



### **Finding and Recording Radio-Frequency Heating in the Eyes**

**Katelynn Stroth (Dennis Parker, PhD)**

**Department of Biomedical Engineering**

Magnetic Resonance Imaging (MRI) machines have been around for quite some time, helping take images of vital organs in the body with the use of radio frequency (RF) magnetic fields. MRI's use high powered magnets that align the protons in the body with the magnetic field. An RF magnetic field is then applied through to the patient, stimulating the protons in the body to rotate out of equilibrium. Once the RF field is turned off, the sensors in the MRI will detect the energy released as the protons attempt to realign with the magnetic field. As the amounts of energy released change, physicians are able to tell the difference in tissue types from these magnetic properties.

When a patient is placed in an MRI, the patient's body is subjected to the RF magnetic field, which is then used to rotate the magnetic moments from alignment within the main field and deposits energy in the body (similar to a microwave oven). One of organs that might experience heating from the RF magnetic field is the eye. This could pose a potential problem because the eye can't regulate heat like other body parts. Some organs rely on perfusion to lower their temperature; however, the eye experiences very minimal to no perfusion. The amounts of RF heating are not enough to be potentially life-threatening, however, there is evidence that too much RF heating may cause cataracts, or clouding of the natural lens.

We aim to validate how a cow eye model can mimic the properties of soft tissues during induced heating. To test this aim, we placed six non-fixed cow eyes in a fixture that mimics soft facial tissues in the face. Four temperature probes were placed in the fixture, then placed in an MRI scanner (3T TIM TRIO) capable of RF heating. The data acquired was analyzed in MATLAB and converted into temperature graphs. The importance of this study was to determine if the eye could be heated and if the tissues in the eye mimicked facial tissue properties. We were able to find temperature changes within the eye and able to understand a little bit more about eye tissue properties. This study could be the stepping stone to future research in determining how the eye can be damaged by MRI RF heating.