

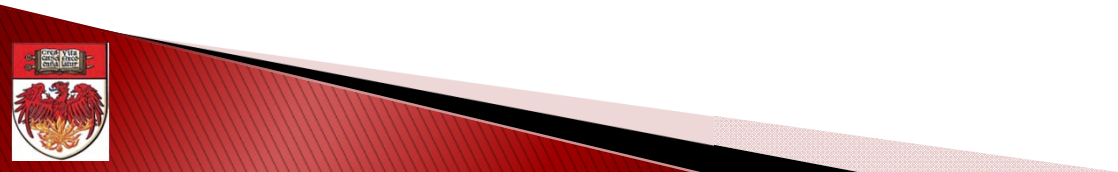
# Immunotherapy Killed the IGRT Star

<https://www.youtube.com/watch?v=lwuy4hHO3YQ&feature=youtu.be>



# Learning objectives

- 1) Learn about the role of radiation as an immune booster in cancer therapy
- 2) Summarize ongoing clinical trials combining radiation and immunotherapy
- 3) Discuss the evolving role of IGRT



# A Physicist's Cliff Notes to Immunotherapy

Hania Al-Hallaq, Ph.D.  
The University of Chicago  
Radiation & Cellular Oncology



# Disclosures

- ▶ I receive royalties from the University of Chicago for software licensed for computer aided detection of breast cancer.
- ▶ I am co-Chair of TG-302: Surface Image Guided RT.
- ▶ I serve as Physics PI on NRG/Alliance/institutional clinical trials.



# Outline

1. Overview of immunotherapy definitions/principles
2. Review of the role of IGRT for accurate targeting of tumors in SBRT
3. Discuss role of IGRT with shifting goal of radiotherapy is to induce an immune response



# 1. Overview of Immunotherapy

➤➤ Definitions/Principles



# Definitions

- ▶ Immunotherapy – harnesses the body’s immune system to fight cancer
- ▶ Types of immunotherapy:
  - **Monoclonal antibodies** – flag cancer cells, block immune system inhibitors (e.g., Pembrolizumab)
  - **Oncolytic virus therapy** – genetically modified virus to kill cancer cells
  - **T-cell therapy** – genetically modify T-cells to kill cancer
  - **Cancer vaccines** – triggers immune system by exposing it to an antigen

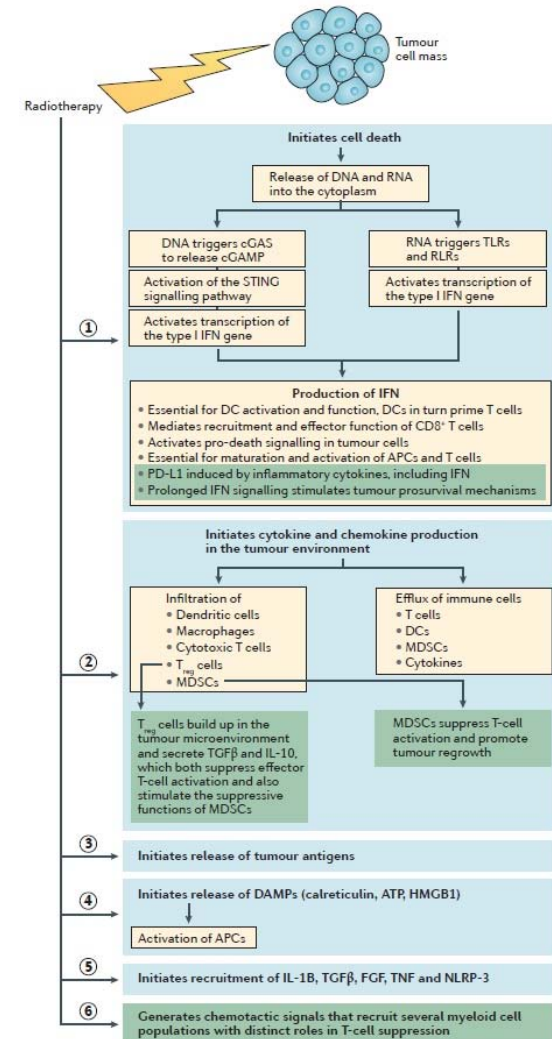
*[www.Mayoclinic.org](http://www.Mayoclinic.org)*

*[www.Cancer.net](http://www.Cancer.net)*



# Principles

- ▶ Radiation can induce an immune response (Weichselbaum et al., “Radiotherapy and immunotherapy: a beneficial liaison?”)





# Principles

- ▶ Radiation can induce an immune response <sup>1</sup>
  - Is there a dose threshold? <sup>2</sup>
  - Is there tumor volume threshold? <sup>2</sup>
  - Can this immune response treat tumor cells that are not directly irradiated (i.e., abscopal effect)? <sup>3</sup>

- 1) *Weichselbaum et al., "Radiotherapy and immunotherapy: a beneficial liaison?"*
- 2) *Chajon et al, "The synergistic effect of radiotherapy and immunotherapy: A promising but not simple partnership."*
- 3) *Jatoi, et al, Hypothesis: can the abscopal effect explain the impact of adjuvant radiotherapy on breast cancer mortality?*



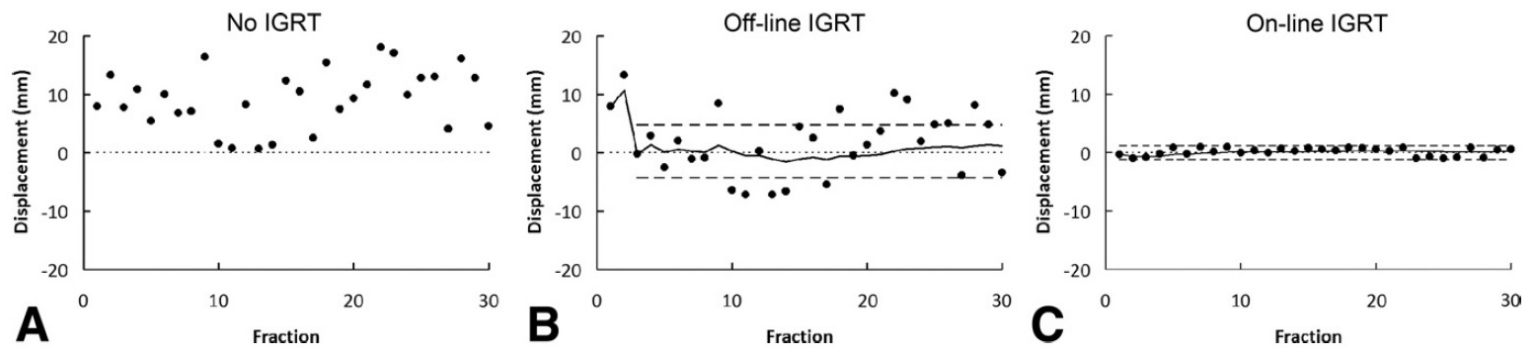
## 2. Role of IGRT in SBRT

»» Tumor Targeting



# IGRT

- ▶ Imaging in the treatment room<sup>1</sup>
  - Reduces geometric uncertainty
  - Improves agreement between planned and delivered dose

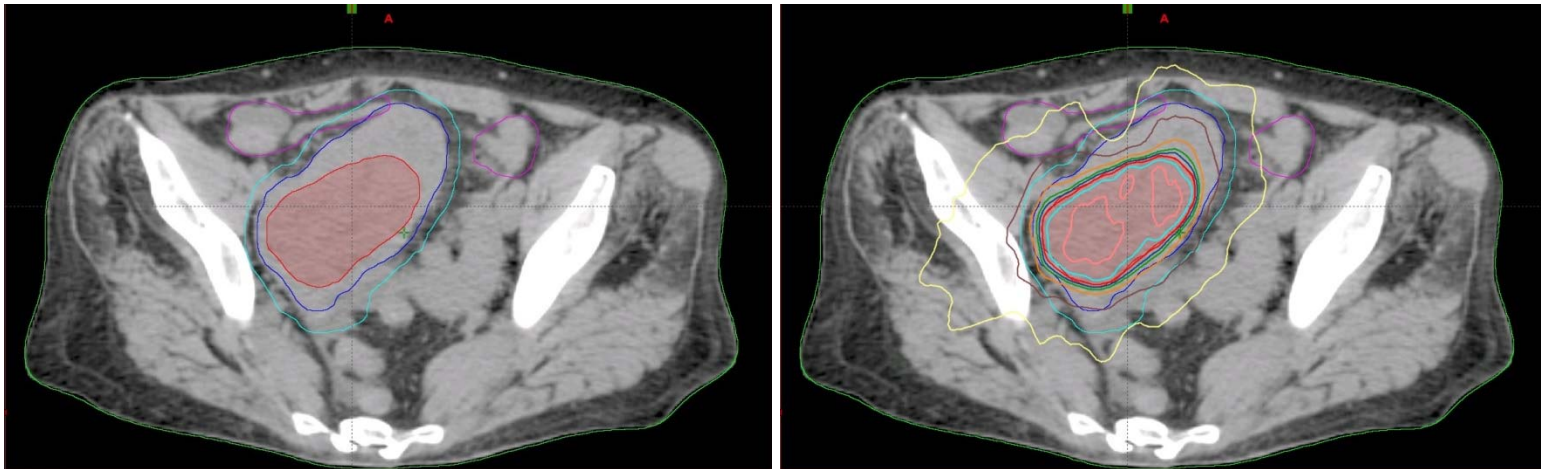


1) Bujold et al., "Image-guided radiotherapy: has it influenced patient outcomes?"



# IGRT for SBRT

- ▶ IGRT has enabled SBRT & other hypo-fractionated RT
- ▶ Does the role of IGRT differ if treatment intent is immuno-modulation instead of total ablation?

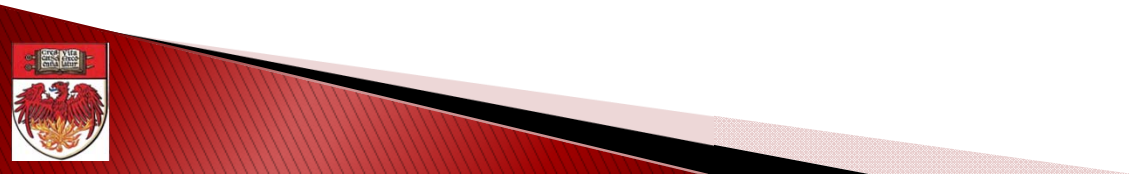


Luke et al., "Safety and Clinical Activity of Pembrolizumab and Multisite Stereotactic Body Radiotherapy in Patients With Advanced Solid Tumors"



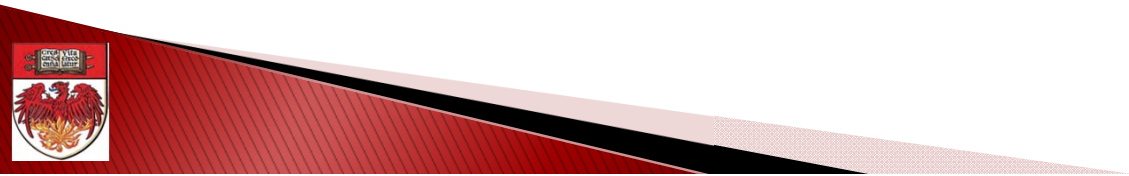
# IGRT for SBRT

- ▶ Is localization accuracy as important for immuno-modulation as for ablation?
- ▶ Did video kill the radio star?
- ▶ Did immuno kill the IGRT star?



# Discussion points

1. What clinical evidence exists that radiation is an immune modulator before the introduction of immunotherapy?
2. How will the optimal timing and dose of radiation in relationship to immunotherapy be determined?
3. What is the role of IGRT if the intention is no longer to deliver dose to the entire tumor volume?



Thank you for  
your attention!

