**Introduction**

Radiation therapy is part of the current medical standard for the treatment of brain tumors. However, late effects of radiation therapy, including radiation necrosis and white matter changes, are extremely common and can dramatically alter quality of life. Symptoms include seizures, memory loss, attention problems, and decrease in IQ. The injurious and reparative sequence of events following exposure to radiation is currently unclear. Brain injuries related to radiation are often hidden when analyzed with magnetic resonance imaging (MRI). The goal of this project is to track structural changes and neuroinflammatory tendencies following irradiation of the mouse brain using histological procedures rather than MRI. A better understanding of these damage-response mechanisms will be imperative to developing therapies to prevent and treat long term complications associated with radiation therapy.

**Methods**

Female BALB/c mice irradiated at 5 weeks of age: euthanized at 4, 8, 12, or 16 weeks post treatment.

Staining and Immunohistochemistry

**Hematoxylin and Eosin**
- Basic structure visualization
- Purple nuclei; pink cytoplasm

**Anti-myelin basic protein (MBP)**
- Visualization of white matter
- Brown MBP, the primary component of myelin

**Anti-S100**
- Visualization of astrogliosis
- Brown S100 protein, the primary component of astrocytes

**Results**

<table>
<thead>
<tr>
<th>Hematoxylin and Eosin</th>
<th>Four weeks post irradiation</th>
<th>Eight weeks post irradiation</th>
<th>Twelve weeks post irradiation</th>
<th>Sixteen weeks post irradiation</th>
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<tbody>
<tr>
<td>Control 10 Gy 15 Gy 20 Gy 25 Gy 30 Gy</td>
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<td>10x 20x 50x 10x 10x 20x 10x 20x</td>
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**Results Continued**

<table>
<thead>
<tr>
<th>Anti-Myelin Basic Protein (30 Gy)</th>
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<tr>
<td>Control 4 weeks 8 weeks 12 weeks 16 weeks</td>
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</table>

**Conclusions**

- Only the white matter is damaged. Grey matter is not nearly as susceptible to radiation induced damage.
- Structural damage is very subtle, which poses challenges to visualizing changes using MRI.
- At four weeks, loss of signal (less white matter) and holes in the white matter due to swelling.
- At eight weeks, the white matter appears normal.
- At twelve weeks, loss of signal, holes, and mononuclear cells filling the holes.
- At sixteen weeks, the changes observed at twelve weeks are more dramatic and pronounced.

**Future Directions**

- Complete anti-S100 immunohistochemistry in order to determine whether or not the mononuclear cells (infiltrating the holes in the white matter) are astrocytes.
- Find a stain for microglia in order to determine whether the mononuclear cells (infiltrating the white matter due to swelling).

**Acknowledgements**

Purdue Histology Laboratory