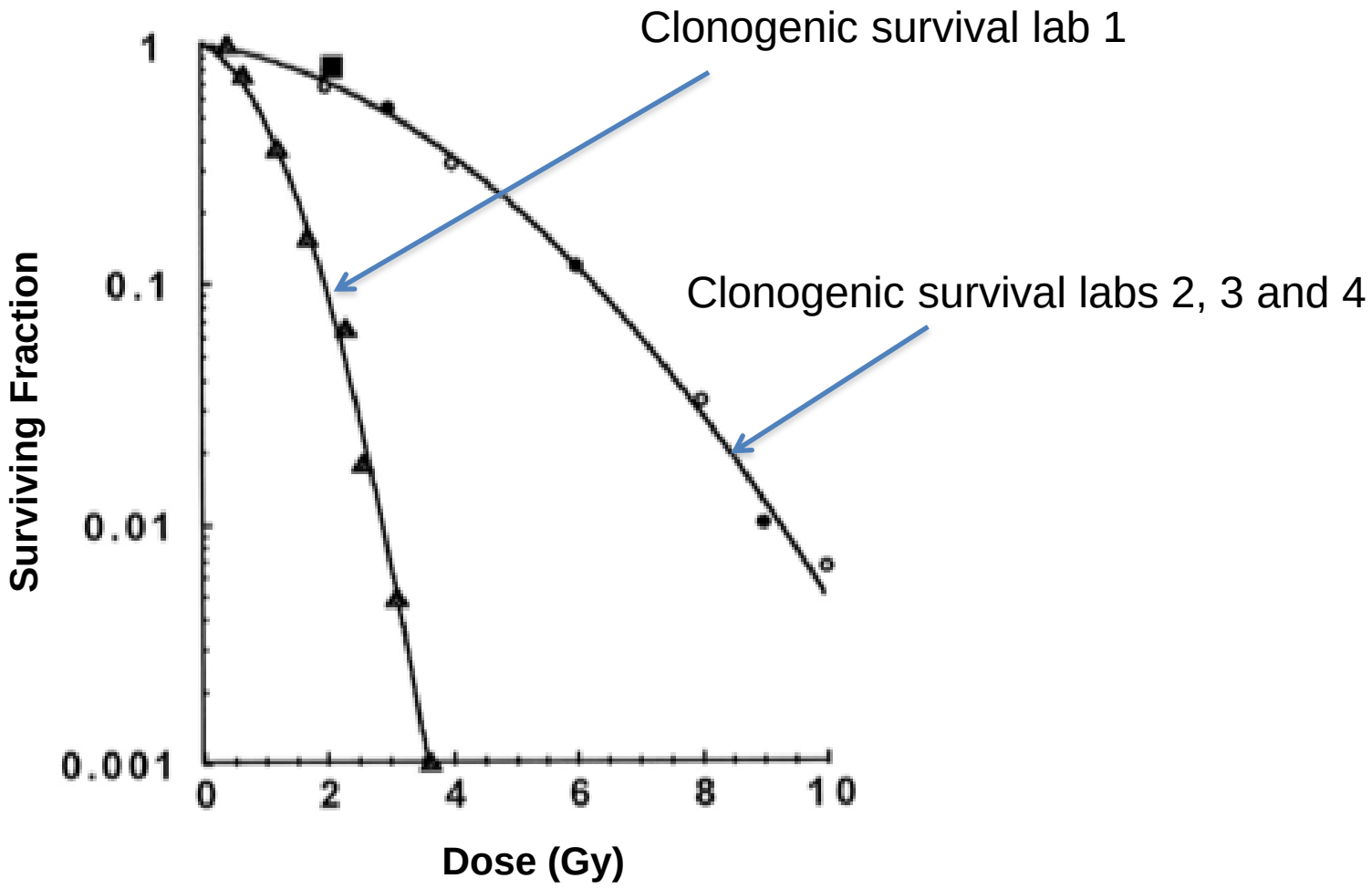
The NCI Radiation Research Program:

Grant portfolio and radiation dosimetry as applied to radiobiology

The Problem:
Data Reproducibility



RRP portfolio consists of:

- 158 research grants (R01, P01 and R21 and R37s). Of those that utilize radiation:
- 6 use tissue culture models only
- 110 utilize animal models (89 animals no human subject material, 21 use both)
  - 109 utilize rodent models
  - 2 have canine subjects
- 39 use human subjects or human subject materials only.

Dose and Dosimetry

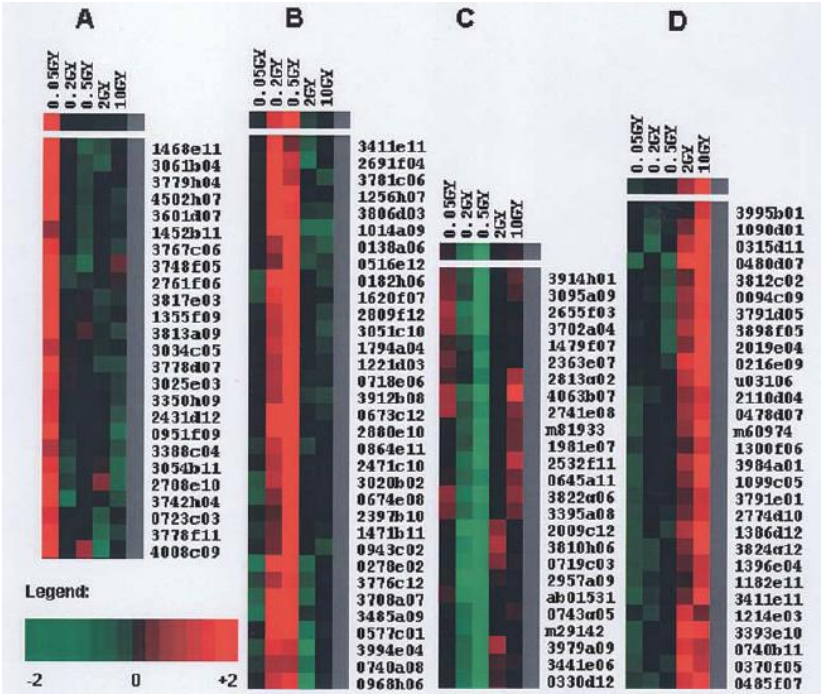
- The majority of PDT, hyperthermia and RIT grants mention dosimetry in some way(>90%).
- Few grants utilizing ionizing radiation (excepting those with human subjects or physics grants) mention dosimetry in the proposals (4 total).
- Most preclinical grants do mention the doses to be used and delivery schedules / fractionation (but not dosimetry).

Possible obstacles to proper dosimetry reporting:

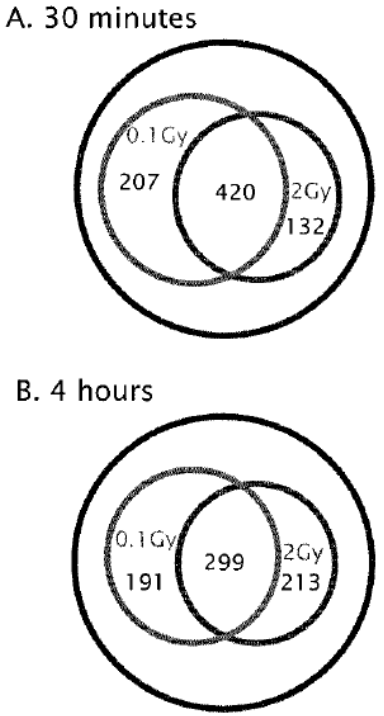
- Lack of investigator training in dosimetry
- Limited access to physics support
- Disconnect between dosimetry techniques appropriate for the clinic and for the lab.
- Space constraints in applications / publications
- It's a given that dosimetry is done.

Dosimetry going forward:

- More precise measurements needed:
  - Gene & pathway activation at low dose
  - Gene expression varies with radiation dose.



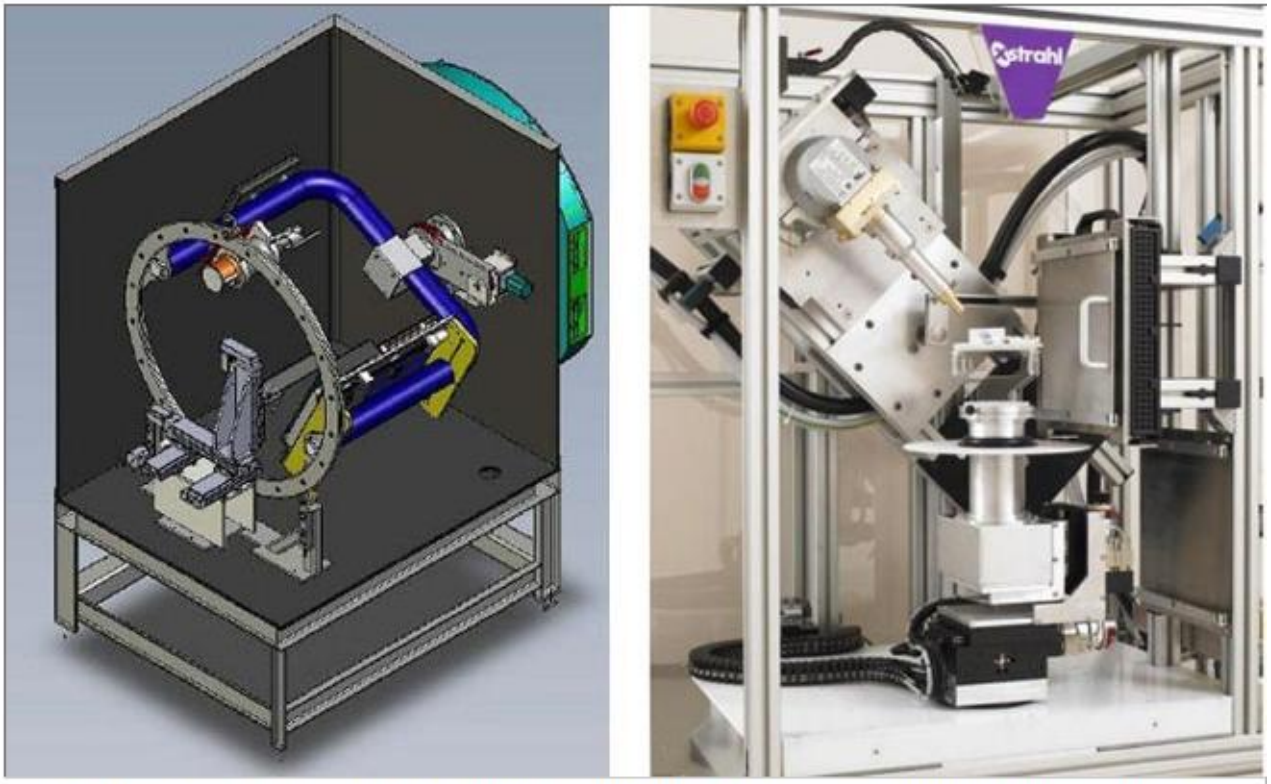
Yin et al. Int J Radiat Biol. 2003 Oct;79(10):759-75.



Long XH,et al. Int J Mol Med. 2007 Apr;19(4):607-15

Wyrobek et al. Mutation Research/Genetic Toxicology & Environmental Mutagenesis Volume 722, Issue 2, 17 June 2011

- More advanced delivery precision in animal experiments requires enhanced dosimetry.



Two commercially available small-animal radiation research platforms. Left: system developed at Princess Margaret Hospital (Courtesy of PXI). Right: system engineered at Johns Hopkins University (Courtesy of Xstrahl; also Wong *et al.*[3]). Both systems have precision animal positioning systems, an onboard X-ray imager and stable X-ray tubes with precision collimators for irradiation fields which could be smaller than 1 mm.

Frank Verhaegen Med Physics web