National Cancer Institute

Predictive Biomarkers for Improving Radiation Therapy

Pataje G. Prasanna, PH.D.
Program Director

Radiation Research Program
National Cancer Institute
Bethesda, MD, USA

E-mail: pat.prasanna@nih.gov

- No financial conflict of interest
- Views expressed in this presentation are those of the authors; no endorsement by NCI, NIH or any other US Government Agency agencies has been given, implied, or inferred

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
National Institutes of Health

Advise potential applicants and grantees and direct research in radiation therapy

Advise clinical trial work groups, SBIR Development Center, and Cancer Therapy Evaluation Program (CTEP) regarding scientific priorities and quality assurance in studies involving RT

Serve as NCI's liaison and advisor for radiation injury to normal tissue and development of radiation biomarkers to other institute centers and agencies

Advise extramural investigators interested in the use of radiation biomarkers

Estimated Number of New Cancer Cases and Deaths, US 2015*

Sites	Estimated New Cases	Estimated Deaths
All sites	**1,658,370**	**589,430**
Oral Cavity and Pharynx	45,780	8,650
Digestive System	291,150	149,300
Respiratory System	240,390	162,460
Brain and Nervous System	22,850	15,320
Breast	234,190	40,730
Prostate	220,800	27,540
Lymphoma	80,900	20,940

*American Cancer Society Data

Dose Delivery and Distribution

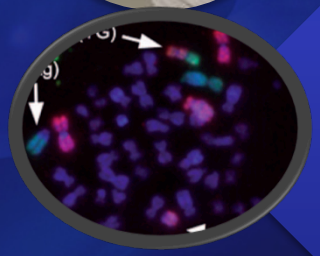
Radiation-Effect Modulators

Improved Efficacy of Radiotherapy and Quality of Life

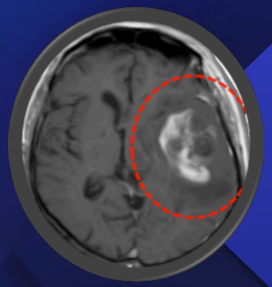
Biomarkers

Clinical Needs for Biomarkers

Predict individual radiosensitivity



Predict normal tissue tolerance/toxicity

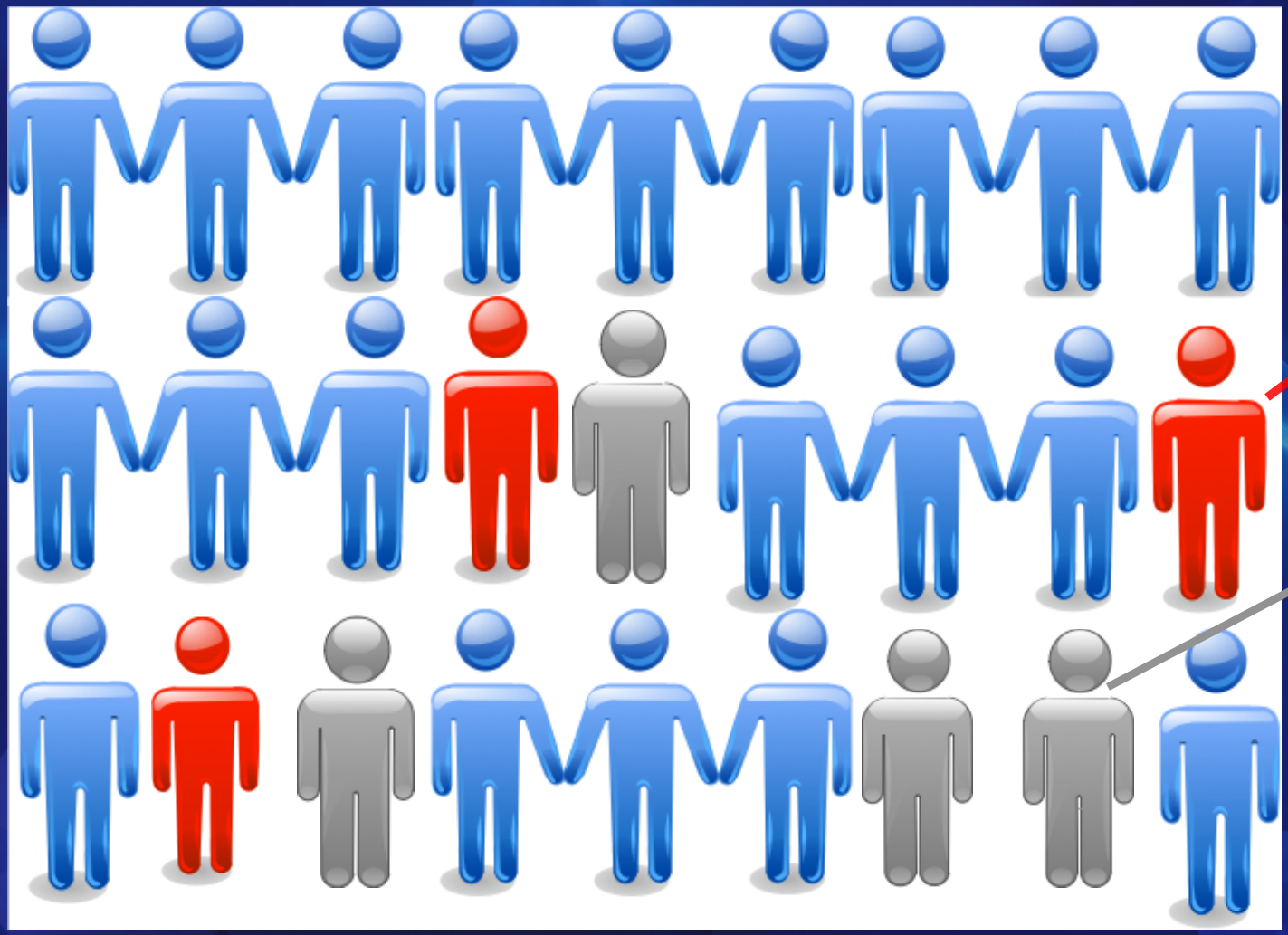


Assess/monitor tumor response

Important Adverse Effects after Conventional Radiotherapy of the Respiratory System : An Example

Cancer Type	Treatment	Adverse Intermediate Effects
Larynx (Locally advanced)	Cisplatin	Persistent dysphagia (7-15%)
Lung, Non small cell (Locally advanced)	Continuous hyperfractionated accelerated radiotherapy	
Lung, Non Small Cell (Locally advanced)	Chemo before radiation	Gr 3-5 Late toxicity
Lung, Small cell (Limited disease)	Chemotherapy	Fibrosis

Prasanna et al. 2012



Patient Selection is Critical to Improve Outcome

Radiation-Induced Brain Damage: Need for Predictive Biomarkers

International Journal of Radiation Biology

Taylor & Francis
Taylor & Francis Group

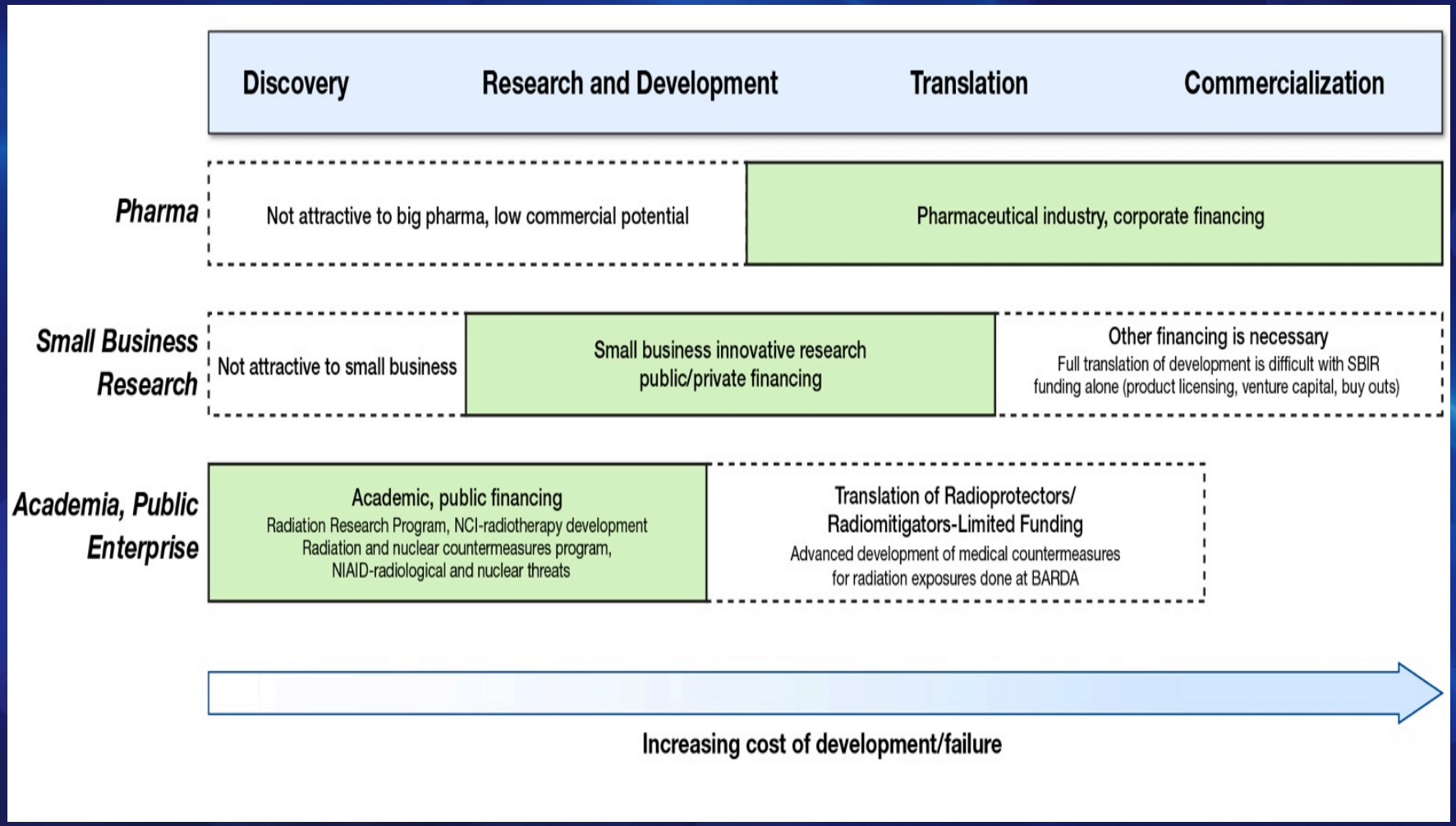
Conclusions: Predictive biomarkers of radiation-induced brain injury may enable stratifying patients for customization of treatment and thus aid in improving the QOL and possibly prolonging survival. Here we discuss the challenges involved in leveraging recent advances in radiation-specific biomarker research and translating them to radiotherapy, which for the foreseeable future is likely to remain a cornerstone of the treatment of brain tumors.

Keywords: Radiotherapy, radiation-induced brain damage, mechanisms, radiation mitigator, predictive biomarkers

of Radiation Biology, 90:9, 742-752

To link to this article: http://dx.doi.org/10.3109/09553002.2014.925607

Acceleration of Clinical Translation: Radiation-Effect Modulators Model



Prasanna *et al*., Radiat. Res. 2015

Summary

- Predicting individual radiation sensitivity, adverse effects of radiation therapy, and monitoring tumor response all will help improve treatment outcome.
- Current focus on radiation biomarkers is primarily on assessment of radiation doses after catastrophic accidental radiation exposures has advanced many technologies and platforms
- This recent progress may have cross utility to improve radiation therapy outcome among cancer patients and their quality of life.
- Discovery, development and validation of predictive biomarkers while provides an opportunity to improve radiation therapy outcome, it also presents several challenges

NATIONAL® CANCER INSTITUTE