Yang Xia

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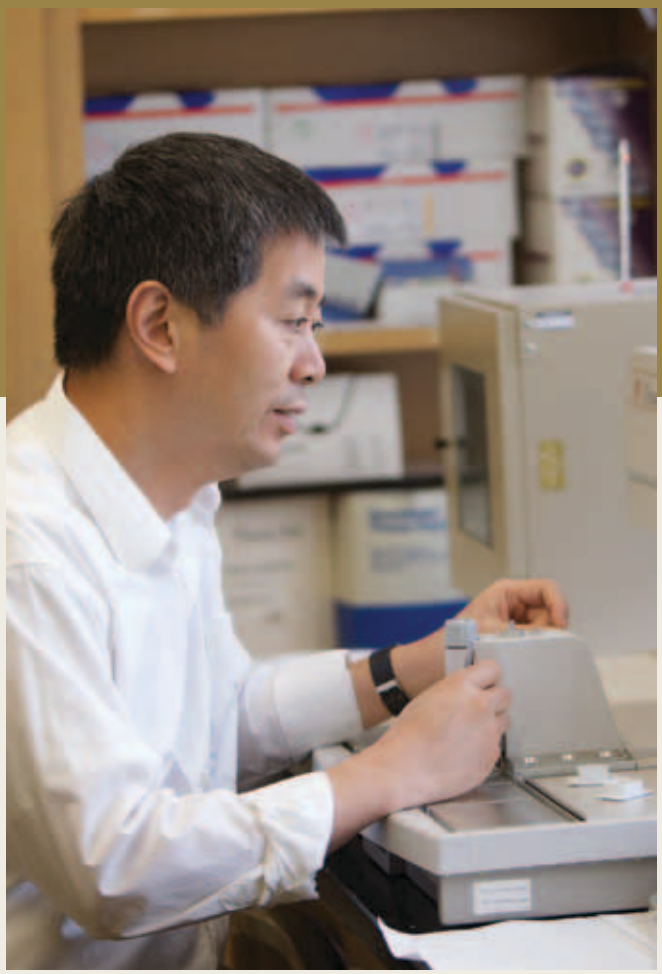

Bridging science and clinical medicine

Articular cartilage is a thin layer of highly specialized tissue covering the load-bearing ends of bones in joints to absorb shocks and to distribute loads. The gradual degradation of cartilage plays the critical role in the development of osteoarthritis (OA) and related joint diseases. Our current understanding of how healthy cartilage bears load, lubricates joints, and progressively loses these functions in OA is still fragmented, mainly because the tissue degradation is preceded "unnoticeably" by a number of insidious processes characterized by subtle changes in tissue's fine structure and delicate functions. Consequently, an accurate diagnosis of early OA remains elusive in clinical practice.

For the last fifteen years, Yang Xia's major research effort has been concentrated on the study of articular cartilage using multidisciplinary microscopic imaging techniques — including microscopic magnetic resonance imaging (μMRI), polarized light microscopy (PLM), and fourier-transform infrared imaging (FTIRI) — together with biochemical assays and biomechanical testing. Xia uses these techniques to correlate among different biological/chemical/physical properties of the tissue and to discriminate among the various possible degradation states of the tissue and their influence on tissue's functional integrity.

Xia's research has been funded by various sources. In addition to receiving internal support from Oakland University (especially the Research Excellence Fund in Biotechnology from the Center for Biomedical Research), Xia's research has been funded by three five-year R01 grants from the National Institutes of Health (NIH) since January 1999, with total federal funding of $5 million.

Currently, Xia has two ongoing projects funded by NIH. A combined PLM/FTIRI study of cartilage revealed unique information regarding the structural and molecular modifications in articular cartilage due to external loading. This is the first infrared imaging study of articular cartilage while the tissue is being compressed. Results appeared on the cover of the *Journal of Structural Biology* in its October 2008 issue.

Xia is confident that his multidisciplinary microscopic imaging research in medical physics will lead to new sensitive measures of cartilage degradation, contributing to the understanding and, ultimately, management of early arthritic diseases.

Representative Recent Publications

1. Zheng SK, Xia Y, Bidthanapally A, Badar F, Ilsar I, Duvoisin N. 2009. Damages to the extracellular matrix in articular cartilage due to cryopreservation by microscopic MRI (μMRI) and biochemistry. *Magn Reson Imag* 27:648-655.

2. Zheng SK, Xia Y. 2009. Multi-components of T2 Relaxation in ex vivo cartilage and tendon. *J Magn Reson* 198:188-196.

3. Zheng SK, Xia Y. 2009. The effect of phosphate electrolyte buffer on the dynamics of water in tendon and cartilage. *NMR in Biomed* 22:158-164.

4. Ramakrishnan N, Xia Y, Bidthanapally A. 2008. Fourier-transform infrared anisotropy in cross and parallel sections of tendon and articular cartilage. *J Orthop Surg Res* 3:48.

5. Xia Y, Alhadlaq H, Ramakrishnan N, Bidthanapally A, Badar F, Lu M. 2008. Molecular and morphological adaptations in compressed articular cartilage by polarized light microscopy and Fourier-transform infrared imaging. *J Struct Biol* 164:88-95.

6. Xie TQ, Xia Y, Guo SG, Hoover P, Chen ZP, Peavy GM. 2008. Topographical variations in the polarization sensitivity of articular cartilage as determined by polarization sensitive optical coherence tomography and polarized light microscopy. *J Biomed Opt* 13:054034.

7. Xia Y, Zheng SK, Bidthanapally A. 2008. Depth-dependent profiles of glycosaminoglycans in articular cartilage by μMRI and histochemistry. *J Magn Reson Imaging* 28:151-157.

8. Xia Y. 2008. Averaged and depth-dependent anisotropy of articular cartilage by microscopic imaging. *Semin Arthritis Rheum* 37:317-327.