

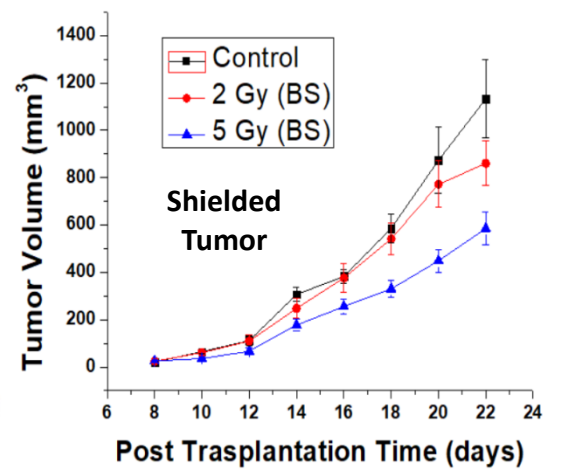
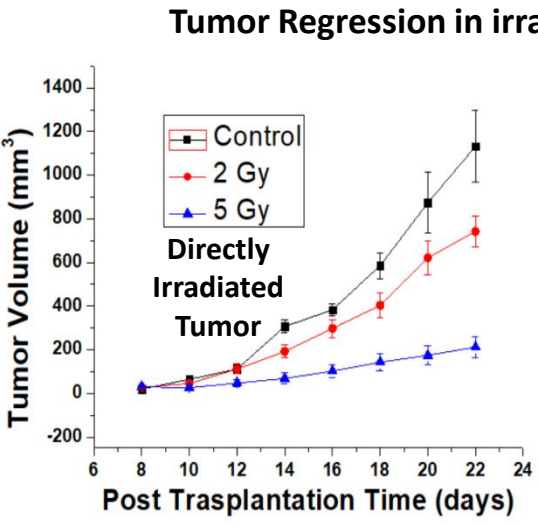
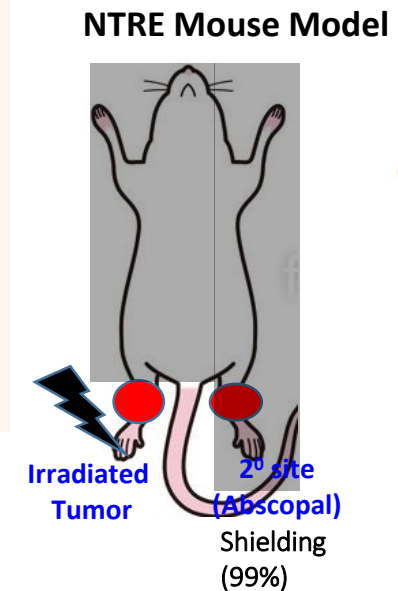
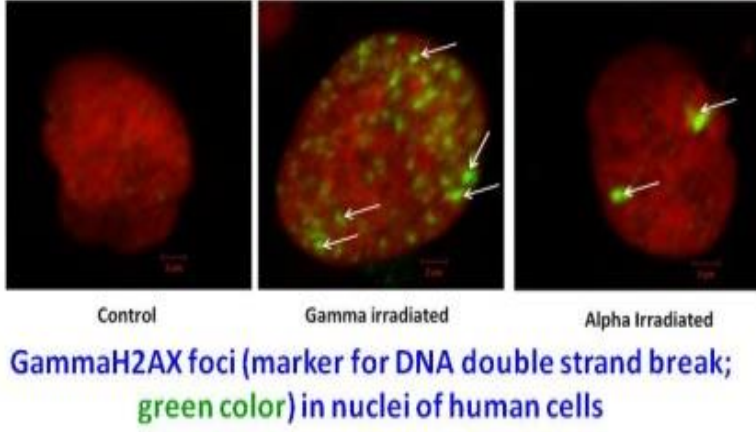
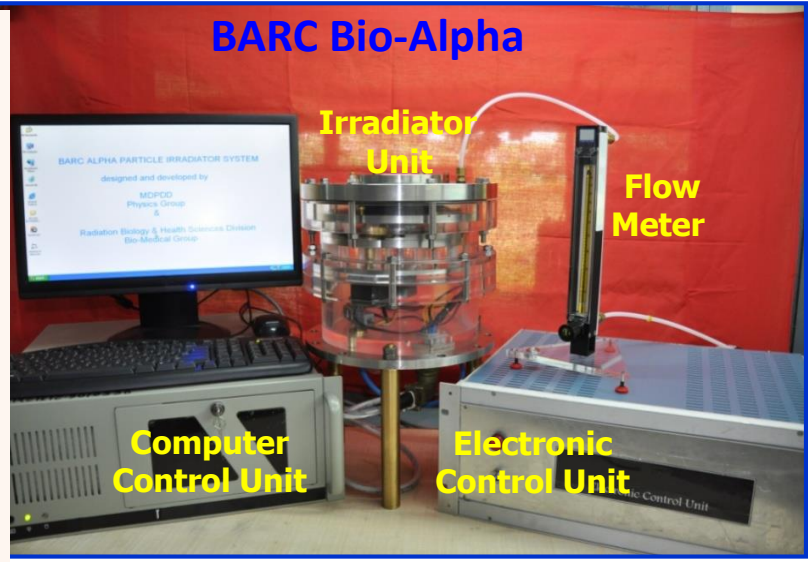
Radiation Signaling and Cancer Biology Section

Sectional Research Projects

- **Mechanism of Targeted and Non-targeted Effects of Ionizing Radiation on Normal and Tumor Cells with Relevance to the Improvement of Cancer Radiotherapy**
- **Targeted Magnetic Nanoparticles-based formulation for Cancer Chemo-Radiotherapy**
- **Biological Effects of Thorium and Uranium in Human cells/Animals and Development of Efficient Decorporation Strategies to mitigate their Radiation and Chemical Toxicity**
- **Gamma radiation-induced EMT-like changes in human cancer cells with relevance to prevent tumor invasion and metastasis**

Mechanism of Targeted and Non-targeted Effects of Ionizing Radiation on Normal and Tumor Cells with Relevance to the Improvement of Cancer Radiotherapy

- Major Research Objectives:**
- Basic Mechanisms of radiobiological effects of alpha, beta, gamma and proton radiation
 - Non-targeted effects of low and high LET radiation in tumor cells for improvement of cancer radiotherapy
 - Identification of putative targets to enhance tumor cytotoxicity
 - Mechanism of Bystander and Abscopal effect in animal tumor models
 - Role of cancer stem cells in tumor radioresistance.



Biological Effects of Thorium and Uranium in Human cells and Animals and Development of Decorporation Strategies

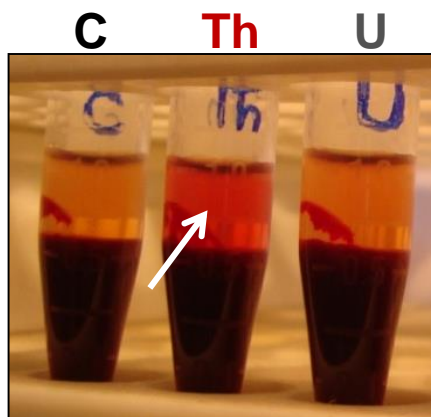
Rational: DAE's three-stage nuclear power programme is aimed to utilize domestic Thorium on large scale. Therefore, there is a need to understand its biological effects.

Current Research Objectives :

- Mechanism of **Th/U internalization** and **associated responses** in liver, lung, bone and kidney cells
- Mechanism of **Thorium-induced Liver Carcinogenesis** and **Neurological changes**
- Effect of Th/U after **Inhalation exposure**
- Development of **Decorporation approaches** for Th and U
- Development of **Biomarker of Th/U exposure**

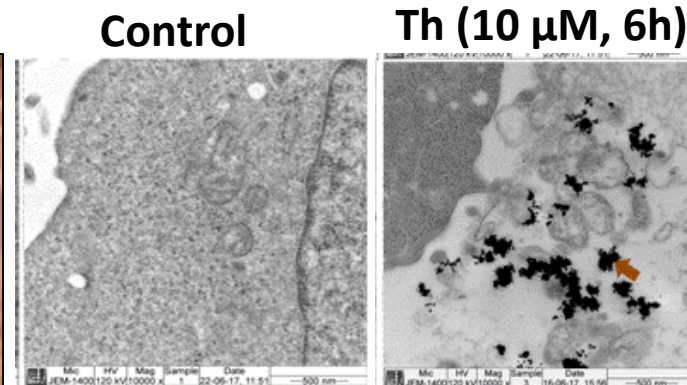
Deliverables: -Novel treatments for internal contamination with DAE relevant radionuclides in Human
-Basic mechanisms of effects of actinides

Human Blood



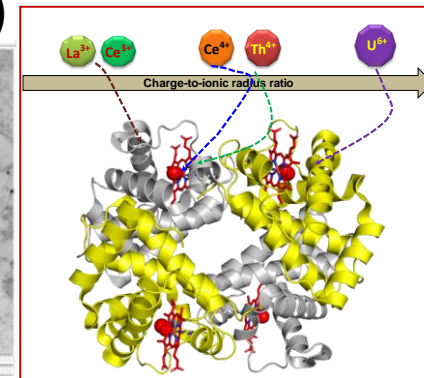
Kumar et al., JHM (2016)

Human Liver Cells (WRL68)



Manjoor et al., JHM (2019)

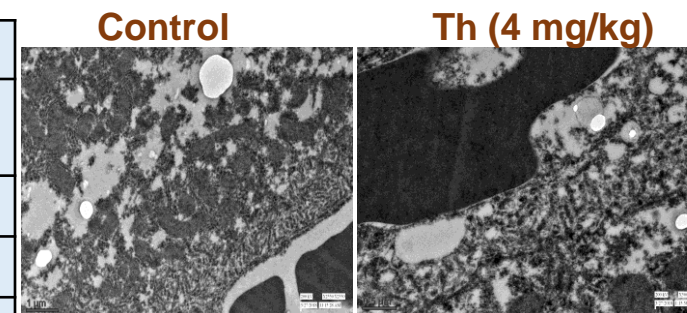
Th-Hemoglobin studies



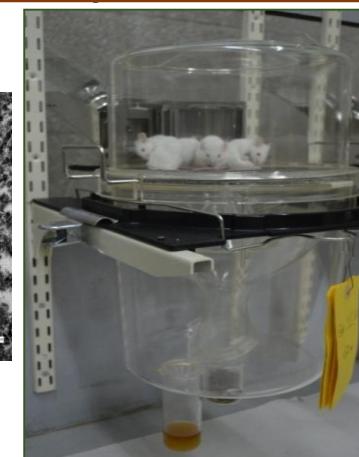
Th-232 Biodistribution

% accumulation of injected ²³² Th	
Mice Organs /Tissues	Chronic exp (10 mg/kg, i.p.)
Liver	27 ± 2.4
Skeleton	24 ± 3.67
Spleen	10 ± 1.87
Brain	3.0 ± 0.28

Mice Liver



Decorporation Studies



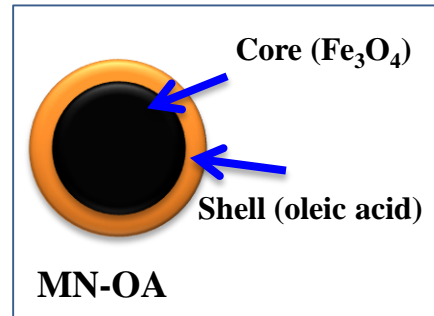
Development of Magnetic Nanoparticles-based Formulations for Cancer Chemo-Radiotherapy

Rational: Iron-oxide magnetic nanoparticles are suitable for MRI and HT, offer platform for capping and delivery of chemotherapeutic agent.

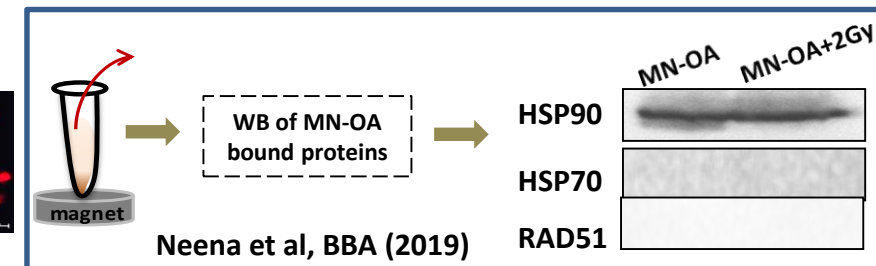
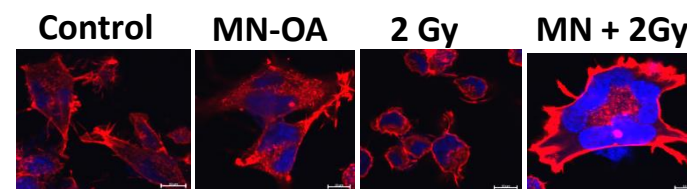
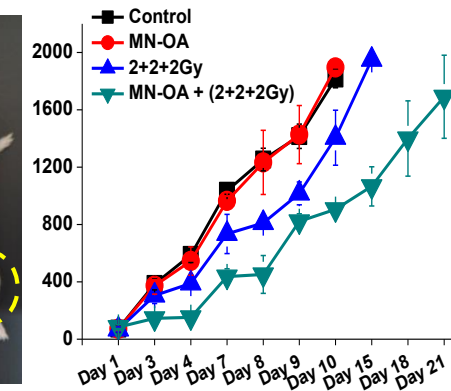
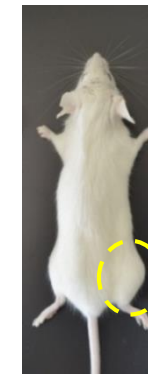
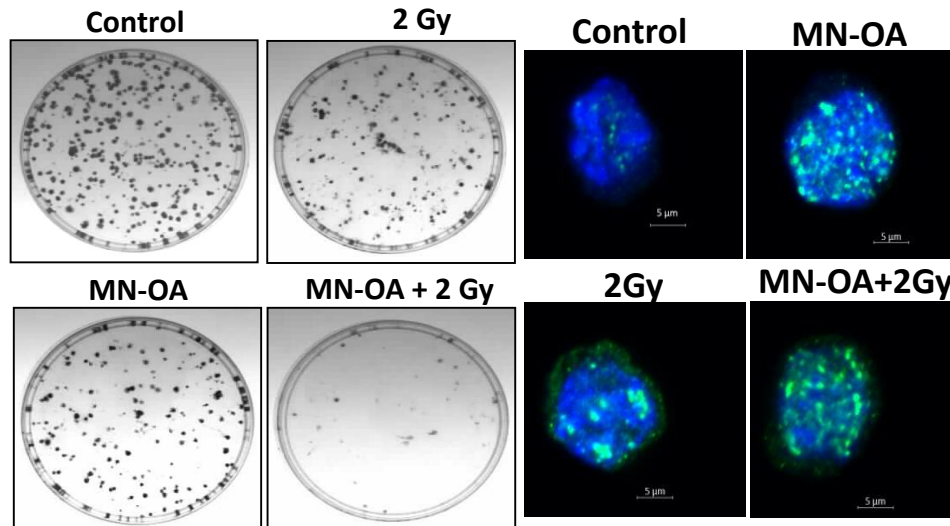
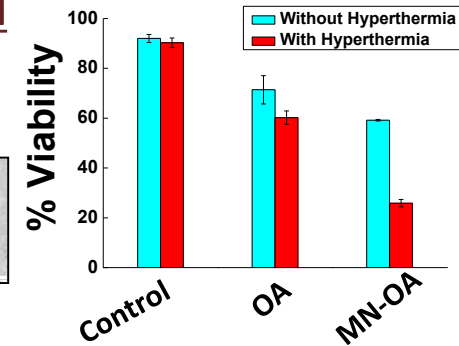
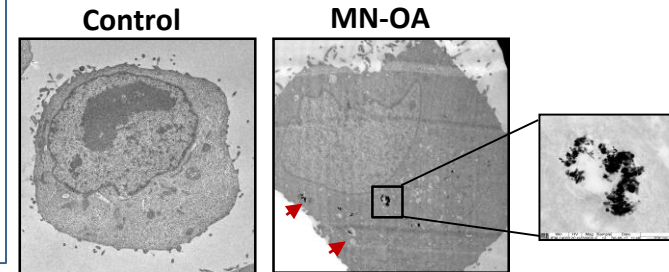
Current Research Objectives :

- Anticancer potential of MN-OA in combination with hyperthermia and radiotherapy
- Role of HSP90-centric mechanism in MN-OA activity
- Development of tumor-targeted formulation of MN-OA for in-vivo application for cancer chemo-radiotherapy or HT

Deliverables: - MNPs Formulation for RT, Chemo-RT or HT therapy of cancer



Fibrosarcoma cells (WEHI164): TEM

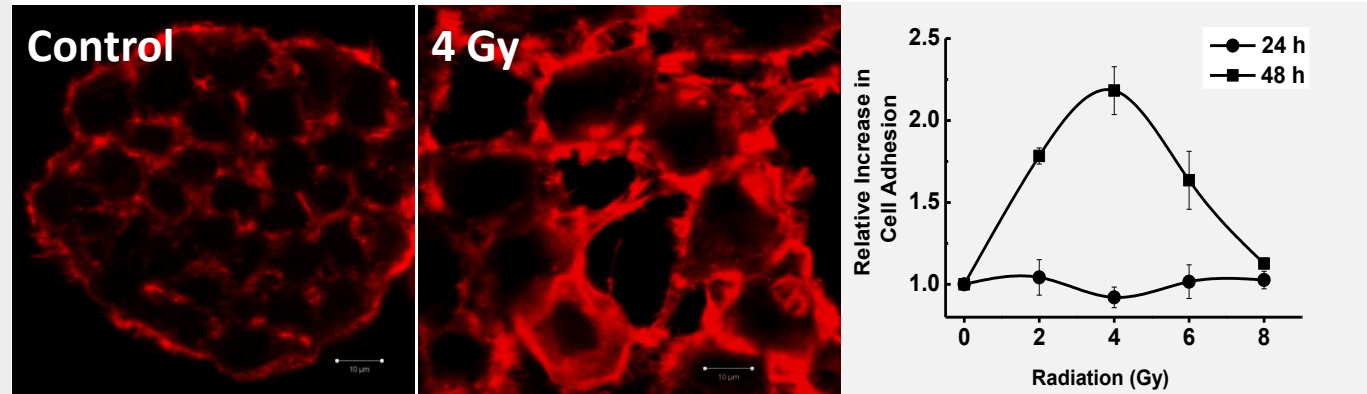


Gamma radiation-induced EMT-like changes in human carcinoma cells with relevance to prevent tumor invasion and metastasis

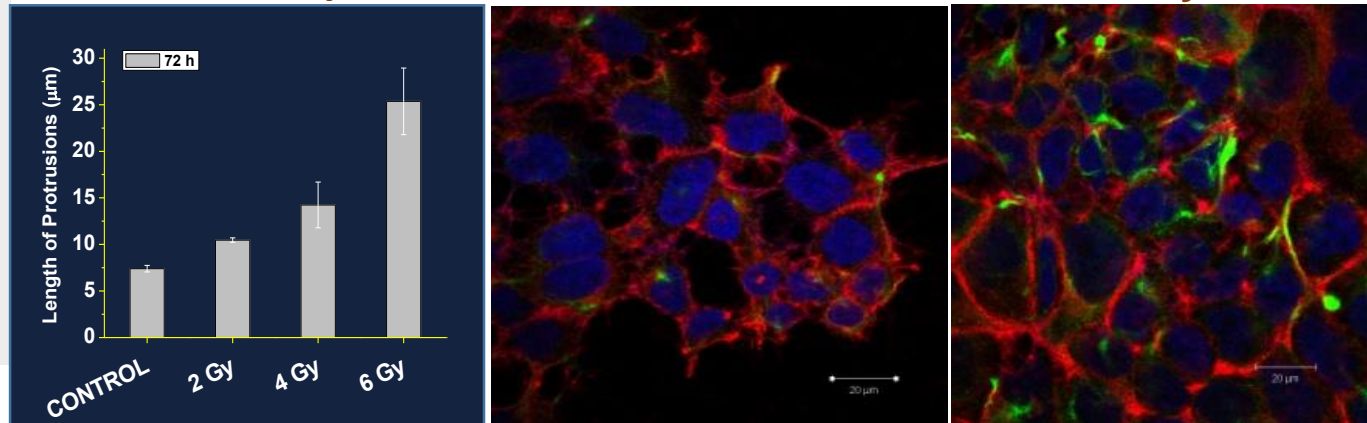
Major Research Activities:

- Mechanism of IR induced changes in cell shape, cell size/polarity and surface protrusions in carcinoma cells
- Mechanism of IR-induced cancer cell adhesion, migration and invasion
- IR induced epithelial-to-mesenchymal transition like changes
- Mechanism of post-irradiation survival of cancer cells at both low (2 Gy) and high doses (SDRT)

Radiation increased F-actin in breast carcinoma cells (MCF7)



Filo/Lammelipodia



Implications: Mechanism of radiation-induced adhesion, migration and invasion, which may represent unique therapeutic target to suppress local tumor invasion and metastasis after radiotherapy

Major Facilities

- Mammalian cell culture facility
- Alpha and gamma irradiator
- In-vivo photon imaging system
- Hyperthermia Facility for cells and animals
- Cell culture Facility for Hypoxia experiment
- Animal experiments using Metabolic cages
- Elemental analysis in biological samples