INTRODUCTION
Anesthesia at an early age causes persistent memory deficits in many species including rats, mice and non-human primates. And there is evidence for persistent memory deficits in humans as well. The circuitry related to the hippocampus seems implicated in both rats and humans. Hippocampal inflammation after irradiation reveals similar deficits to those seen in murine models after early anesthetic exposure. And there is a known link between hippocampal inflammation and neuroapoptosis or behavioral deficits. Further, mitigating that inflammation ameliorates the resultant deficits.

The use of MRI in murine models is well described and, with use of an inert perfluorocarbon contrast agent, Fluorine-19 (19F) MRI has promise in the in vivo assessment of inflammation associated with anesthetics.

METHODS
Sprague-Dawley rat pups receive 10 Gray (Gy) of brain x-ray irradiation. 5Gy irradiation was administered to the ventral and 5Gy to the dorsal surface of the head.

All images in this study were acquired with a 9.4T, Bruker Avance Biospec Spectrometer, 21 cm bore horizontal scanner with a 35mm volume resonator (Bruker Biospin, Billerica, MA). Osirix software (© Pixmeo SARL) was used for image processing.

Either one or two separate injections of 0.1 mL/20g of V-Sense 1000 DM Red (© Celsense) was injected via the tail vein at varying times within 4d of imaging, with irradiation occurring either the day of the second injection or the day after a single injection.

RESULTS
Sprague-Dawley pups received isoflurane anesthesia via nose cone for irradiation and contrast injection. A total of 5 min and 31 sec of x-ray irradiation was administered for 10Gy of total irradiation, with balking seen in the path of the irradiating beam. (Fig. 1)

Animals were sacrificed before imaging for image optimization. A total of 6 irradiated and 2 control pups were imaged.

19F signal was observed in the cortex and cerebellum bilaterally in one rat pup who received contrast injections 3d and 2d prior to imaging. (Fig. 2) 19F signal was observed in the brainstem of another rat pup who received injections 2d and 1d prior to imaging (images not shown). No 19F signal was seen in control rats or those receiving single injections.

CONCLUSION
The initial step presented are the first images of central inflammation after X-ray irradiation using 19F MRI. This imaging modality has the potential for in vivo assessment of inflammation associated with anesthesia, anesthesia plus surgery, and other inflammatory conditions. Further image optimization is needed.


