Using a Multiple Isotope Approach to Understand Uranium Cellular Effects

Alexandra C. Miller, PhD, Uniformed Services University, Armed Forces Radiobiology Research Institute, 8901 Wisconsin Ave. Bethesda, MD 20889

What prompted DU Research?

1991 Gulf War

- Friendly fire incidents

- Soldiers injured with depleted uranium shrapnel

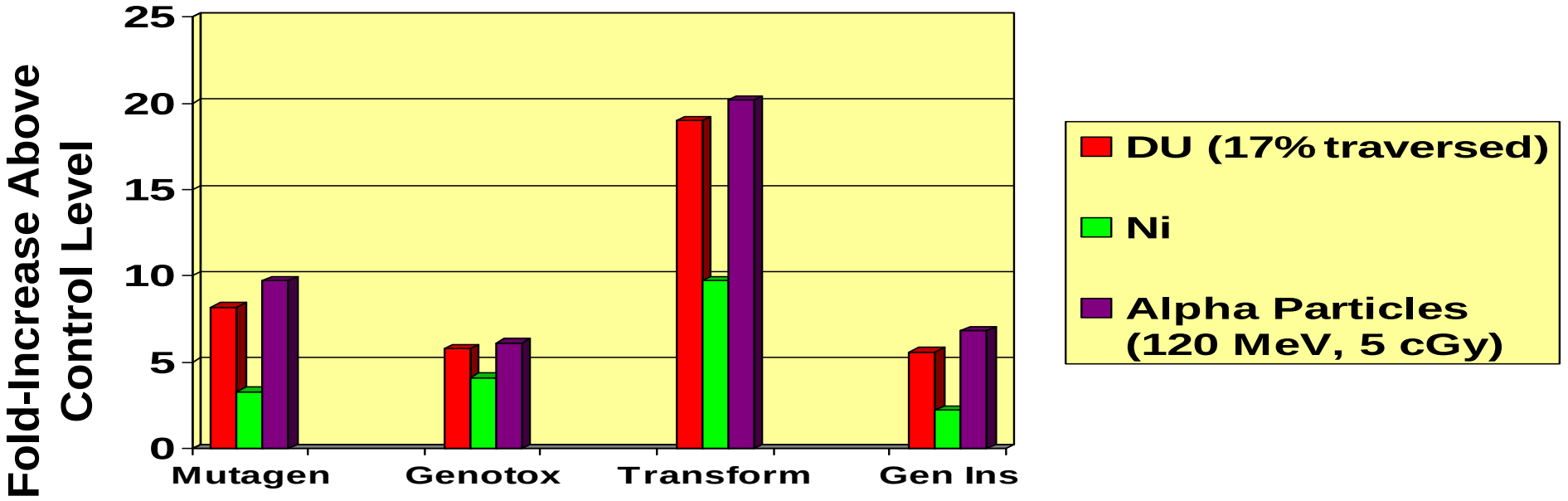
Comparison of the Relative Contribution of Uranium Isotopes*

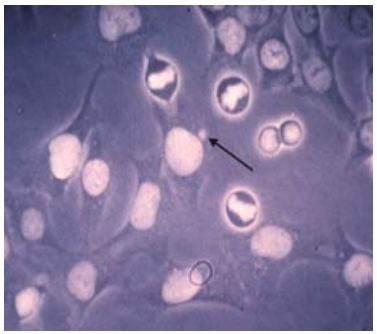
(natural and depleted)

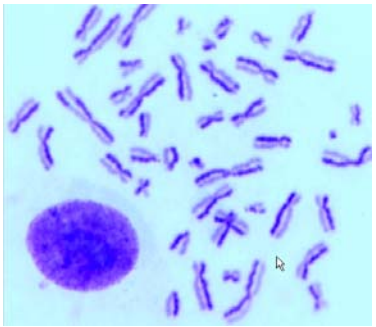
Isotope	Specific Activity (μCi/g)	DU SA by WT% (μCi/g)	Natural Uranium SA by WT% (μCi/g)
^{238}U	0.333	0.332	0.331
^{236}U (not naturally occurring)	63.6	0.0001	0
^{235}U	2.2	0.0044	0.051
^{234}U	6200	0.093	0.310
Total		**0.4295**	**0.692**

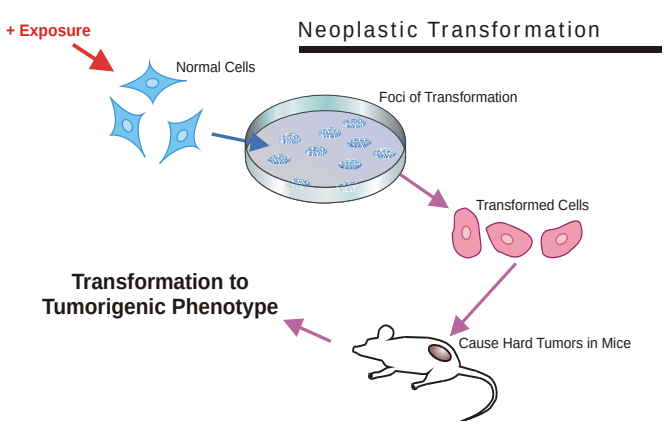
*Contribution of the daughter products is not included.

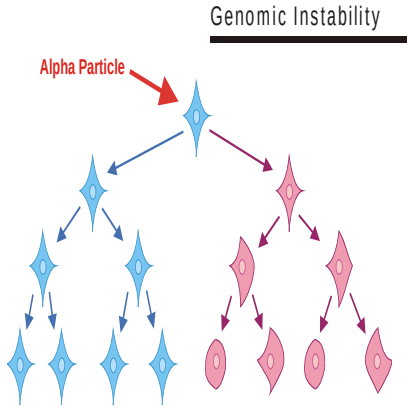
Short-Term Carcinogenicity Tests:
Relative Comparison of DU, Nickel, and Alpha Particles











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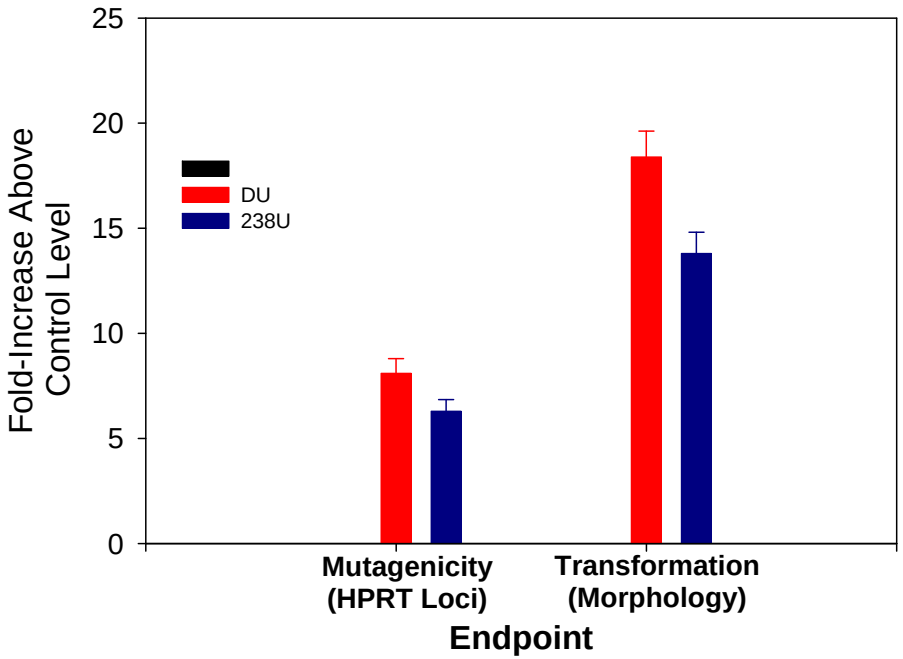
How to Answer Question Regarding DU Radiation Specific Effects??

Uranium Isotope Comparison Model System (Uranyl nitrate)

Uranium Isotopes:	**Specific Activity**
^{235}U	**2.2**
DU	**0.43**
^{238}U	**0.33**

Radiation Effects of DU:
In vitro studies with Uranium Isotopes

Uranium Isotope	Specific Activity
DU	**0.43**
^{238}U	**0.33**



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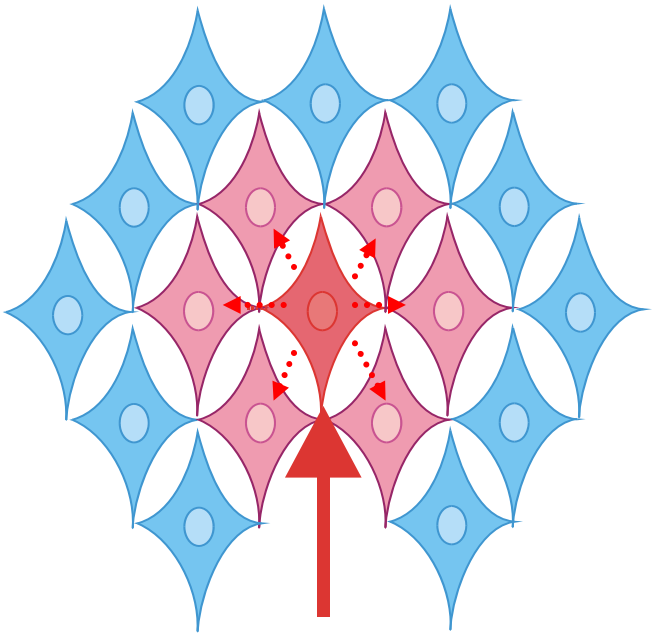
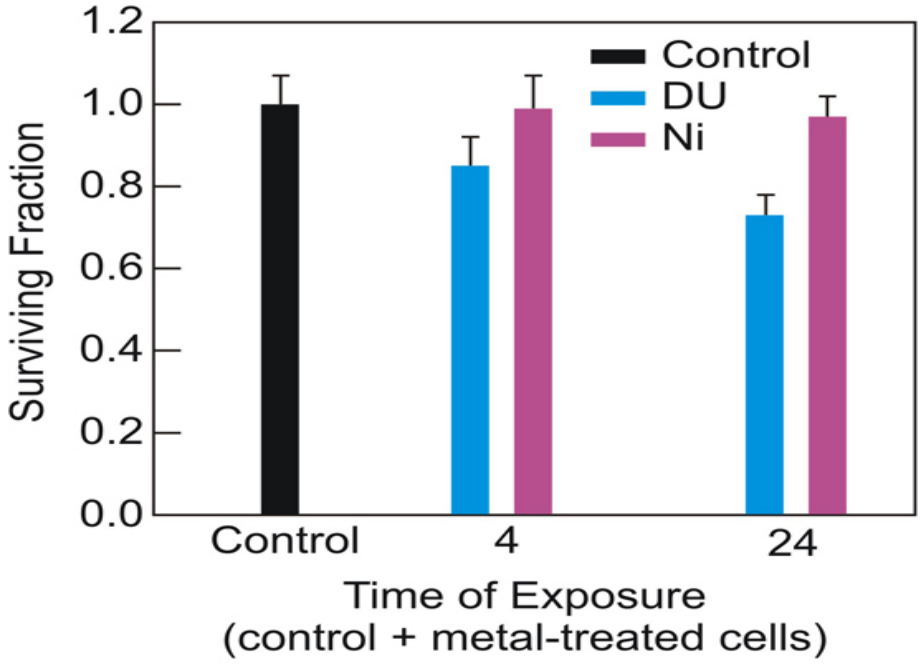
Radiation Effects of DU:
In vitro studies with Uranium Isotopes

Uranium causes non-targeted "bystander effects"



Alpha Particle



Methodology:
Mix control cells with uranium isotope-treated cells
Measure survival, transformation

FINDINGS:

- ✓ Uranium causes radiation damage in cells not directly hit by radiation
- ✓ Non-radioactive heavy metal does not cause effects in "bystander cells"

Conclusions

The use of uranium isotopes has enabled us to:

1) **Understand basic radiobiology mechanisms**

2) **Examine the role of radiation in DU cellular effects**

3) **Evaluate DU radiation “bystander” effects**

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