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Osteoarthritis Studies at the Light Source

By Lisa Miller, NSLS

Osteoarthritis is the leading cause of disability in people over the age of 65, and affects over 40 million people in the United States alone. Joint replacement for the knee and hip is a painful surgery that requires hospitalization and results in over $10 billion in associated health care costs every year.

The pain in osteoarthritis is due to breakdown of the joint cartilage, but recent studies on a large colony of monkeys has shown that the underlying bone becomes thickened before the cartilage breaks down. Since monkeys naturally develop osteoarthritis that is very similar to humans, it is thought that the early stages of human osteoarthritis also begin with thickening of the underlying bone.

To date, it is unclear why the underlying bone thickens and how it plays a role in joint cartilage breakdown. Researchers have proposed that thick, dense bone may fail to absorb impact forces on the joint, leading to cartilage damage. Very little is known, however, about the specific chemical makeup of the underlying bone.

By using both x-ray and infrared micro-spectroscopy techniques at the National Synchrotron Light Source, scientists from BNL, the Albert Einstein College of Medicine and the University of Minnesota are examining the protein, calcium, phosphate and carbonate compositions simultaneously in the underlying bone. Our findings show an increase in mineral content in the bone of monkeys with severe osteoarthritis. An altered collagen structure is also observed, which may be a critical contributing factor to the increased mineralization.

We postulate that these changes in the underlying bone may make it more brittle, leading to micro-fractures. In order to repair these tiny cracks, bone production increases, potentially leading to thickened bone beneath the joint cartilage. These results are consistent with human clinical studies. Other protein abnormalities that are linked to an alteration in collagen mineralization have been observed in "brittle bone disease" and suggested in osteoporosis as well.

My colleagues in this work are Jim Ablett and Chi-Chang Kao (BNL); David Hamerman (Albert Einstein College of Medicine); and Cathy Carlson (University of Minnesota). We hope that these studies will provide a better understanding of the mineralization process in bone disease and will help in the development of ways to prevent or even reverse these debilitating diseases in the future.

More information on this work can be found at: http://www.nsls.bnl.gov/BeamRD/LiteBites/miller1.html, and information on other infrared microspectroscopy projects can be found at http://infrared.nsls.bnl.gov/u10b/home.htm

Saturday Shopping Shuttle

BNL's Saturday shopping shuttle offers free transportation to and from the Southport Shopping Mall in Shirley. New departure times and locations have been added to the route. Departures: 8:30am from Fleming House (Bldg 180), 8:35am from Curie House (Bldg. 258), 8:45am from Lollipop House. The shuttle operates continuously to and from the Southport Shopping Mall with the last trip departing from the Mall at 12 noon in front of the Waldbaum's supermarket. The vehicle is provided by Sunrise Coach Lines. For more information, contact BNL's Transportation Office, X2535.

Observed Holiday – September 4

BNL will be observing the Labor Day holiday on September 4. First-time users and those with expired appointments who plan to perform experiments at the NSLS on that day should arrive at NSLS User Administration no later Friday September 1 by 3:00 p.m. for registration and training.

Call for Abstracts

Experimental Summary Abstracts will be accepted for FY 2000 (10/1/99-9/30/00) beginning September 1, 2000. The new system and instructions can be found online at: http://nslsweb.nsls.bnl.gov/nsls/pubs/abstracts/submit.asp Submissions will be accepted in Word and WordPerfect. Deadline is October 30.

Call for General User Proposals

Proposals and Requests for Beam Time are being accepted for the January through April 2001 cycle. Complete proposal packages must be received by User Administration no later than 5 p.m. (EST) on October 2nd. Forms can be found at http://nslsweb.nsls.bnl.gov/nsls/users/procedures/forms.htm

Call for FY2000 Publication References

Please submit publication references for FY2000 (10/1/99-9/30/00). References are an important element in how funding agencies judge NSLS productivity. All NSLS users are obligated to submit complete publication references for any paper based in whole or in part on research done at the NSLS. Each beamline PRT submits a list of their own papers as part of their Annual Beamline Progress Report and the NSLS must also collect references by General Users and other collaborators in order to present the complete picture of the work being done here. Please email your references to Nancye Wright at wright1@bnl.gov.

User Obligations and Reminders

(1) All users must pre-register for each visit. Go to URL: http://nslsweb.nsls.bnl.gov/nsls/dbforms/user-regis.asp
(2) All foreign nationals must submit Form IA-473. Go to: http://nslsweb.nsls.bnl.gov/nsls/users/procedures/foreign.htm
(3) All foreign nationals who require registration must arrive on normal workdays only (Monday through Friday; no holidays).
(4) All users who require training must arrive before 3:00 p.m. (Monday through Friday; no holidays)
(5) All users: please complete End of Run Summary Form: http://nslsweb.nsls.bnl.gov/nsls/dbforms/end-of-run.asp

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