Collaboration; Key to Success in Biomedical Research

The Creighton University Osteoporosis Research Center (ORC) has been conducting research for nearly 50 years. Our primary goal has been to discover ways to prevent and cure osteoporosis that occurs mostly in women after menopause. Indeed, at the present time 50% of women and 20% of men over age 50 will suffer a low-trauma, osteoporotic fracture before they die. It is the 10th leading expense for Medicare. We have helped contribute to advances in the field that include drugs that reduce the risk of fracture about 50% in patients with osteoporosis; although impressive, we have a long way to go.

In the 1970’s instruments were developed (Dual X-ray Absorptiometry, DXA) to measure bone mass and density. Since then we have discovered that only about half of the risk of fractures is due to insufficient bone mass. The remainder is due to defects (weakness) in the bone tissue itself. We must gain an understanding of the nature of these weaknesses in order to develop treatments that can help remove them. The ORC has been working in this area for the past 6 years. This work has required use of extremely sophisticated technology, which has led us to purchase an expensive new laboratory instrument, and broad collaboration with scientists at other institutions.

The instrument, a MicroXCT-200, is a newly available imaging device which provides 3-dimensional images of mineralized bone tissue from human bone biopsies at extremely high resolution, i.e., 0.6 microns. This is about 1% the size of the diameter of a human hair.

This allows us to study cells called osteocytes and their connections to one another. These cells, and the very tiny connections between them, are buried in the mineral tissue of bone. They are numerous, about 32,000 per cubic centimeter of calcified bone tissue. They are the “life” of bone tissue because they detect cracks that appear due to repeated mechanical loading coming from our life in earth’s gravity, and regulate the bones’ repair mechanisms for these cracks. Using this methodology we will understand how these cells work, in order to invent ways to correct their malfunction which results in weakened bone tissue and risk of fracture.

We have also developed collaborations with a number of laboratories that possess very sophisticated technologies that allow us to examine the complexity of bone tissue, searching for the elements that cause bone to lose its incredible strength. Human bone tissue is a “composite” material. That means it contains a number of chemical elements that are responsible for its strength. Indeed, engineers have measured the strength of bone and find that, pound-for-pound, it is as strong as annealed steel. (Incidentally, that allows us to exist in
earth’s gravity, while permitting us to float in a swimming pool.)

Since bone tissue is a composite material, made up of many elements, we need to study those elements and their organization in order to understand how bone might lose its strength even though its mass is unchanged. These studies require use of special technology. For example about one half of the volume of bone is made up of a protein (collagen). It exists in layers that are attached to one another. The mineral in bone is precipitated in and around the collagen protein as mineral crystals made up of calcium and other minerals.

In order to study the protein and its geometry, we have collaborated with a laboratory at Columbia University in New York. The technology is called “Fluoro-transfer-infra-red-imageing” (FTIRI). It measures the collagen molecule and its links, giving us a method of examining the composite structure of bone.

Another technology we use is Raman Spectroscopy, a method that allows us to examine the mineral phase of bone, giving us clues to the crystal makeup of the bone from biopsies, and their contribution to its weakening. We are collaborating with a laboratory at the University of Michigan for this work.

Still another technology we have accessed is called, “nano-indentation”. This provides us with a method of measuring the mechanical properties of bone from human biopsies. It tells us how hard the tissue is, how elastic it is, how flexible it is, and how it might resist fracture. We are collaborating with a laboratory in the University of Nebraska, Lincoln for these analyses.

The final collaboration in this work is with a laboratory in Lyon France which is able to measure the concentration of mineral in the collagen protein in the human bone biopsies we send to them.

This group of collaborators allows us to combine efforts to study the details of the molecular makeup of bone tissue, and how defects in these various measures contribute to weakening of bone. We have been studying a group of fracturing patients matched to controls that are non-fracturing and have found that the bone tissue in the fracturing patients exhibit defects in strength, and in chemical makeup. We are studying the huge amount of data from these studies, and the outlook is positive for finding defects in the bone material that account for as much as half of the risk of fracture. Our collaborations have been outstanding, and many more results are anticipated. This research would be impossible without the large range of technology provided by our collaborators. No one laboratory would be able to purchase and house all of this technology, and be expert in its application.

We are also collaborating with scientists at other institutions, Dr. Elizabeth Shane at Columbia University, New York.
2015 Osteoporosis Run & Walk

Saturday, November 7
Register @ 8 a.m. | Start @ 9:30 a.m.
Lake Zorinsky, Shelter 5, Omaha
Sign up at moveit5k.org
THE SECOND MOVE IT OR LOSE IT 5K
Saturday, November 7, 2015 at Zorinsky Lake Park, Shelter 5
Turn into the park at 156th and F streets.

Osteoporosis is a serious but under recognized disease.
Amy Porter, Executive Director of the National Osteoporosis Foundation was quoted as saying:

“More than half of the total U.S. adult population over 50 is currently affected by osteoporosis and low bone mass.”

You can help us at the Osteoporosis Research Center change that statistic by running or walking in the 2015 Move It or Lose It event. If you are not in Omaha or don’t want to walk or run, you can still help by donating to become a Booster Buddy. With a $25 donation, you will get one of our 2015 iconic t shirts. Last year Move It or Lose It increased the Endowment by $8,000. With your help this year, we can do better.

We owe a Special thanks to Bailey Lauerman for donating their talents in producing the Logo for this year.

We thank our supporters:

- Nebraska Spine Center
- UBS
- Mobile Animal Clinic
- CHI
- Blue Cross Blue Shield of Nebraska
- Dr. Donald Wass from Dallas, Texas
- Donna Astuto in Memory of her mother, Dorothy Beckendorf
Fall 2015 Research Opportunities

**Creighton University Young Women’s Bone Health Study**

Did you know that healthy young women can develop osteoporosis?

- bones are weak and may break easily.
- can lead to numerous and serious broken bones (fractures).

Many young women who have osteoporosis are unaware that they have it.

Healthy women ages 20-45 may qualify for a free screening test if you have:

- regular menstrual periods (use of birth control is okay)
- had a broken bone or stress fracture
- family history of osteoporosis

After screening, you may qualify for our study to find a treatment for this disorder.

This study will provide free medication and a $400 stipend.

Please contact our research staff at **402.280.2663** mention the “Young Women’s” study.

**Heartland Osteoporosis Prevention Study**

The Creighton University Osteoporosis Research Center is collaborating with the University of Nebraska Medical Center (UNMC) on the Heartland Osteoporosis Prevention Study.

Menopausal women are often losing bone, but don’t know it, because menopause is a time of rapid bone loss for women, an average of 15%.

Heartland Osteoporosis Prevention Study (HOPS) will evaluate the best way to prevent bone loss in women during these crucial years.

- Women who are in the first five years of menopause are needed to participate in this research study.
- This study will compare recommended Calcium and Vitamin D intake to medication and exercises.

If you are interested in participating, please contact study personnel at **HOPS@unmc.edu** or call **402.559.6584**.

You may also visit our screening website at **unmc.edu/alliedhealth/research/hops**.

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**Recent Donations to the Creighton Endowment for Osteoporosis**

**IN MEMORY OF**
- Sister Anne Evers
  *from Dr. and Mrs. Tom Connolly*
- Dorothy Beckendorf
  *from her daughter, Donna Astuto*
- Loretta West
  *from her husband, Everett West*
- Irene Clancy, mother of a Endowment Committee member, Kathy Mcdonald
  *from the members of the ORC*

**IN HONOR OF**
- Dr. Robert Recker
  *from Mary Harty*
- All of the people of the ORC
  *from Jim and Jane O’Brien*
- Irene Armknecht Treaster
  *from her sister, Viola Armknecht*
- Retired Fire Captain, David Mann
  *for his work with kids from Dr. and Mrs. Robert Recker*

**IN CELEBRATION OF**
- Ken and Gere Dell Karr
  *from Ruth Anne Fountain*
THE GIFT OF GIVING

Consider a donation in honor of a loved one to the Osteoporosis Research Center.

Mail form to:
Creighton Endowment for Osteoporosis
In memory of Sister Anne Evers
601 North 30th Street, Suite 4820
Omaha, NE 68131

A Contribution is enclosed to the Sister Anne Evers Endowed Research Fund

___ In Memory of  ___ In Honor of  ___ In Celebration of  ___ In Appreciation of

Name ________________________________________________________________

Address ________________________________________________________________

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I give permission to print donor and recipient name in a future newsletter  ___ Yes  ___ No

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