Fulfilling the Promise

Osteoarthritis: A Debilitating and Progressive Disease

With Americans urged to exercise daily to ward off the diseases of aging and stem the growing epidemic of obesity, joint pain and stiffness can stand in the way of the best fitness plans. But for millions of older Americans who have the degenerative joint disease osteoarthritis (OA), even basic physical activities are a challenge.

Osteoarthritis, by far the most common form of arthritis, affects an estimated 21 million Americans. It is caused by a breakdown of cartilage—the smooth, elastic tissue that normally covers and cushions the ends of bones where they meet to form a joint. For many, the result is daily joint pain, stiffness, and disability. Osteoarthritis can occur in any joint but most often affects the hands, spine, knees, and hips. While medications can help control the pain of OA, nothing can stop the disease process. Once the damage has occurred, there is no effective way to repair the cartilage.

The National Institutes of Health (NIH), principally through its National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS), supports research at the nation’s medical schools and teaching hospitals to determine the underlying causes of OA and devise prevention and treatment strategies that can keep Americans active for a lifetime. Some important findings from NIH-supported research follow.

Causes and Prevention
Risk for OA increases with age, and it is more likely to occur in people who are overweight or perform jobs or activities that place stress on particular joints. NIH-supported researchers are developing new strategies to better predict who is at risk of developing OA and preempt the joint degeneration that causes OA pain and disability.

• Men who suffer knee or hip injuries early in adult life are at greater risk for OA in these joints later in life compared with men who do not have such injuries, according to a 2000 study by researchers at Johns Hopkins University School of Medicine, the University of Maryland School of Medicine, and the Veterans Affairs Medical Center, all in Baltimore.

• In 2001, researchers at MCP Hahnemann University School of Medicine, Philadelphia, and the University of Alabama at Birmingham School of Medicine discovered a gene mutation that weakens collagen (a major component of cartilage) and causes it to break down more easily under stress.

The Osteoarthritis Initiative
To find new ways to prevent osteoarthritis and speed studies of new treatments, the NIH collaborated with private-sector sponsors and the Food and Drug Administration to launch the Osteoarthritis Initiative (OAI), a unique, long-term, public-private partnership to create a publicly available research resource to identify and evaluate biomarkers for osteoarthritis. With better biomarkers—including physical signs or biological substances in body fluids—scientists could diagnose the disease in its earlier stages and better monitor changes in joint health.

The OAI has 4,800 participants who are at high risk for knee osteoarthritis. The initiative includes four clinical centers and a data coordinating center, located at the following U.S. medical schools:

• University of Maryland School of Medicine, Baltimore
• The Ohio State University College of Medicine, Columbus
• University of Pittsburgh School of Medicine
• Memorial Hospital of Rhode Island, Pawtucket
• University of California, San Francisco (data coordinating center)

For more information about the OAI, go to www.oai.ucsf.edu/datarelease/About.asp.

Association of American Medical Colleges
• OA susceptibility increases when chondrocytes—cells in the body that maintain and repair cartilage—are damaged. Researchers at the University of Iowa Hospitals and Clinics (Iowa City) reported in 2006 that chondrocyte damage occurs with normal aging, but also from oxidative stress, which occurs with joint injury.

• Researchers at Vanderbilt University Medical Center in Nashville, Tenn., are leading a 2007 study by six academic centers to determine the most important predictors that may lead to eventual OA in the knees of patients who undergo reconstructive surgery of a torn anterior cruciate ligament, an injury common in athletes.

• Smokers who have osteoarthritis have more severe joint pain and a greater degree of cartilage breakdown than nonsmokers with OA, according to a 2006 study by researchers at Mayo Clinic College of Medicine in Rochester, Minn. and Boston University School of Medicine.

Treatment
NIH-supported scientists are currently working to improve existing treatments for OA. For example, surgical advances have made hip replacements safer for older adults, who have often had other conditions that made them ineligible for this procedure in the past. Longer-lasting materials are also making knee replacements a better option for younger, more active individuals. In addition, the NIH is investing in emerging areas of research at U.S. medical schools and teaching hospitals, including tissue engineering and regenerative medicine, to engineer new cartilage (sometimes from a patient’s own tissue) that can support the damaged joint. The goal is to stop or slow OA, and one day hopefully eliminate the need for joint replacements.

• People aged 60 and older with osteoarthritis of the knee who exercise in moderation have less pain, reduced disability, and can improve their physical performance, according to a 1997 clinical study conducted at Bowman Gray School of Medicine at Wake Forest University (Winston-Salem, N.C.) and the University of Tennessee (Memphis).

• By devising an animal model of vertebral disk compression and degeneration, researchers at the University of California, San Francisco, Medical Center have been working since 1998 to improve understanding of the cellular and molecular events of disk aging and degeneration, and enhance the feasibility of tissue engineering approaches to disk repair.

• Since 2001, researchers at Duke University Medical Center (Durham, N.C.) have been working on a three-dimensional fabric scaffold that could one day be used to patch damaged joint surfaces, allowing a patient’s cartilage-forming stem cells (taken from his or her own fat tissue) to move in and repair the damage. The hope is that this approach will delay or even eliminate the need for joint replacement.

• Acupuncture can reduce pain and improve function in patients with knee OA, according to a 2004 study by researchers at the University of Maryland School of Medicine.
• Case Western Reserve University School of Medicine (Cleveland) scientists have been investigating factors that cause artificial joints to fail, and, in 2006, clarified the role of bacteria in the loosening of orthopaedic implants.

• OA patients who participate in exercise programs before receiving an artificial knee or hip are more likely to skip inpatient rehabilitation after surgery and go directly home instead, a much more cost-effective option, according to a 2006 study by researchers at Harvard Medical School (Boston).

For more information about how medical schools and teaching hospitals are fulfilling the promise of medical research, go to www.aamc.org/research/ftp.