**Mission**

The Biomaterials Laboratory develops methods to study natural and synthetic biomaterials using magnetic resonance imaging and spectroscopy.

- Bone mineral
- Pathological calcification (atherosclerosis)
- Synthetic calcium phosphate ceramic implants
- Polymeric implants
- Composite implants
- Intravascular RF coils

**Investigators and MGH Collaborators**

- Christian T. Farrar, Ph.D.
- Gyunggoo Cho, Ph.D. (Present address: Seoul National University Hospital)
- Van J. Wedeen, M.D.
- Denise P. Hinton, Ph.D.
- David A. Chesler, Ph.D.
- Janelle Chang, Dartmouth College

**Children’s Hospital Collaborators**

- Melvin J. Glimcher, M.D.
- Yaotang Wu, Ph.D.
- Lila Graham, Ph.D.
- Jinxi Wang, M.D., Ph.D.


**To learn more about the Biomaterials Laboratory, visit the Martinos Center for Biomedical Imaging website.**

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**Two Dimensional Solid State NMR Spectroscopy of Bone Mineral**

Do hydroxyl ions exist in the bone mineral crystal lattice?

- Historical controversy: possibly not
- Unequivocal solid state NMR evidence: YES!


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**MR Compatible Furnace for In-Situ MRI of High Temperature Materials Processing**

**Furnace Photograph**

Dewaxing of a Green β-Tricalcium Phosphate Ceramic Pellet at 200 °C by Proton MRI

**1H Spin Echo Images of Molten LiCl at 700 °C**

Transverse

**Side**

Field of view = 100 mm, TR = 1 s, TE = 16 ms, number of points = 64x64, slice thickness = 5 mm.


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**Intravascular RF Coils**

**Cylindrical Meanderline Coil**

Sensing volume

**Prototype Cylindrical Meanderline Coil**

Van Wedeen, 1992

**Effect of Loading by Immersion of Coil**

Free Space

Saline Immersed

**Endarterectomy Specimen**

**Remcom FDTD Simulation**

**Transverse view**

**Axial view**

**Magnetic Flux Density (B), dB**

**Endarterectomy Specimen**

**Cylindrical meanderline radio frequency coil for intravascular magnetic resonance studies of atherosclerotic plaque. Magn Reson Med. In press.**

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**‘H Solid State MRI of Bone Matrix**

Axial Views

- Cortical bone
- Marrow

Longitudinal Views

- Cortical bone
- Marrow

**Photograph of the bovine bone specimen**

Projection imaging of free induction decays


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**Porous β-Tricalcium Phosphate Implant Porosity**

Pure water

Large Pores

Small Pores

13 mm implant

Proton MRI of imbibed water measures internal porosity distribution in porous structures.

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**β-Tricalcium Phosphate Implant Porosity**

**Histological controversy:**

- Possibly not
- Unequivocal solid state NMR evidence: YES!


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**13 mm implant**

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**‘H Spin Echo Images of Molten LiCl at 700 °C**

**Side**

Field of view = 100 mm, TR = 1 s, TE = 16 ms, number of points = 64x64, slice thickness = 5 mm.


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**Remcom FDTD Simulation**

**Transverse view**

**Axial view**

**Magnetic Flux Density (B), dB**

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**Endarterectomy Specimen**

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