

Presentation to the Committee on Developing a Long-Term Strategy for Low-Dose Radiation Research in the United States

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My Involvement with the Low Dose Program

- Involved with the Low Dose Program from the late 1990s to 2012
- Was in a collaborative role with other members of OBER staff
- I brought a perspective on genomics and omics that I hoped to inject into the approach of the research efforts.
- We needed to push the boundaries because of the difficulty of characterizing what was happening at low dose and low dose rates.
- Was a member of the Low Dose Radiation Expert Subcommittee reporting to the Biological and Environmental Research Advisory Committee on Low Dose Radiation research in 2016.

Context

- There is a large component of values/philosophical perspective that drives peoples' positions on radiation. That is not a negative reflection on these viewpoints, just a reality.
- Nuclear Energy lost a lot of credibility in the 1970s, particularly over waste management - once lost, it is very difficult to regain public acceptance.
- In this context, it is difficult to produce radiation health effect results that move the needle and that does not evoke concerns about legitimacy.
- It is my hope that the Committee can find a path that is credible because the issues of public radiation exposure and management of radiation and radioactive waste in particular, will not go away.
- I would observe that undertaking a Low Dose Radiation Study Program as part of the research portfolio is viewed by some as a no-win responsibility.

Evolution of the Low Dose Program

- The low dose radiation program was resurrected by Senator Pete Domenici in the late 1990s
- Radiation Biology research in OBER had declined in the early 1990s
- A meeting, including international participants, was held at Arlie House to allow wide-ranging discussions about what elements should be in the program.
- A program plan was developed 1999

Program Plan Identified Research Needs

- Understanding biological responses to low dose radiation exposures
- Low dose radiation versus endogenous oxidative damage
- Thresholds for low dose radiation
- Genetic factors affecting individual susceptibility
- Communication of research results

The Importance of Communication

- It was clear that the program needed not just science but a means to communicate the results effectively
- It needed a mechanism to engaged communities that were skeptical about the credibility of the research
- The program subsequently invited those skeptical of the research to participate in Principal Investigator meetings and published everything in the open literature.
- The selection of research projects were peer reviewed.

A Program View Circa 2014

- Biological systems detect and respond to very low doses of radiation
- Cells not directly exposed can show a biological response to the low dose radiation exposure of neighboring cells
- Cell-cell and cell-matrix communication are critical in the total response to radiation, resulting in whole tissue or organism responses as compared to individual cell responses
- Qualitatively different molecular-level responses result after low doses of radiation vs. high doses of radiation
- Many cellular and tissue-level responses demonstrate non-linear responses with respect to radiation dose
- In addition to radiation-induced DNA damage, other processes are induced by low dose radiation that participate in either increasing or deterring carcinogenesis

Program Interactions

- **Coordination with DOE/HS:** DOE's Office of Health, Safety and Security—regular meetings with colleagues in HS-13 (Office of Domestic and International Health Studies) [now is AU-10, AU-20]
- **Coordination with NASA:** Joint support of research grants with NASA Space Radiation Health Program; regular meetings, reviews
- **Coordination with AFRRI:** meetings, reviews
- **RABRAT** –quarterly meetings with agency colleagues interested in radiobiology and emergency response to radiological events (NCI, NIAID, AFRRI, EPA, DOD, DHS, FDA, CDC, DOE)
- **ISCORS:** Interagency Steering Committee on Radiation Standards, regularly attend meetings as BER observer
- **Coordination with Europe:** MELODI and DoReMi; representatives attend each other's meetings; peer reviewers
- **Coordination with Japan:** representatives attend our Workshops, visit, peer review

Where Should We Go with the Program

- There are enormous opportunities because of the emergence or improvement of biological and technology tools in the last five years
 - Omics
 - Imaging
 - AI and other computational tools
 - Organoids, Collaborative Cross
- Need to find a way to run experiments with a systems biology perspective including complete systems - whole animals, 3-D models
- Keep exploring the relationship between technical findings and epidemiology
- The rise of social media motivates the need to revisit the issues of communicating the results of the technical research and also perception of risk
 - We need to understand how to communicate effectively in this environment and how defend the validity of the results from distortion and misinformation.
 - We need to understand how this environment changes the perception of risk and benefits

Where Should We Go with the Program

- What DOE is good at is managing multidisciplinary program involving high technology. The history in OBER and its predecessor organization is being willing to take risks. It initiated the Human Genome Program when there was a lot of skepticism.
- The Office of Science gets lots of advice from smart people through workshops, Advisory Committees, peer review, so a variety of perspectives are on the table.
- In my experience the challenge for anyone running a science program is to bring together the elements needed – which can be painful.
- Finally, legal advice is important about what can and cannot be done with respect to who can make decisions about money, organization and proposals.