

Research Priorities for the Unified Musculoskeletal Research Agenda

Summary of Future Research Directions, May 2010

The mission of the Unified Musculoskeletal Research Agenda is to advance science and research in musculoskeletal care through a unified advocacy strategy.

Systematic review of orthopaedic literature conducted to develop clinical practice guidelines has identified various gaps in research on musculoskeletal conditions with the greatest burdens of disease. These research gaps are categorically identified, and *high quality research studies* are necessary to develop strong evidence-based practice recommendations and ultimately improve patient care.

Continued and additional support of musculoskeletal research funding is necessary to address these research priorities to advance the science of orthopaedics and reduce the economic and societal loss of function and mobility.

Types of Research: An Overview

- **Basic Research:** answers fundamental questions on the physical, chemical, and functional mechanisms of processes and disease.
- **Translational Research:** translates knowledge from basic research into new or improved methods to treat and prevent disease; translates clinical insights into hypotheses that can be validated in the lab.
- **Clinical Research:** conducted with human subjects, or on material of human origin such as tissue and specimens, with an investigator who interacts directly with human subjects.
- **Health Services Research:** examines access, use, costs, quality, delivery, organization, financing, and effectiveness of health care services.

Musculoskeletal Conditions with the Greatest Burden of Disease

- Bone and Joint Disorders: Arthritis • Major Limb Trauma / High-Energy Extremity Injuries •
- Osteoporosis and Bone Quality; especially fractures in the elderly • Soft Tissue Disorders and Injuries •
- Spinal Disorders • Childhood Musculoskeletal Conditions •

RESEARCH PRIORITIES:

Bone and Joint Disorders: Arthritis

- Explore the **genetic, biological, and mechanical factors** that influence the progression of arthritis.
- Examine the molecular and bioengineering approaches to tissue regeneration with special emphasis on **cartilage repair**.
- Comparative effectiveness research on treatment to maintain mobility and independence.
- Study the interaction of biomaterials and wear, specifically the interaction of the biomaterials with the host.
- Investigate noninvasive diagnostic imaging methods for early detection of cartilage degeneration and implant failure.
- Explore the role of novel imaging technologies on **joint replacement**, including Radiostereometric Analysis (RSA, a form of x-ray), Dual Energy X-ray Absorptiometry (DEXA), surgical navigation, minimally invasive, and robotic surgery.
- Support high quality studies to assess **non-arthroplasty treatment** of knee osteoarthritis and to address the prevention of thromboembolic diseases (**blood clots**) in patients undergoing orthopaedic surgeries.
- Develop and evaluate interventions to prevent osteoarthritis following joint injuries (fracture, infection and congenital diseases).

Major Limb Trauma / High-Energy Extremity Injuries

- Develop **evidence-based clinical practice guidelines** for multidisciplinary care of amputees.
- Develop agents and delivery systems for molecular compounds and biophysical stimuli to **accelerate normal healing**.
- Elucidate causes for nonunion of fractures and develop biologic mediators to initiate **fracture repair**.
- Improve **rehabilitation** with workplace and activity re-entry including assessment of benefits of physical and occupational therapy.
- Develop partnerships with **infectious disease** researchers to prevent and treat infection following high-energy extremity injuries.

Osteoporosis and Bone Quality; especially fractures in the elderly

- Explore factors that contribute to the development of peak **bone mass** in both men and women in all ethnic groups.
- Focus educational efforts on the maintenance of bone mass throughout life and secondary **prevention** such as medical therapies and physical activity training.
- Improve **injury prevention** programs for the elderly, especially fall prevention.
- Determine gene and matrix factors that affect **bone mechanical strength** and optimal fracture healing.
- Develop appropriate, cost-effective methods to **evaluate osteoporosis** at the time of fracture (especially the hip and spine).
- Study pathophysiology and develop new therapeutic strategies for primary and metastatic bone cancers.

Soft Tissue Disorders and Injuries

- Increase the understanding of the causes of peripheral **nerve injuries** and develop enhanced diagnostic methods to facilitate alternatives to surgical treatment.
- Expand the role of prefabricated **engineered tissue** in free tissue transfer and identify the links, if any, between factors that regulate microcirculation and those that mediate pain perception.
- Develop synthetic replacements for muscle, nerve, ligament, tendon, meniscus, and cartilage using **tissue engineering** techniques / gene therapy.
- Study pathomechanics of joint injury focusing on **prevention** and the development of more effective protective strategies for particular sports and jobs where risks of physical impairment exist.
- Study pathophysiology of muscle atrophy and diseases and develop biological or biomedical engineering approaches to restore muscle function and mobility.
- Study pathophysiology and develop new therapeutic strategies for soft tissue sarcomas.

Spinal Disorders

- Improve the ability to **diagnose spinal disorders**, including the ability to localize the source of pain, evaluate motion segment instability, and evaluate the role of muscles and connective tissue on back pain.
- Explore **new treatment** methods and technologies for degenerative disc disease and spinal column tumors.
- Study the etiology of **spinal pain** and the role of medical, complementary, and alternative treatments.
- Develop a collaborative **evidence-based clinical practice guideline** for the treatment of spinal disorders and injuries.

Childhood Musculoskeletal Conditions

- Investigate the developmental **biology** of the musculoskeletal system with emphasis on bone and joint development and mechanism of regeneration.
- Develop additional physiologic **interventions** for the correction of skeletal deformities and neuromuscular conditions including cerebral palsy and muscular dystrophies.
- Improve childhood injury **prevention** programs especially for young athletes with return to play guidelines.
- Study predictors of individual treatment responses and the genetic and molecular basis for childhood **Arthritis**.
- Develop high quality studies for the treatment of **pediatric trauma**.

For information on the burden of musculoskeletal diseases in the United States, please visit

<http://www.aaos.org/research>