# Mechanical Engineering Department Seminar

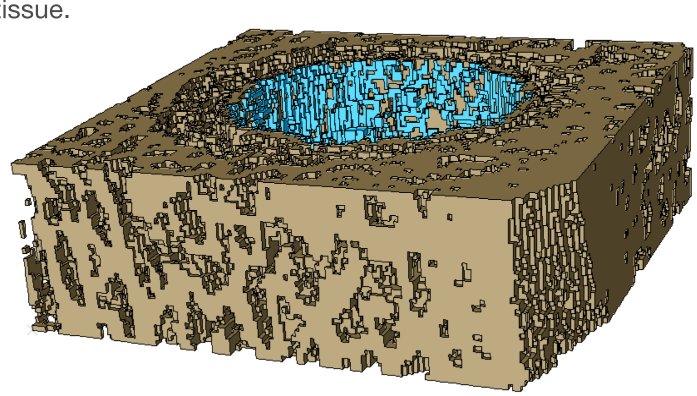
**3:35pm April 10, 2013**
**1130 Mechanical Engineering**

# Combined Mechanical and Biologic Approach To Improve Integrity of Bone-Implant Interface and Increase Longevity of Orthopaedic Joint Replacement Implants


## Joan Bechtold

Director; Orthopedic Biomechanics Laboratory, Excelen Center for Bone and Joint Research and Education and Minneapolis Medical Research Foundation in Minnesota


Total Joint Replacement (TJR) has one of the highest quality of life improvements per health care dollar spent, and currently a combined 1 million hips and knees are implanted in the United States annually. Given increased lifespans and younger age at implantation, the pool of patients with functioning implants is growing. While most implants work well (5-10% failure at 15 years), the larger pool of implants is leading to a larger number of revisions for failed implants. In some hospitals revisions comprise from 10-30% of all TJR surgeries. For over two decades, our laboratory has studied the role of mechanical loading and implant stability (lack of relative motion) in combined experimental and computational approaches, with a focus on the revision implant. This presentation will present a synopsis of our experimental findings and focus on two of our mechanical approaches. Both approaches focus on evaluating the integrity of the bone implant interface. Osseointegration, or direct bone ingrowth into an implant surface is a critical factor in the long-term function of these implants. Proper implant fixation prevents implant migration and loosening leading to failure. Static pushout tests of implants excised from animal studies are a common way to assess the fixation strength of various experimental implant coatings and surgical techniques. However, these tests are costly, time-consuming, and destructive. In this talk we will discuss a method developed to create computational models of implant fixation, in order to complement physical pushout tests. Another approach is to evaluate the fixation of the implants with dynamic loading, to differentiate differences in early soft tissue healing that could lead either to secure bone ingrowth or to persistence of fibrous tissue.



**Bio:** Joan E. Bechtold, PhD, is the Director of Orthopedic Biomechanics Laboratory at Excelen Center for Bone and Joint Research and Education and Minneapolis Medical Research Foundation in Minneapolis. She is Gustilo Professor of Orthopaedic Research at the University of Minnesota and Gradate Professor in Orthopaedic Surgery and member of Graduate Faculty in Mechanical and Biomedical Engineering. Dr. Bechtold is also Professor, Experimental Implant Surgery, at the University of Aarhus in Aarhus, Denmark. Currently, Dr. Bechtold's main research focus is on improving the bone-implant interface, for which she has been funded by NIH since 1995. With DoD and Orthopaedic Trauma Assn. support she investigates musculoskeletal infection and trauma. Her work has won the ORS Harris Award, several NIRA (ORS) finalist awards, and Acta Orthopaedica Paper of the Year.