

## Cancer Immunotherapy in the Clinic

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## Take Home Points

- Cancer Immunotherapy has dramatically improved outcomes in advanced cancer
- Immunotherapy can cause unique side effects
- Further research is needed to bring the benefit of immunotherapy to all patients with cancer



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## Outline

- Examine why cancer immunotherapy offers hope for patients with advanced cancer
- Discuss clinical impact of available cancer immunotherapies and side effects
  - PD-1/PD-L1 inhibitors
  - CTLA-4 inhibitor
  - CAR T-cells
- Brief look at the future of cancer immunotherapy



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## Immunotherapy extends life in...

- Melanoma
- Non-small cell lung cancer
- Small cell lung cancer
- Head and neck cancer
- Kidney
- Bladder
- Cervical
- Stomach
- Certain types of colon cancer
- Liver cancer
- Merkel cell carcinoma
- Primary mediastinal large B-cell lymphoma
- Hodgkin Lymphoma
- Acute Lymphoblastic Leukemia
- Diffuse Large B-cell lymphoma




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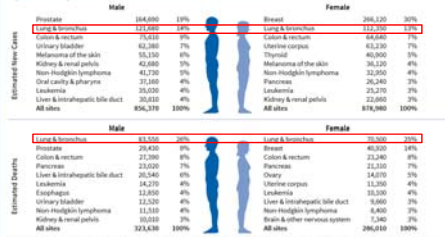
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Figure 3. Leading Sites of New Cancer Cases and Deaths - 2016 Estimates




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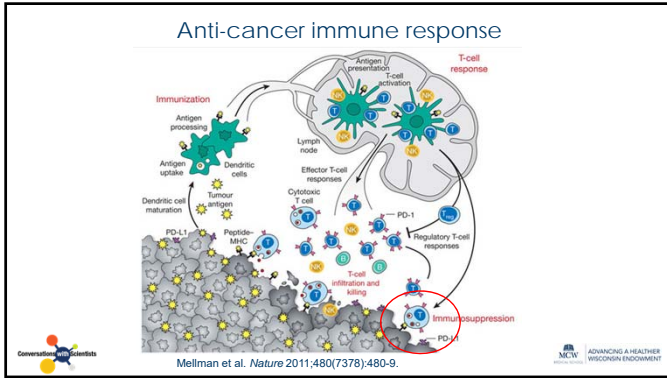
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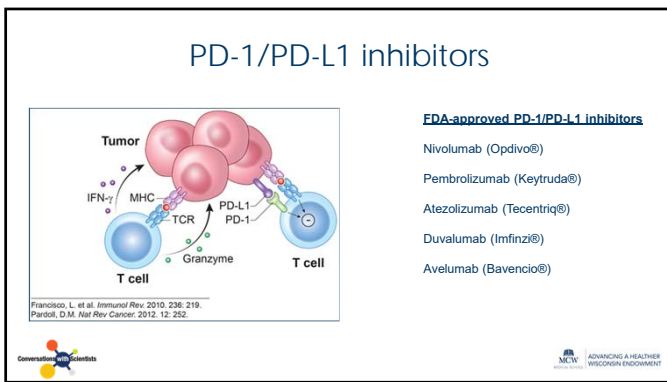
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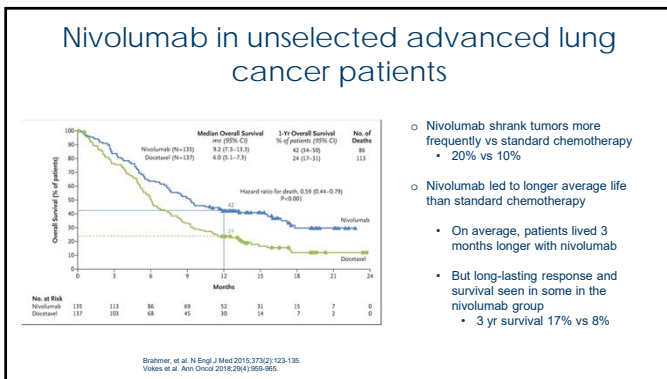
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- Nivolumab shrank tumors more frequently vs standard chemotherapy
  - 20% vs 10%
- Nivolumab led to longer average life than standard chemotherapy
  - On average, patients lived 3 months longer with nivolumab
  - But long-lasting response and survival seen in some in the nivolumab group
    - 3 yr survival 17% vs 8%

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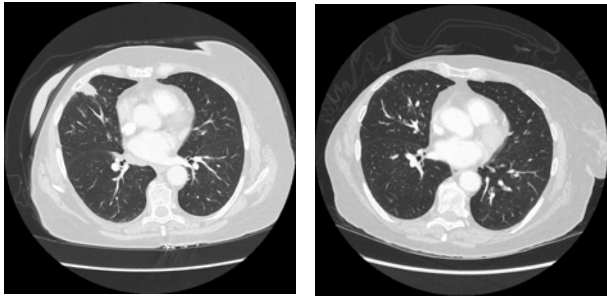
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### High PD-L1 example



Before pembrolizumab

After pembrolizumab

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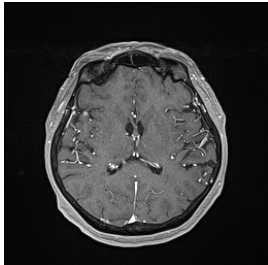
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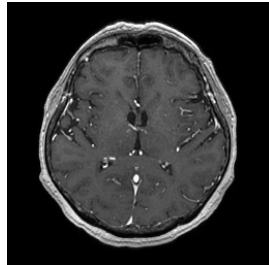
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Before pembrolizumab



After pembrolizumab

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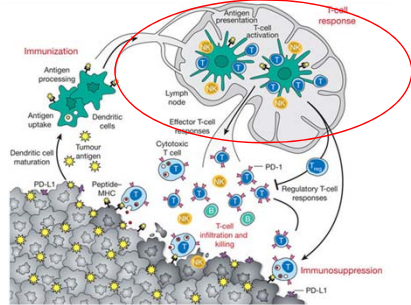
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### Anti-cancer immune response



Mellman et al. Nature 2011;480(7378):480-9.

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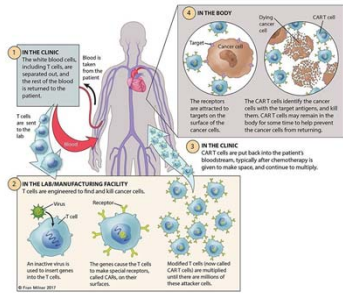
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## Chimeric Antigen Receptor (CAR) T-cells

- FDA approved CAR T-cells
  - Tisagenlecleucel (Kymriah®)
  - Axicabtagene ciloleucel (Yescarta®)
  - More in development
- FDA approved for treatment of multiply relapsed/refractory
  - Acute lymphoblastic leukemia (ALL)
  - Large B cell lymphoma (DLBCL)
- Treatment leads to complete remission in many patients
- Remission can be durable
- Requires treatment at an accredited facility due to risk of cytokine release syndrome (CRS)




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## CAR T-cell MCW example




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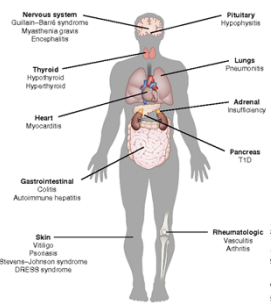
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## Immunotherapy Side Effects




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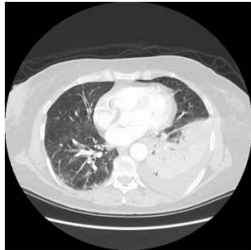
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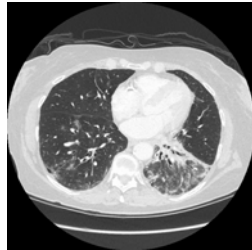
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### Immune Related Pneumonitis



After 2 months of pembrolizumab



After corticosteroids

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### Immunotherapy Future

- Cancer vaccines
  - Introduce non-harmful cancer proteins into the body to activate the immune system
- Combining immunotherapy with chemotherapy and/or radiation
  - Chemo and radiation can activate the immune system
- Drugs that turn on “helpful” immune cells or turn off “harmful” immune cells
- Using the body’s natural bacteria to turn on the immune system

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