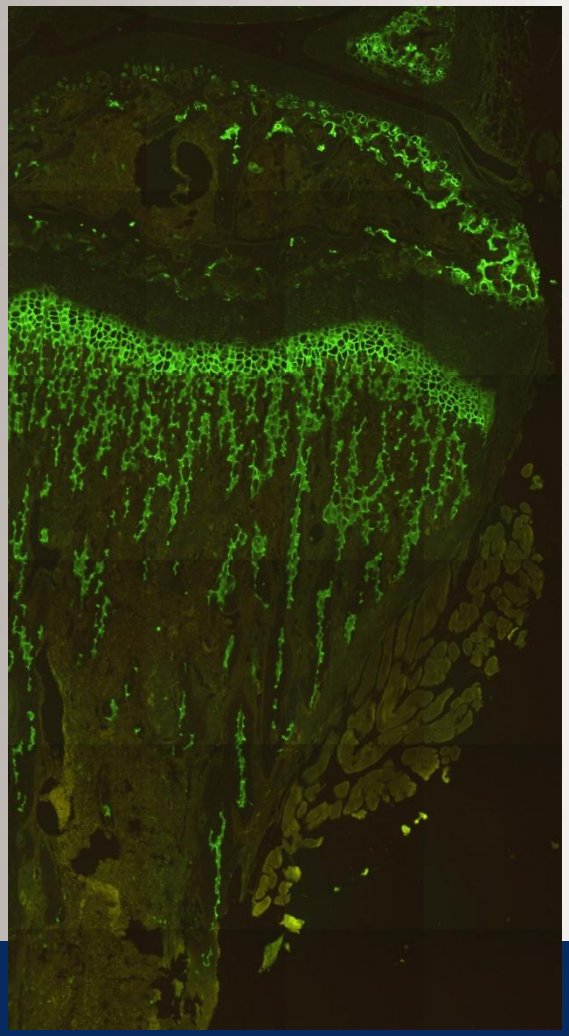
Biochemistry

- OA Pain
  - role of nutraceuticals (e.g., glucosamine, chondroitin sulfate) to treat pain
    - double-blinded study
    - effects of a neutraceutical on knee OA pain

Cell Biology

- Skeletal development and osteoarthritis

G. Gibson



Type X collagen

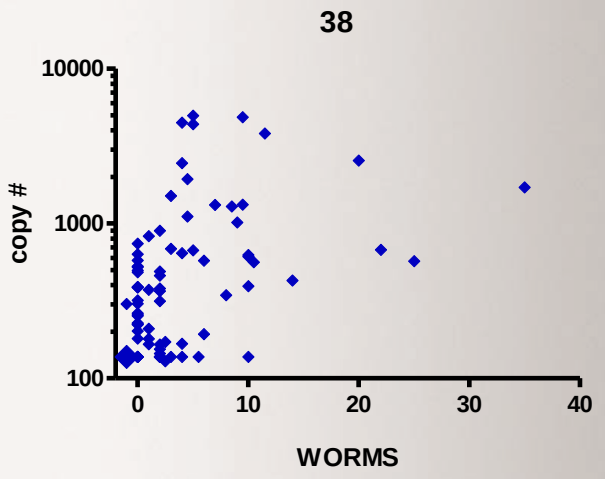
Rat tibia human articular cartilage

interface with subchondral bone

Cell Biology

G. Gibson

- Post-traumatic osteoarthritis
  - use of non-coding RNA's in serum as biomarker for the early prediction of OA



Productivity

- NIH Funding
  - 74 years of grants
  - ~$21 million in total costs
- Publications
  - ~250 full-length manuscripts

Collaborations

- Universities / Research Hospitals
  - California Polytech. State Univ (SLO)
  - Cedarville University
  - Cleveland Clinic
  - Colorado State University
  - Detroit Medical Center
  - Louisiana State University
  - MD Anderson Cancer Center, University of Texas
  - Michigan State University
  - Oakland University
  - Ohio State University
  - Purdue University
  - Royal College of Surgeons in Ireland
  - Tufts University
  - University of California, Davis
  - University of Guelph, Ontario, Canada
  - University of Michigan
  - University of Notre Dame
  - University of Pittsburgh
  - University of Sydney, Australia
  - University of Utah
  - University of Vermont College of Medicine
  - Wayne State University

Collaborations

- Corporate Partners
  - DonJoy Orthopaedics
  - Hills Pet Food
  - Innovative Health Technologies
  - Nike

Additional Info

www.henryfordboneandjointcenter.com

Thank You

Henry Ford Hospital
Detroit, MI

What Causes Knee Arthritis?

"Microklutziness": micro-incoordination causing subtle changes in joint motion

↓

Abnormal forces on the cartilage

↓

Biological changes

↓

Osteoarthritis (worn cartilage)

↓

Pain