Radiotherapy for Prostate Cancer
Hypoxia, Hormones and Hope

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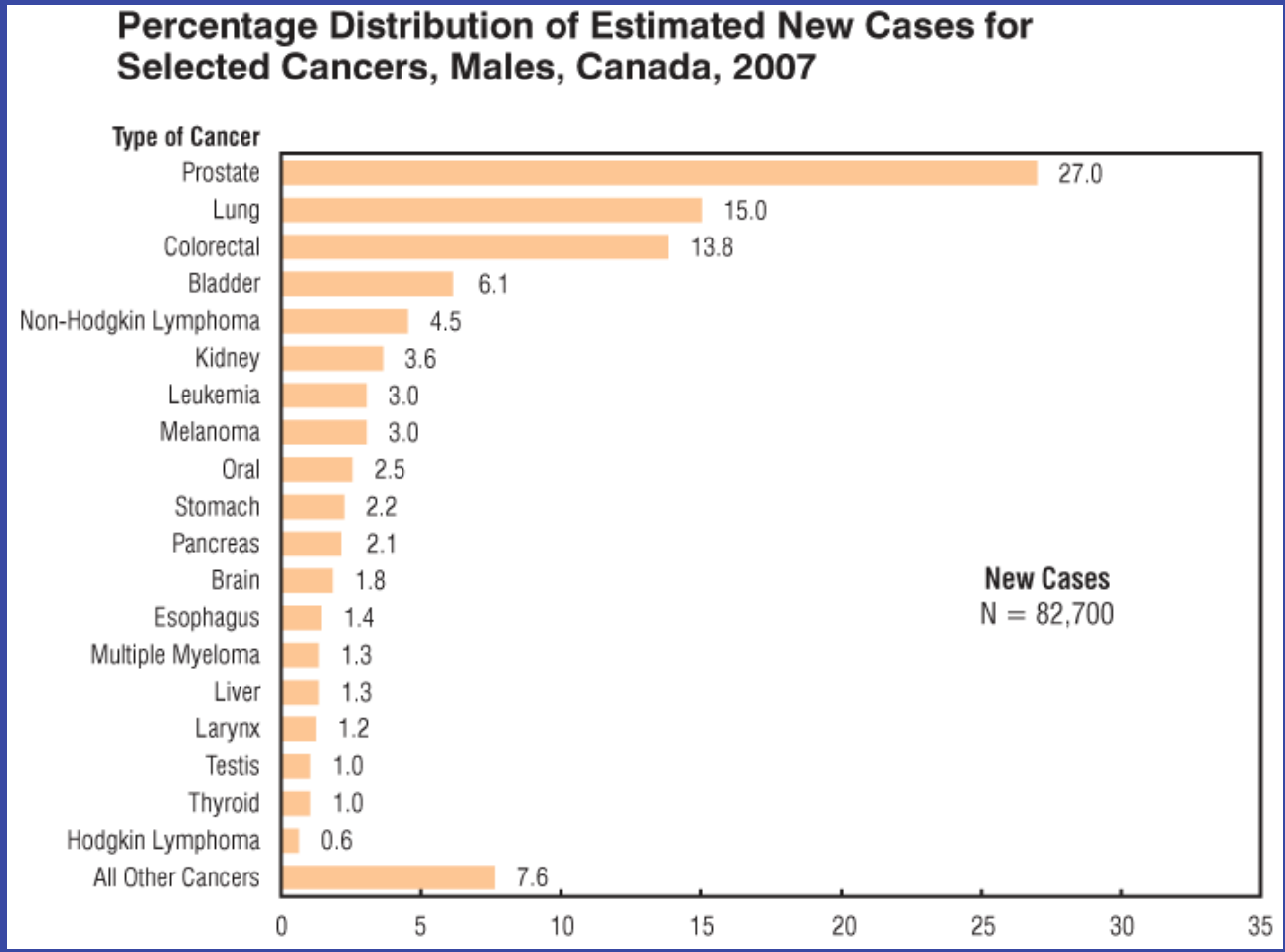
Overview

- The prostate cancer problem
- Radiotherapy 101
  - What is it and how does it work?
  - How is it delivered?
- Understanding biology to improving the success of radiotherapy and other treatments for prostate cancer.
- A plea for your help!

The Prostate Cancer Problem



Most common cancer in men
3rd leading cause of cancer death in men

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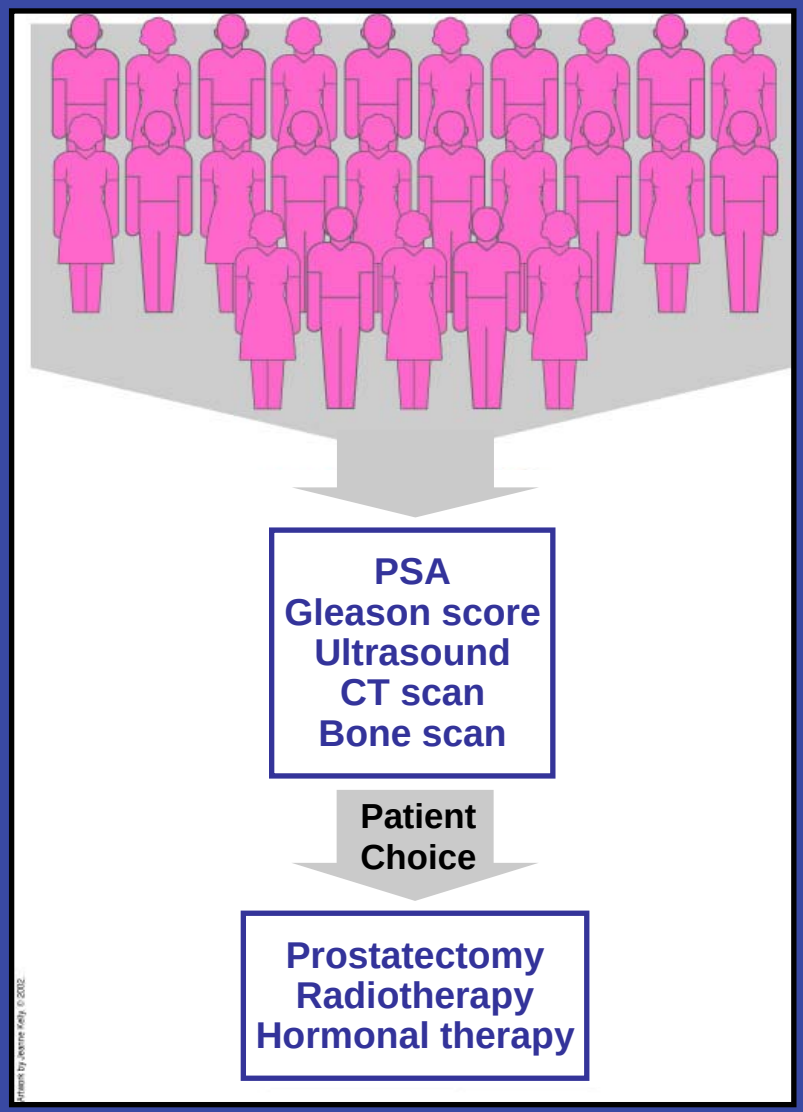
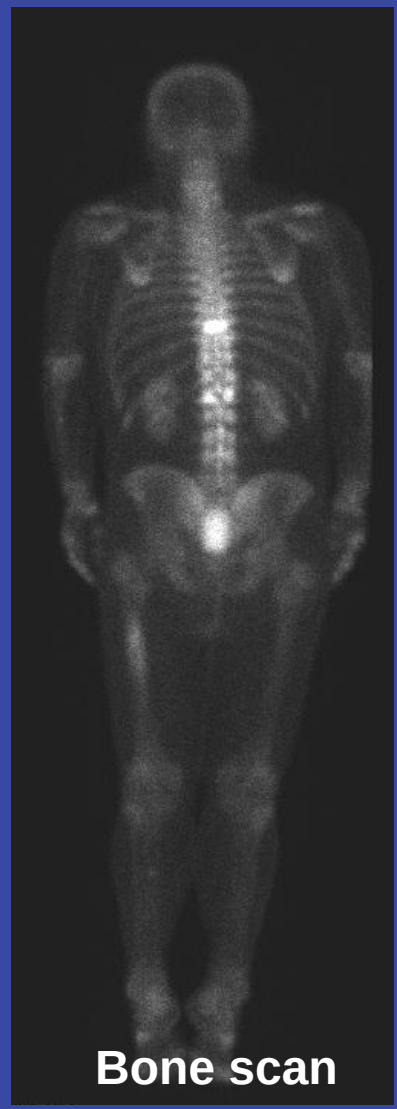
What's the "right" treatment for prostate cancer?



Adapted from press2.nci.nih.gov/sciencebehind/snps_cancer



What's the "right" treatment for prostate cancer?

Prostate cancer risk groups:

- **Low risk**
  - T1-2, PSA <10, Gleason <6
- **Intermediate risk**
- **High risk**
  - T3 or PSA >20 or Gleason ≥8

Observation

Prostatectomy

Radiotherapy
- External
- Brachytherapy

Hormonal therapy

Combinations

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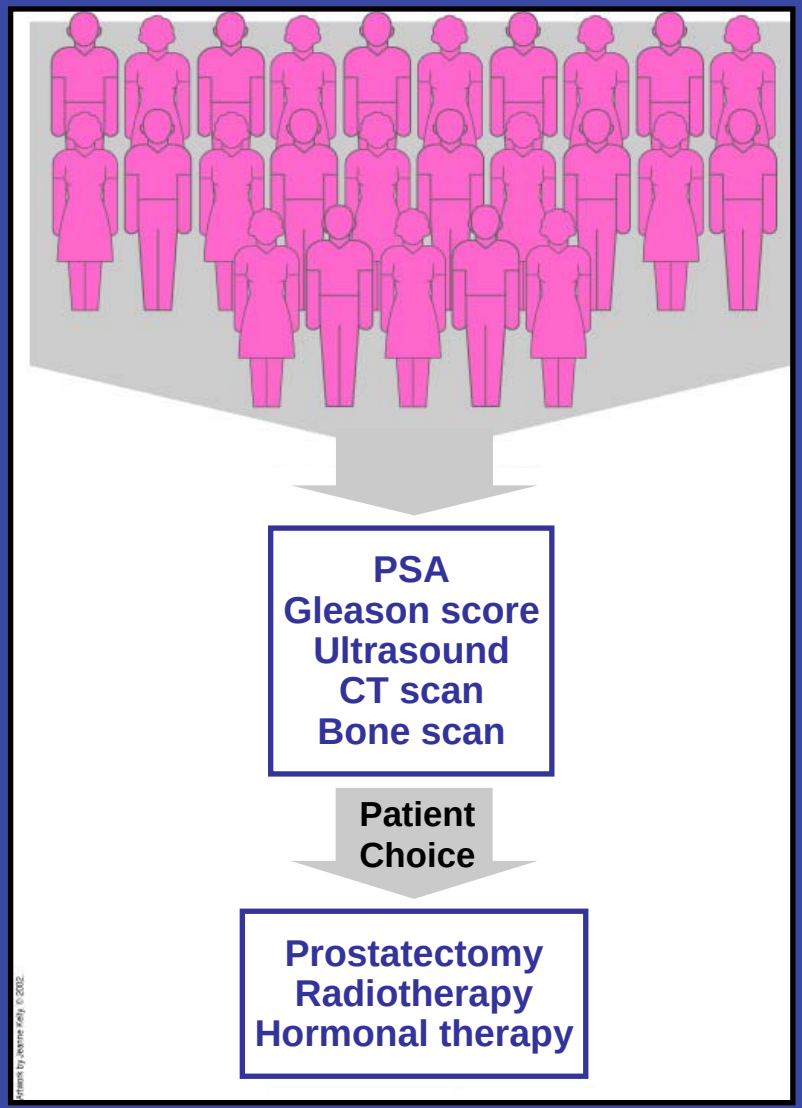
What's the "right" treatment for prostate cancer?



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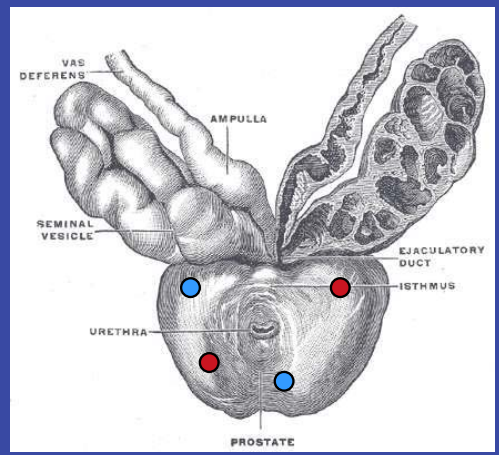
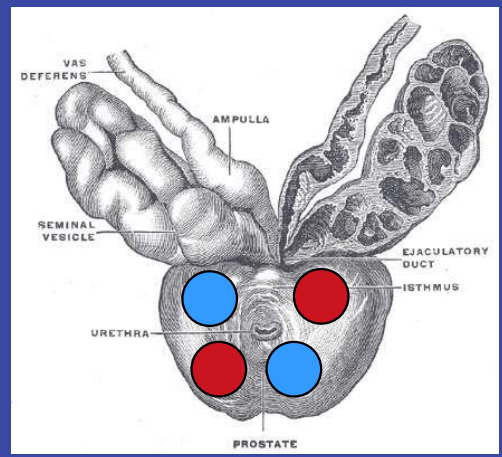


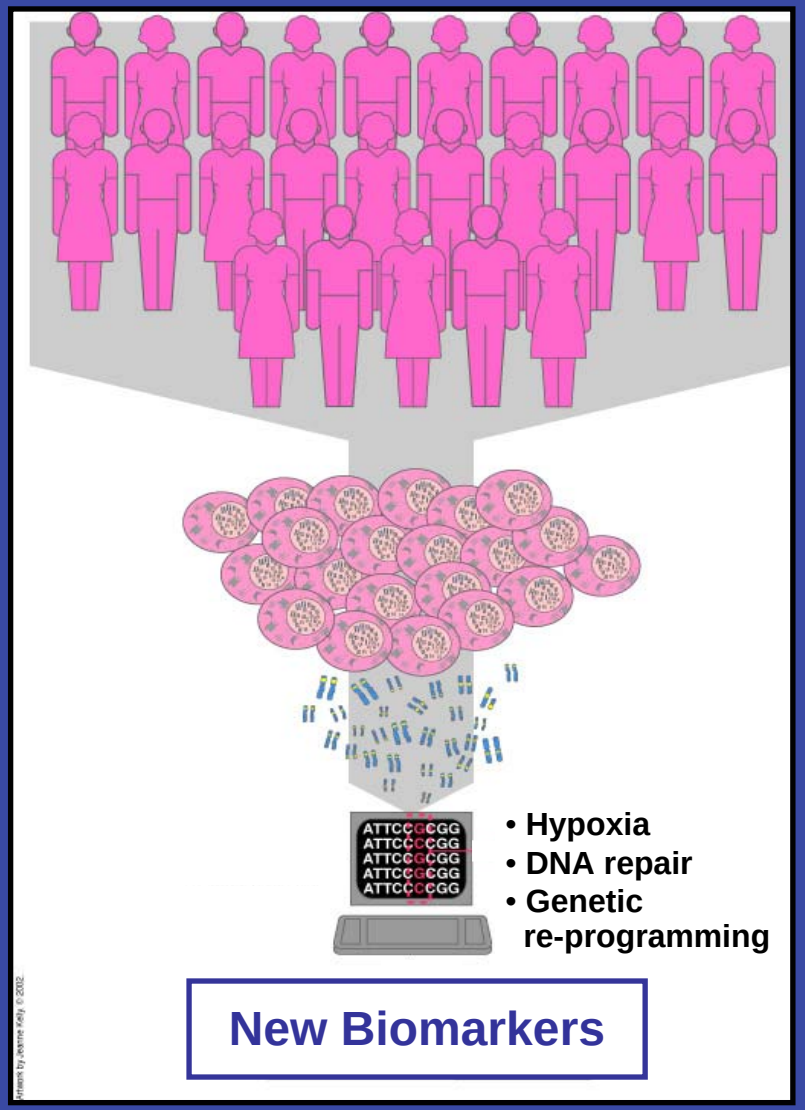


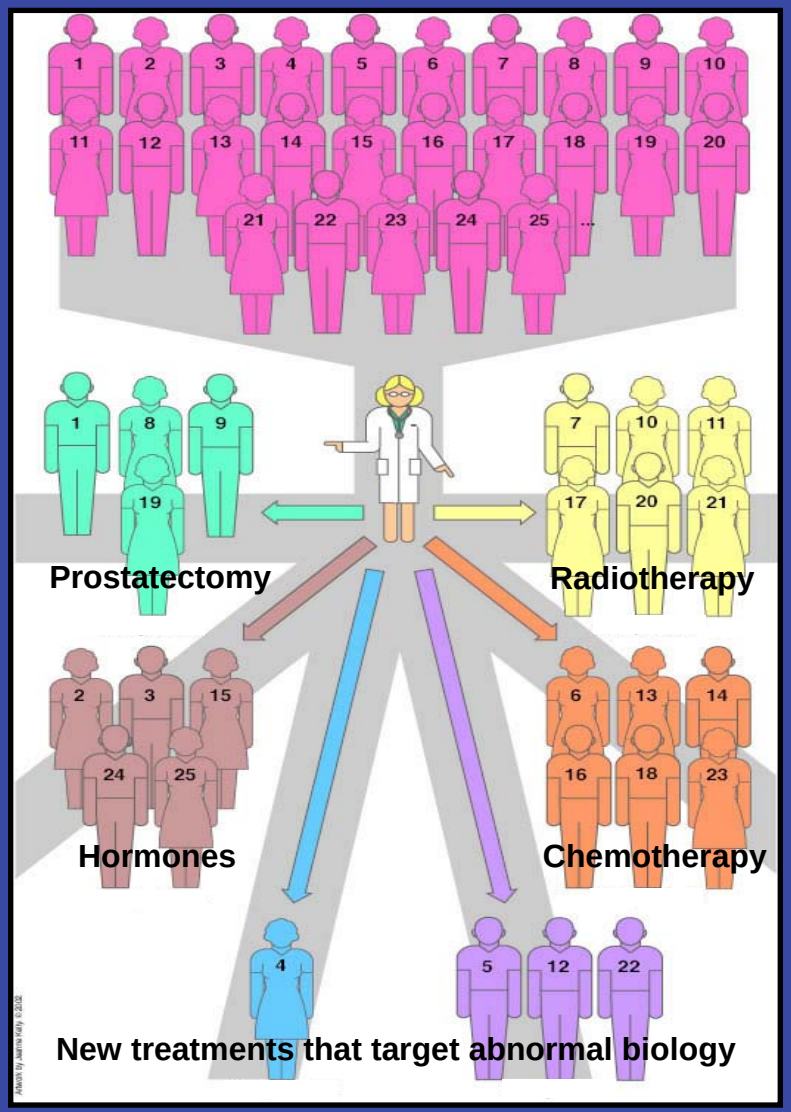
Different patients but:

- **Same stage**
- **Same PSA**
- **Same Gleason**

Need for better tests to select patients for the most appropriate treatment

What's the "right" treatment for prostate cancer?





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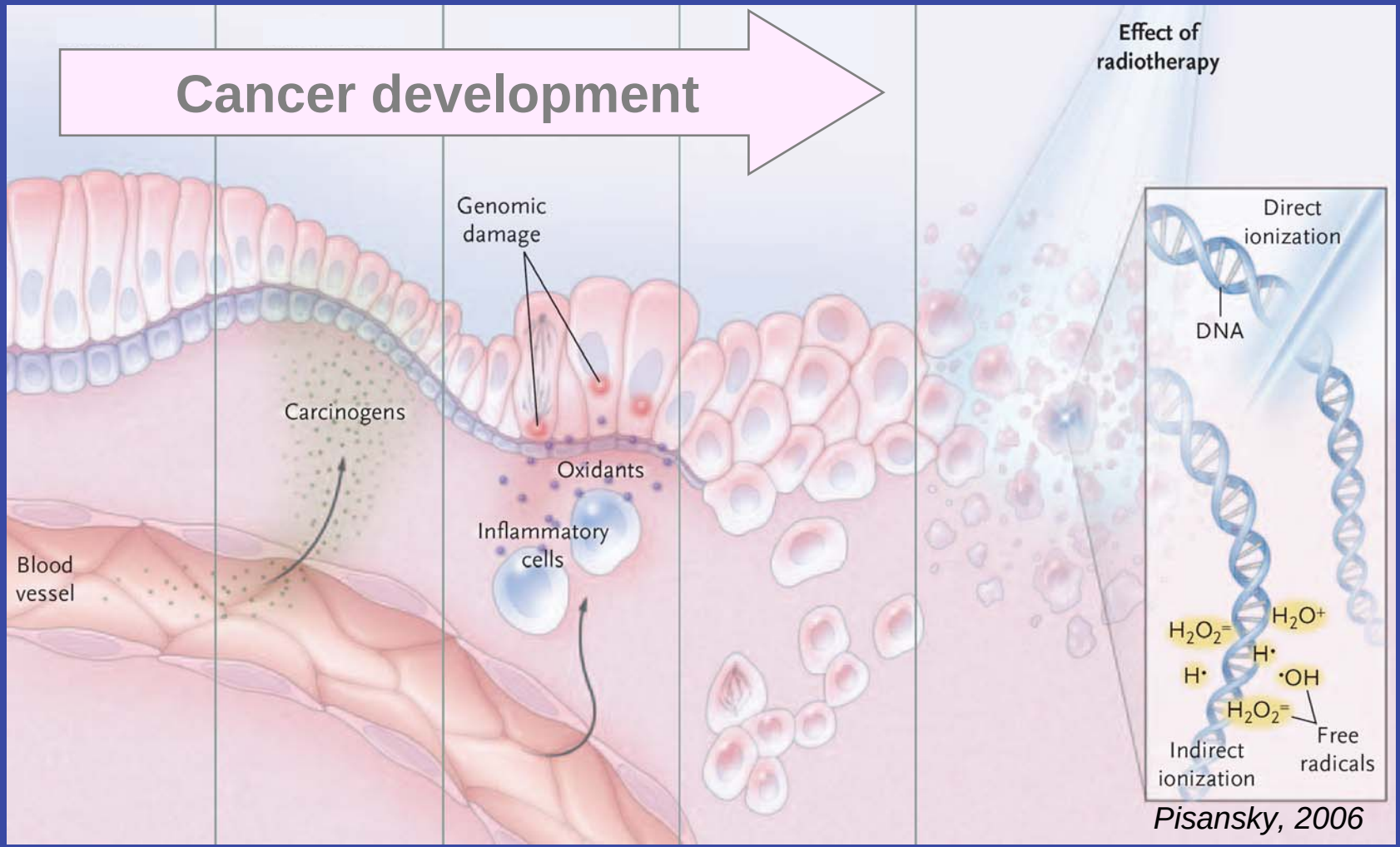
What is Radiotherapy?

- One of the three main treatments for cancer
  - Along with surgery and chemotherapy
- 50% of patients with cancer require RT
  - Breast cancer 83%
  - Prostate cancer 60%
  - Lung cancer 76%
  - Rectal cancer 61%
  - Kidney cancer 27%

Delaney, 2005

Radiotherapy and Tumor Control



Pisansky, 2006

Radiation damages DNA causing cancer cells to die.

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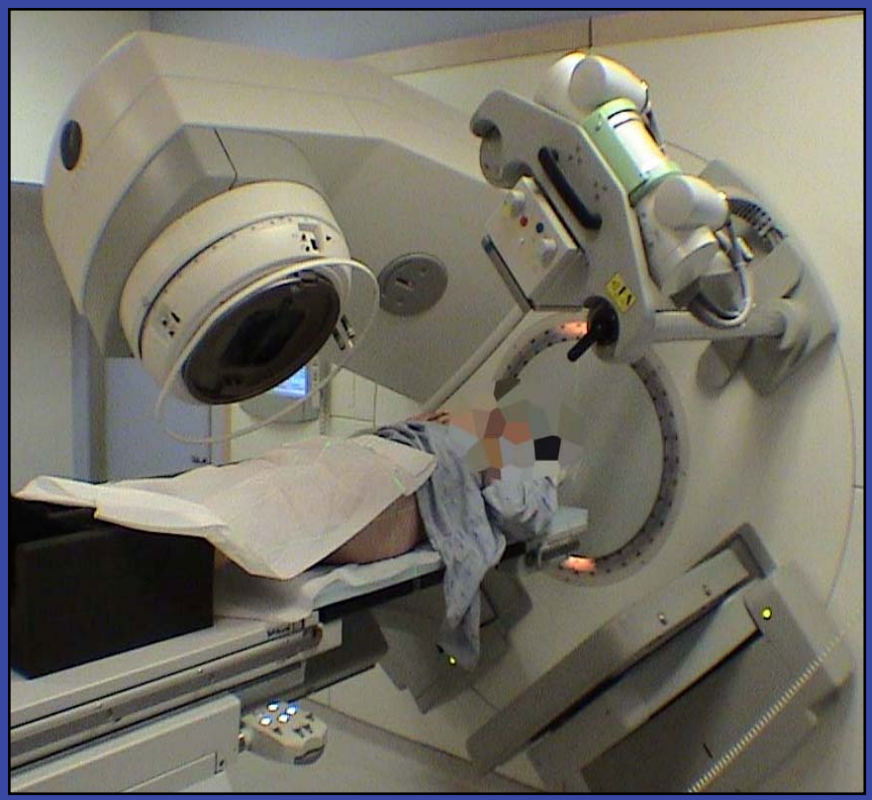
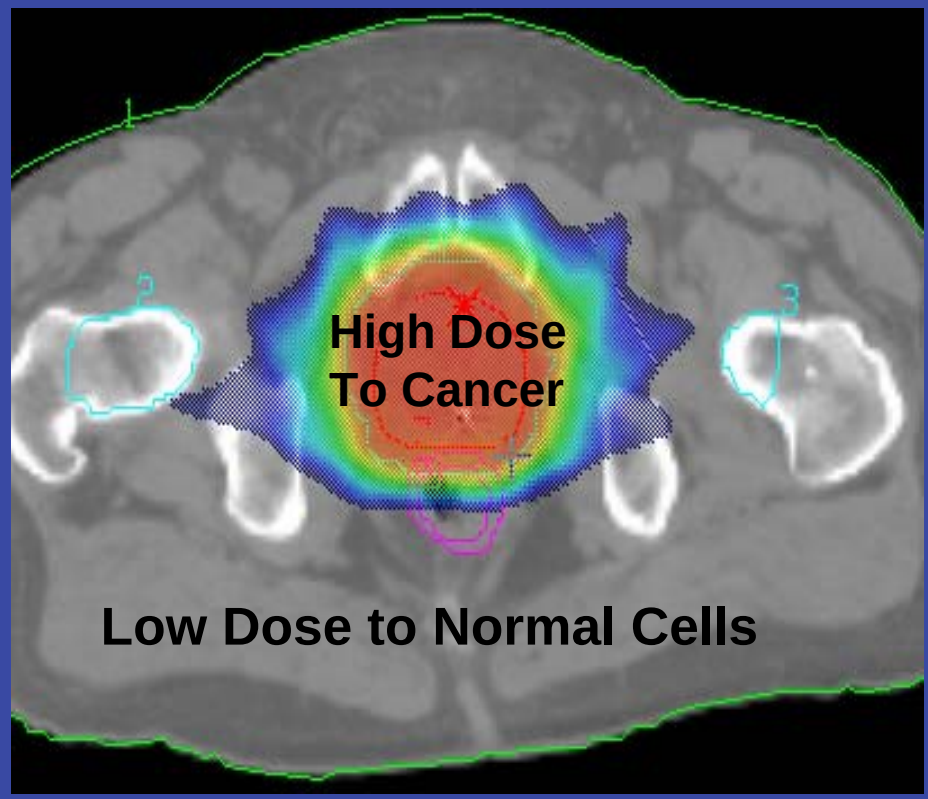
Radiotherapy Delivery



Linear accelerator



Treat the tumor and avoid normal organs

Prevent side effects by precise targeting of the tumor

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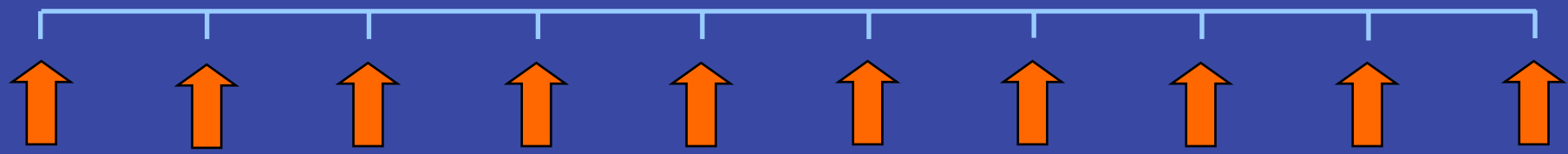
Radiotherapy Delivery

- Fractionation = Small doses of RT each day
- Allows time for DNA repair
- Cancer cells are unable to repair DNA damage as well as normal cells
- Cancer cells die but normal cells survive



Prevent side effects by fractionating radiotherapy

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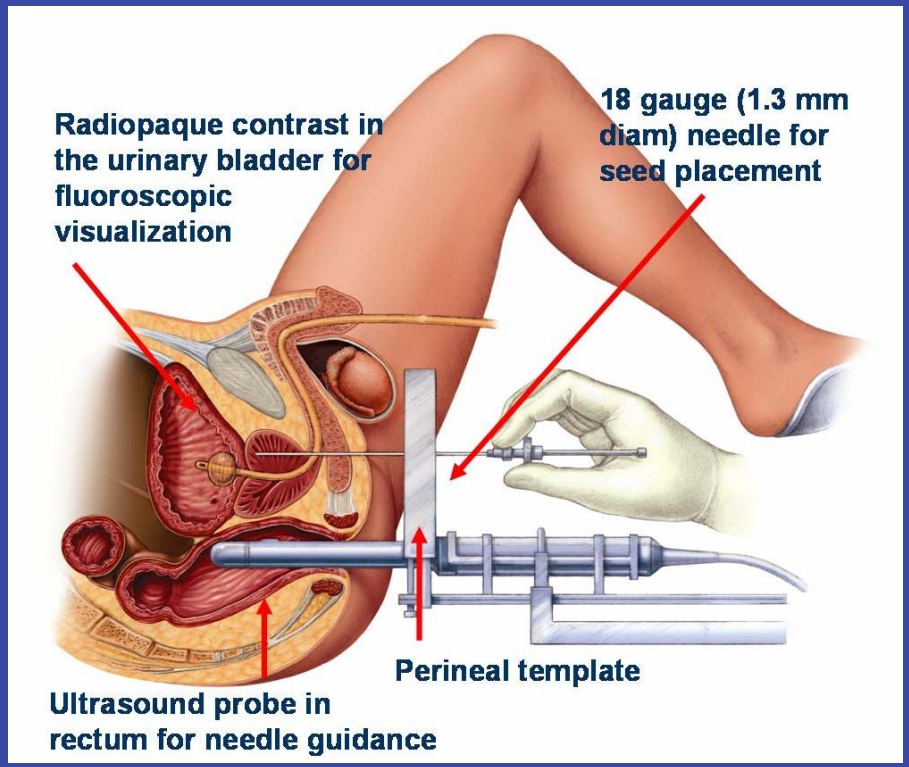
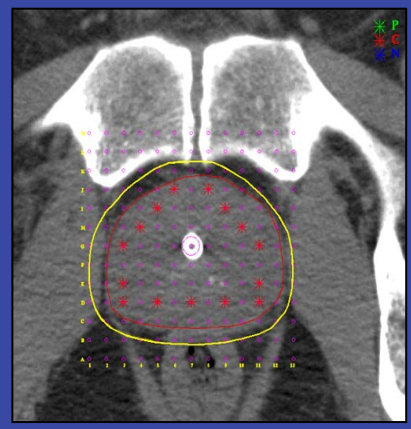
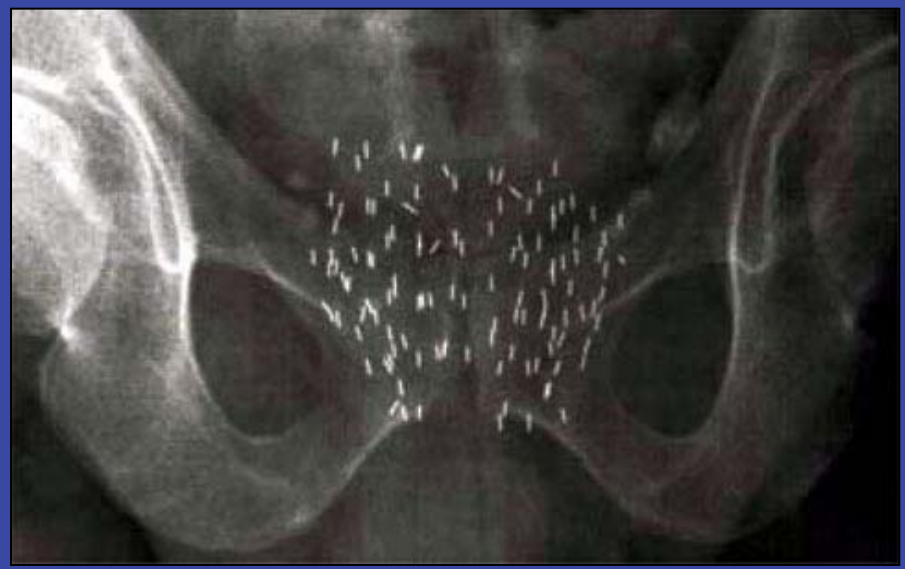
Prostate Brachytherapy







The ultimate in high-precision radiotherapy targeting of prostate cancer

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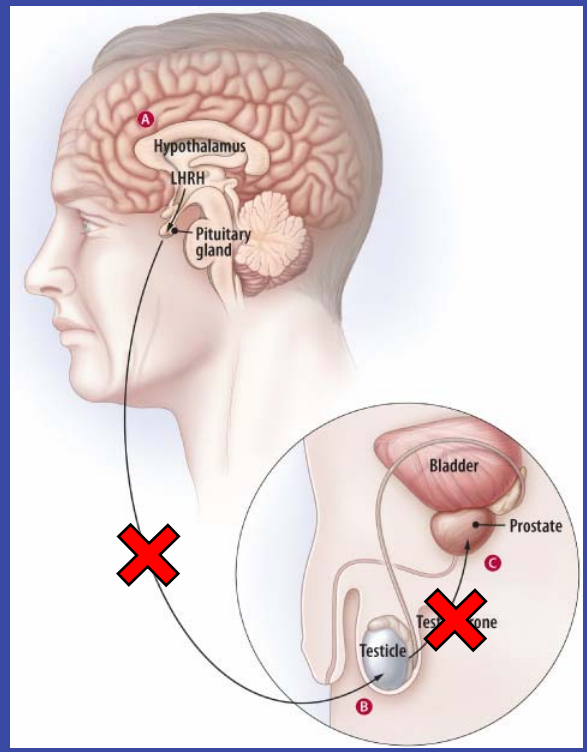
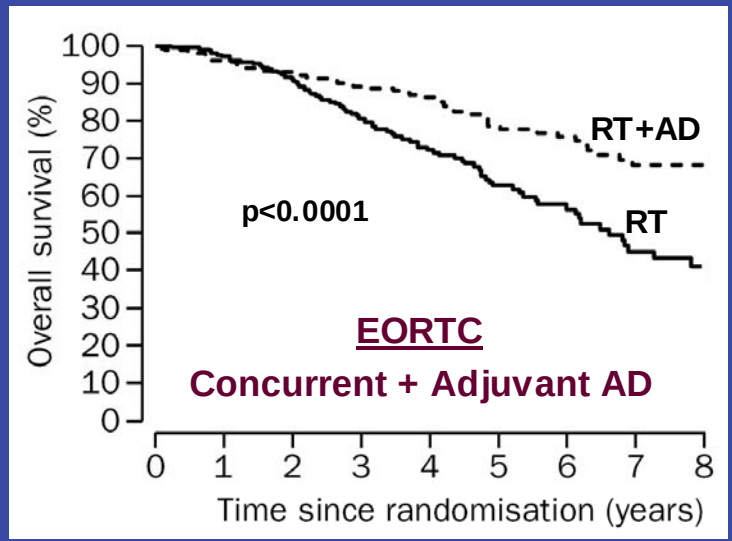
Hormonal Therapy and Radiation

- Many studies
- Improves the survival of men treated with radiotherapy
- Sequence, duration, continuous vs. intermittent?
- How does hormonal therapy work to improve radiation effectiveness?





Bolla, 2002

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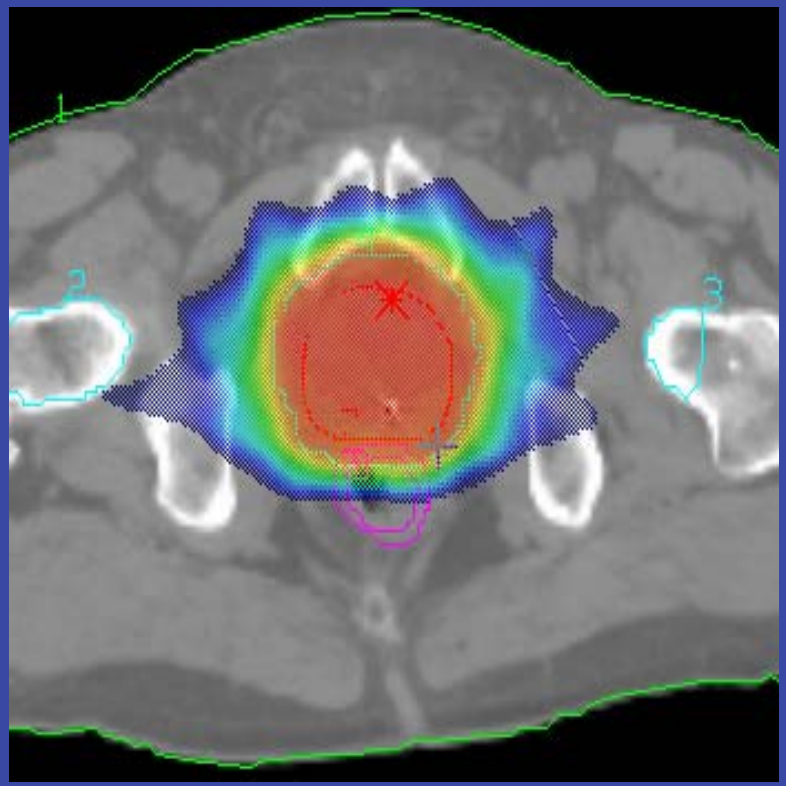
Radiotherapy in the 21st Century: *Individualized Treatment*



High precision radiotherapy

Understanding biology

Synergistic strategies for improving tumor control and reducing side effects

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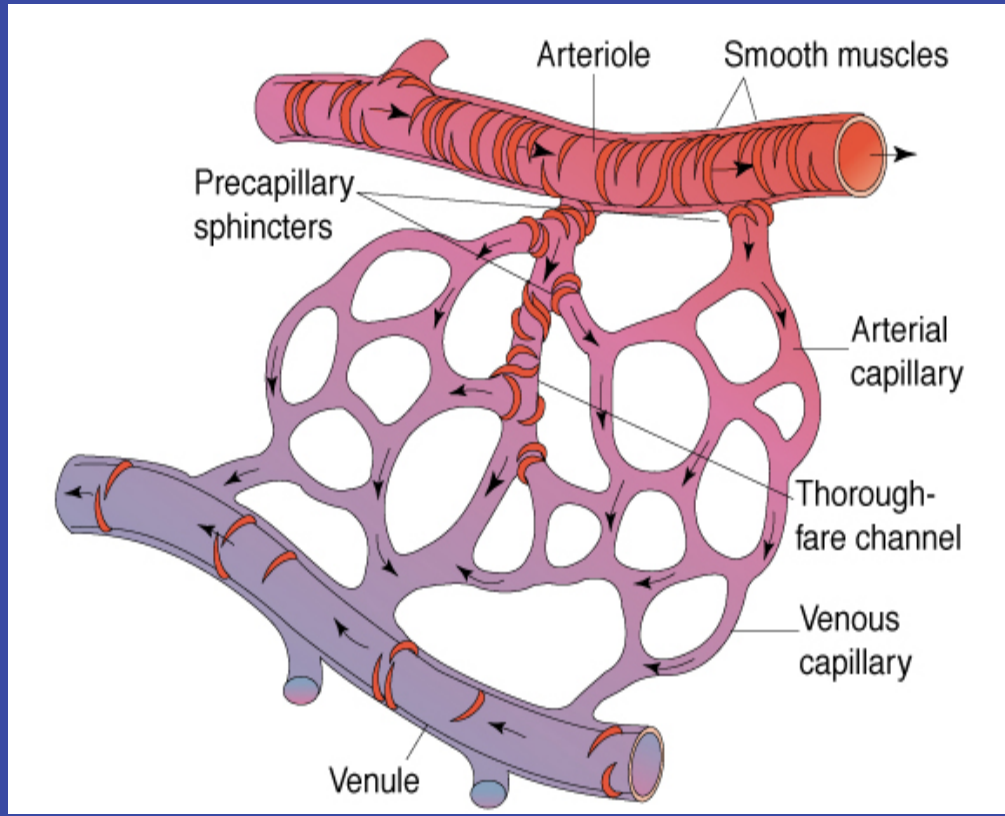
Blood Vessels

Arteries and veins are important for:

- Delivery of nutrients that are necessary for cells and organs to survive
- Removal of waste that would otherwise kill cells and organs



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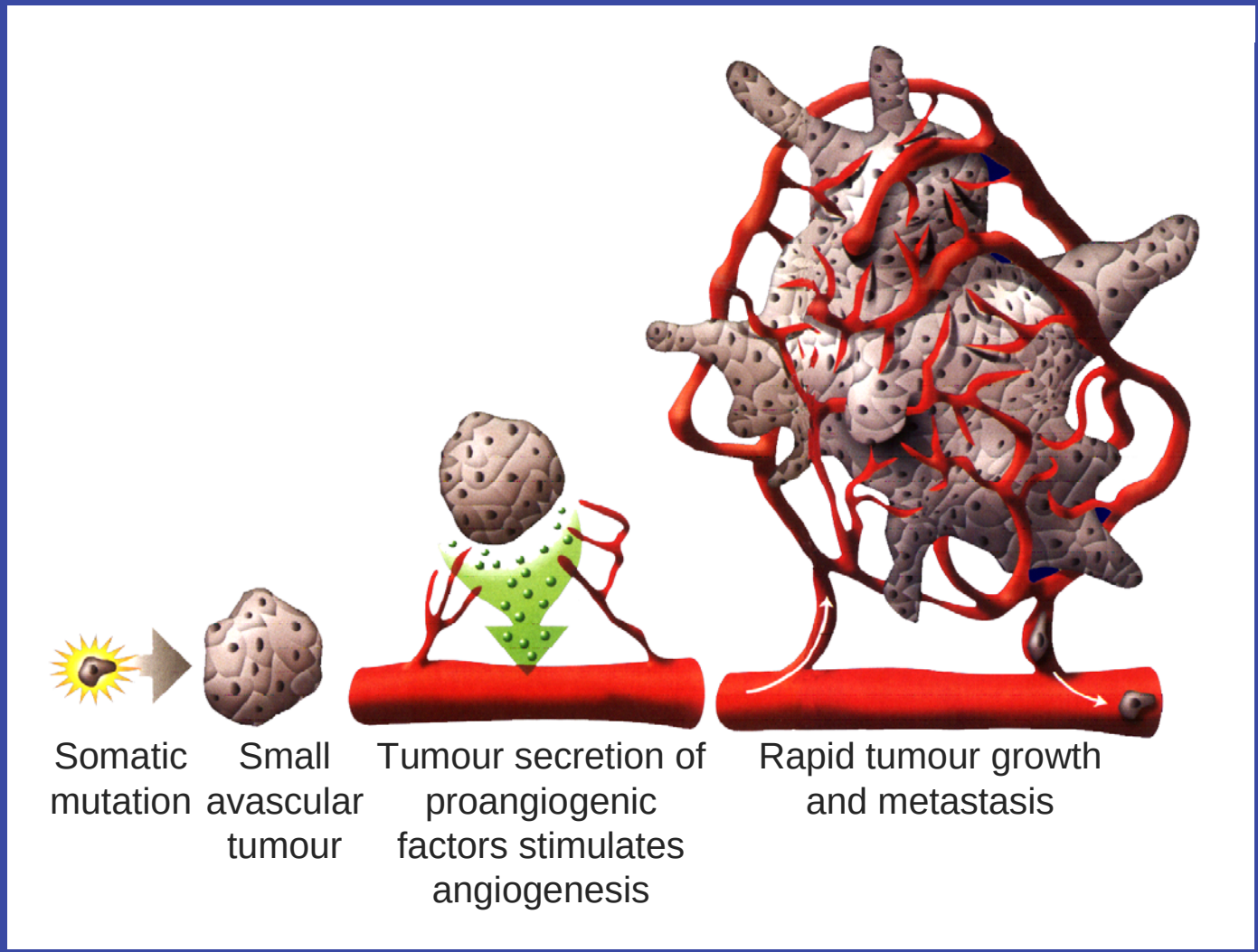
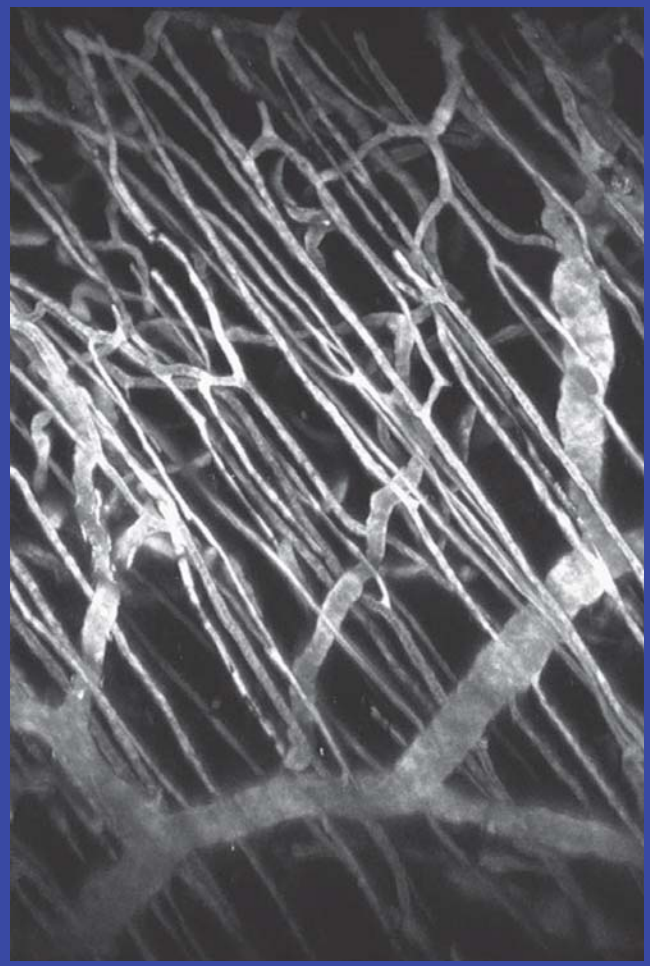
Tumor Angiogenesis

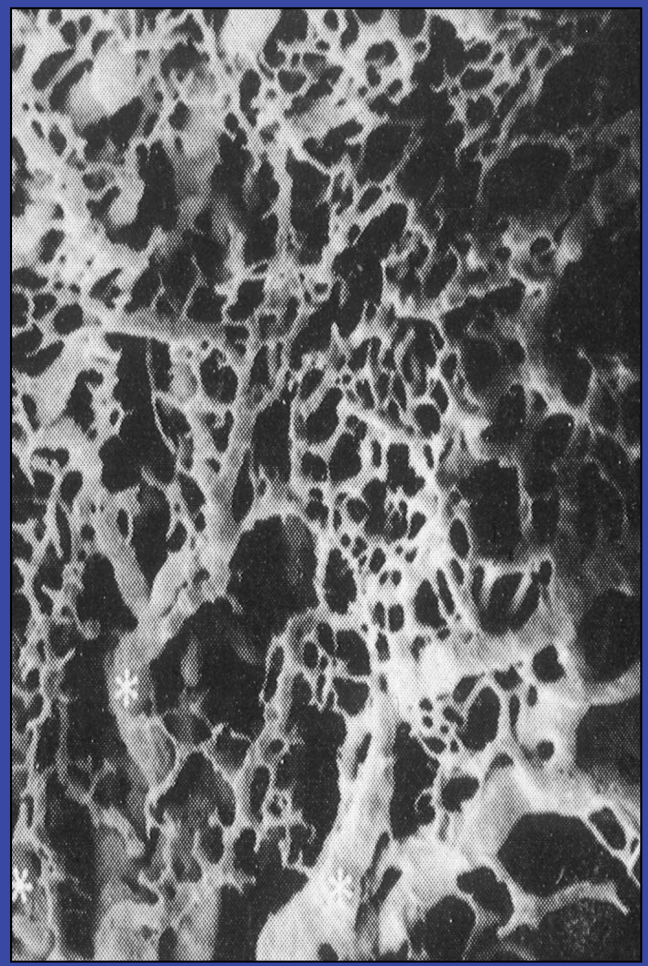


Adapted from Bergers, 2003

Tumor Angiogenesis



Normal vessels



Tumor vessels

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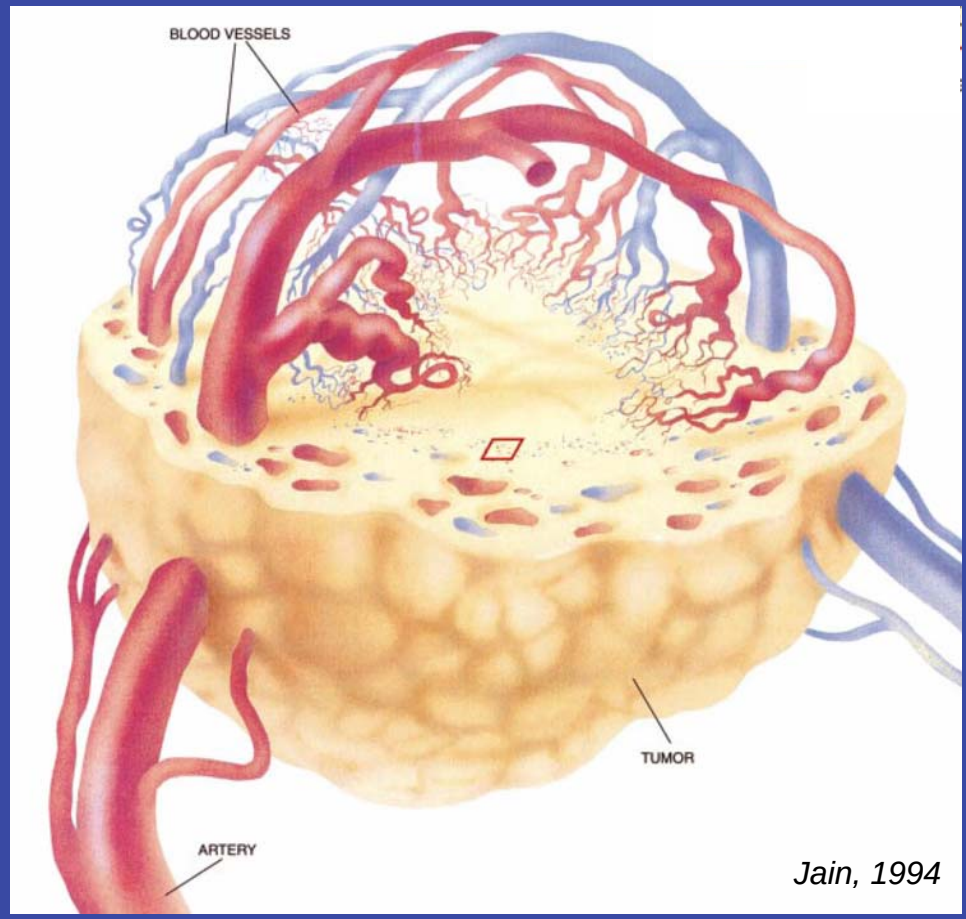
Konerding, 2001; Miller, 2005

Prostate Cancer Angiogenesis

Abnormal tumor blood vessels cause:

- Low oxygen levels
  - **Hypoxia**
- Genetic re-programming
- Aggressive behavior
  - Rapid growth
  - Cancer spread
  - Treatment resistance



Jain, 1994

New treatments to kill abnormal blood vessels

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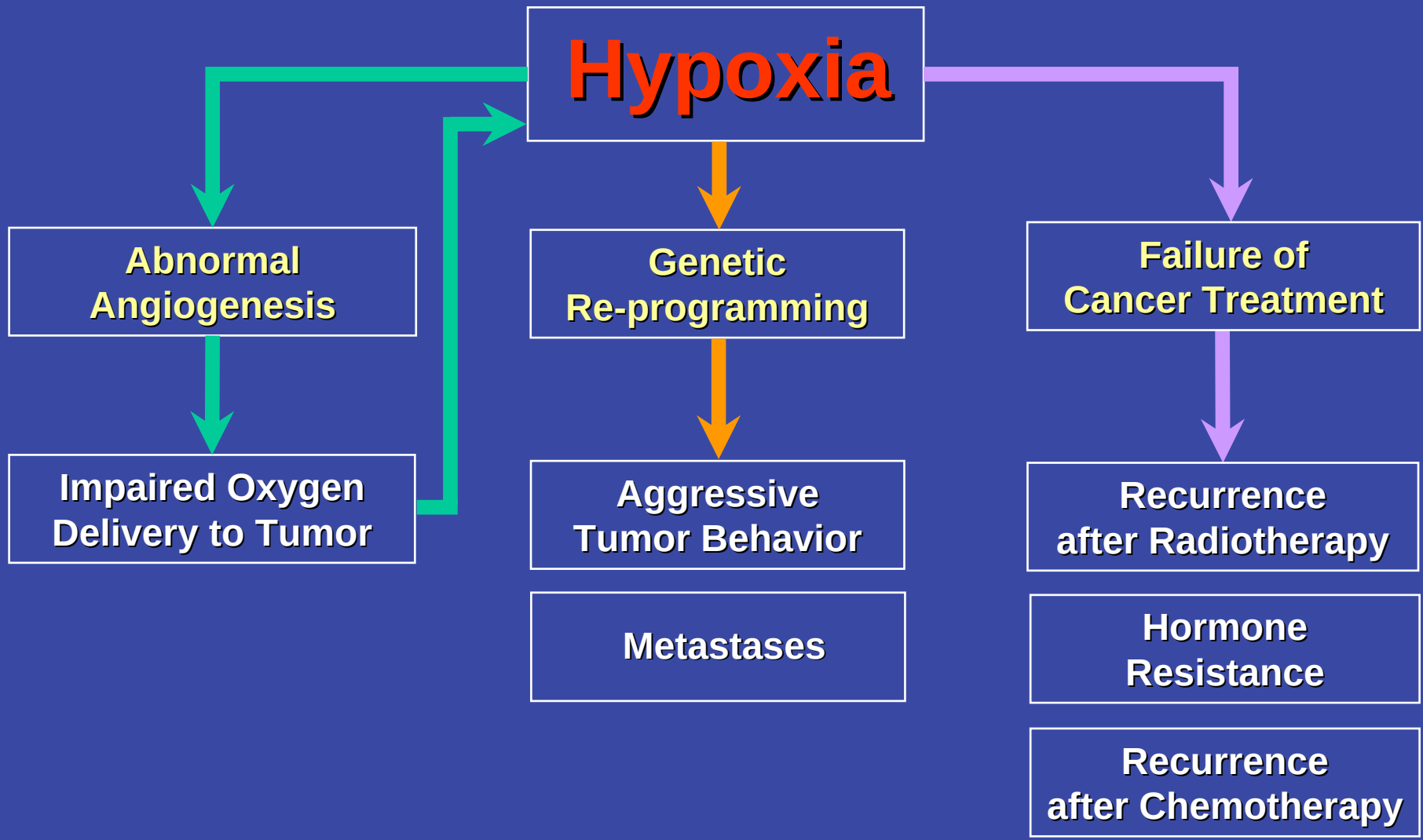

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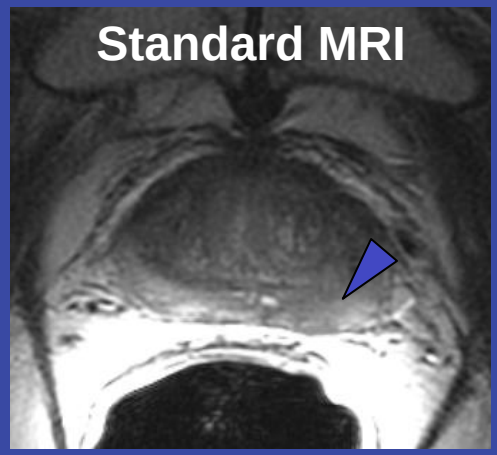
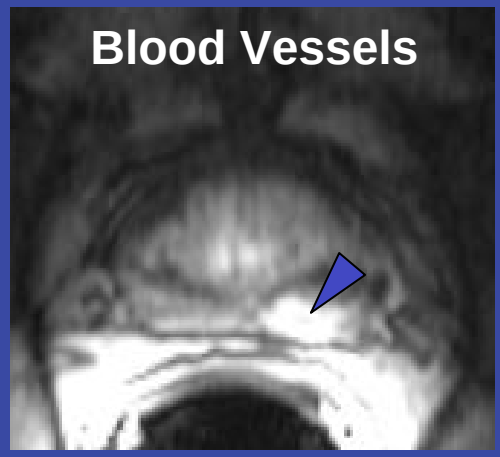
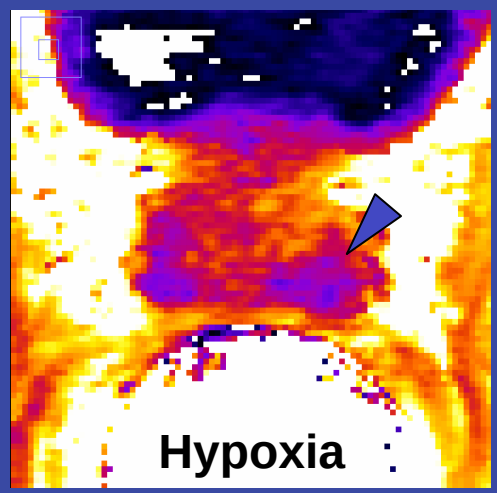
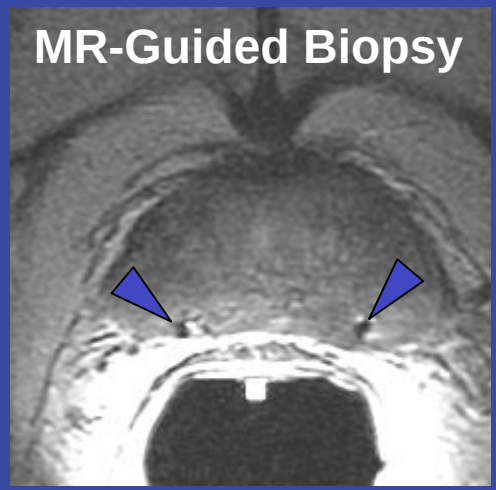
Hypoxia in Prostate Cancer









MRI to detect hypoxia in prostate cancer

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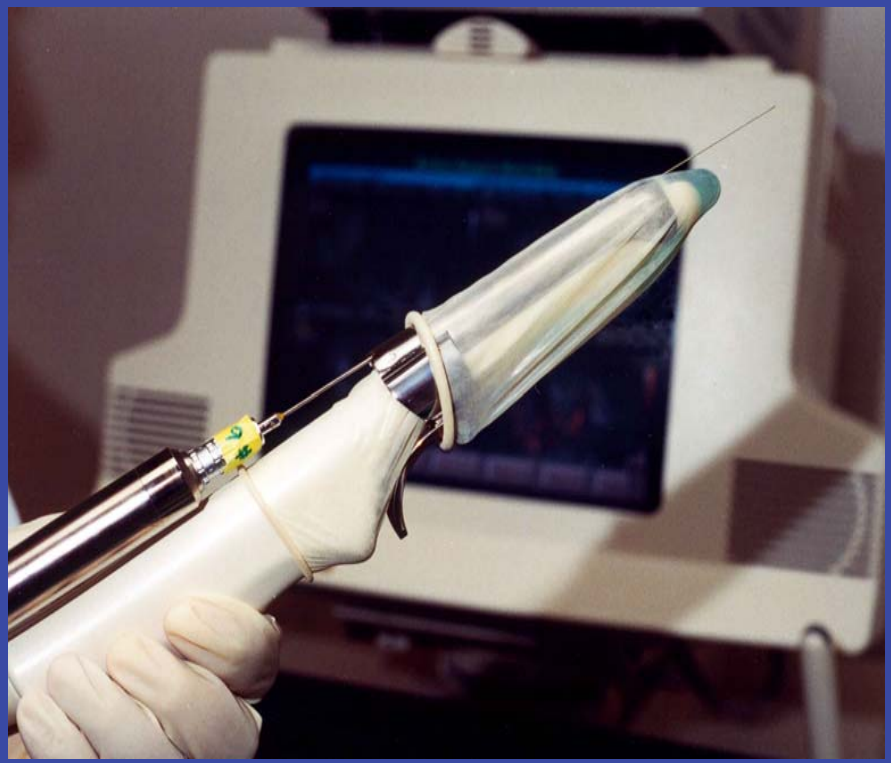
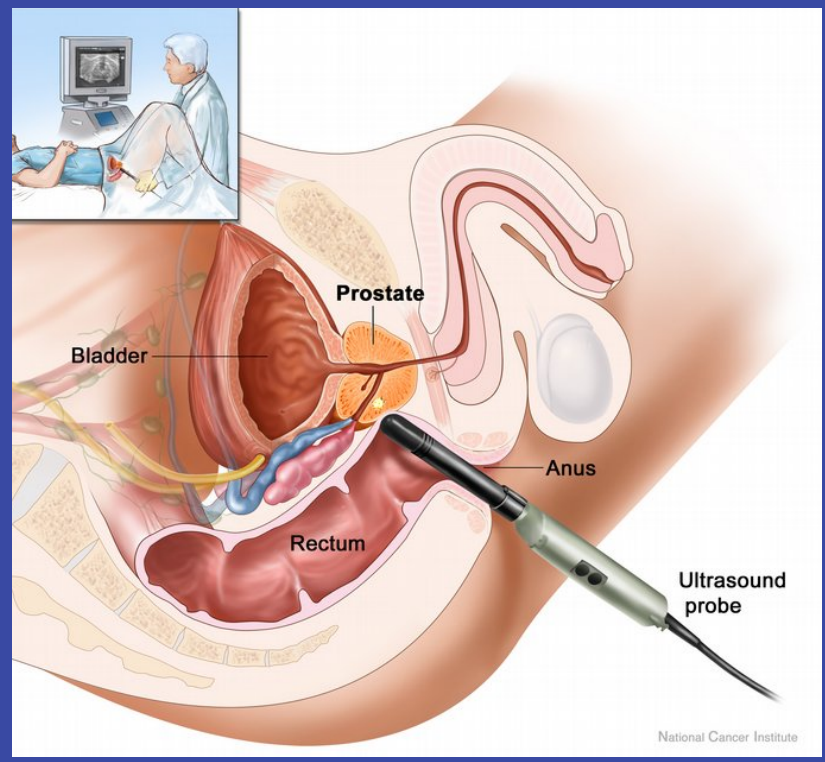
Courtesy of C. Ménard

Hypoxia in Prostate Cancer





Hypoxia measurements in 270 men with prostate cancer before radiotherapy

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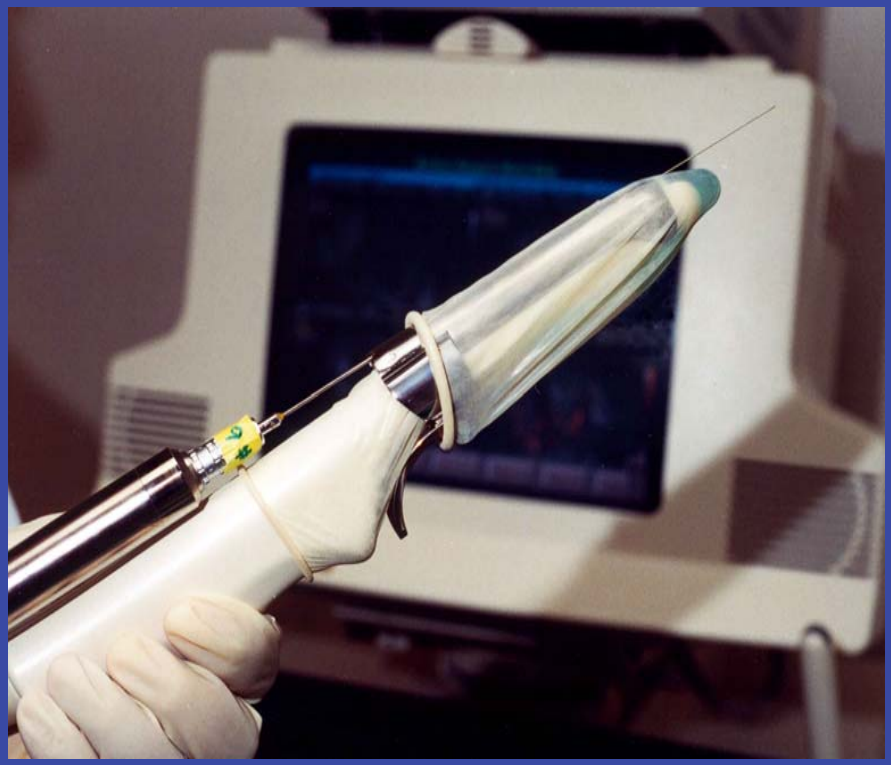
Hypoxia in Prostate Cancer



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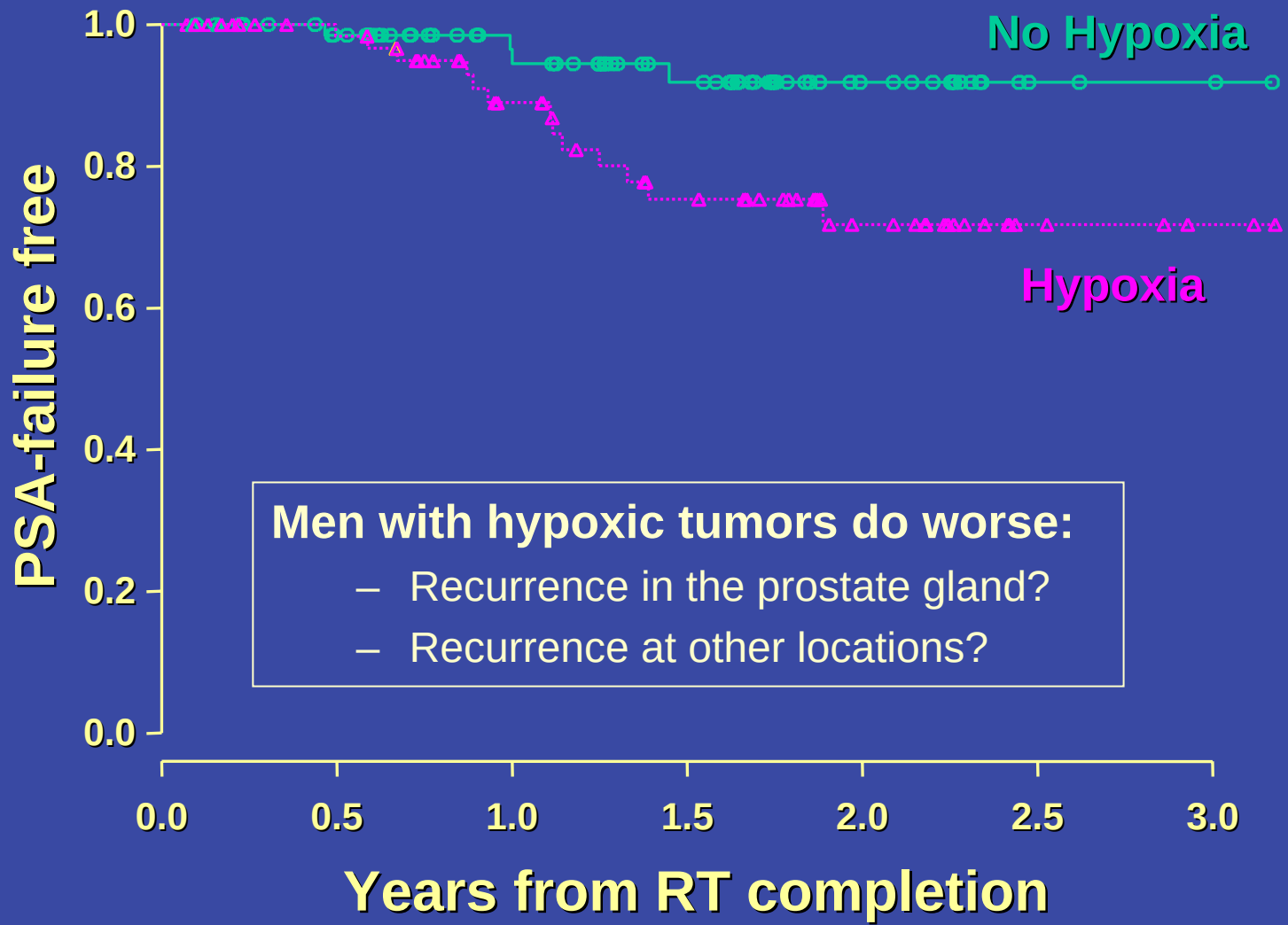

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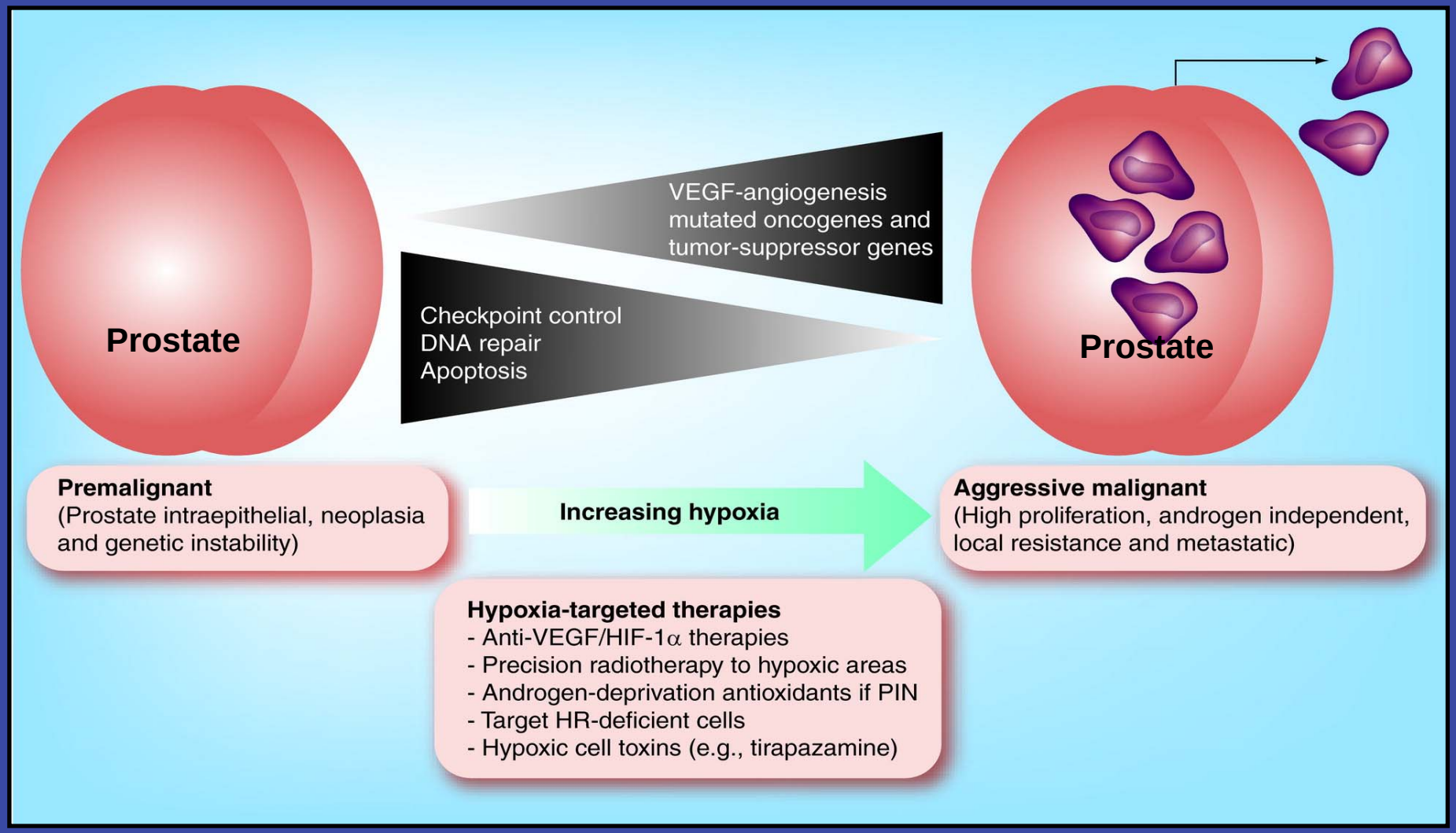

Chan, 2007

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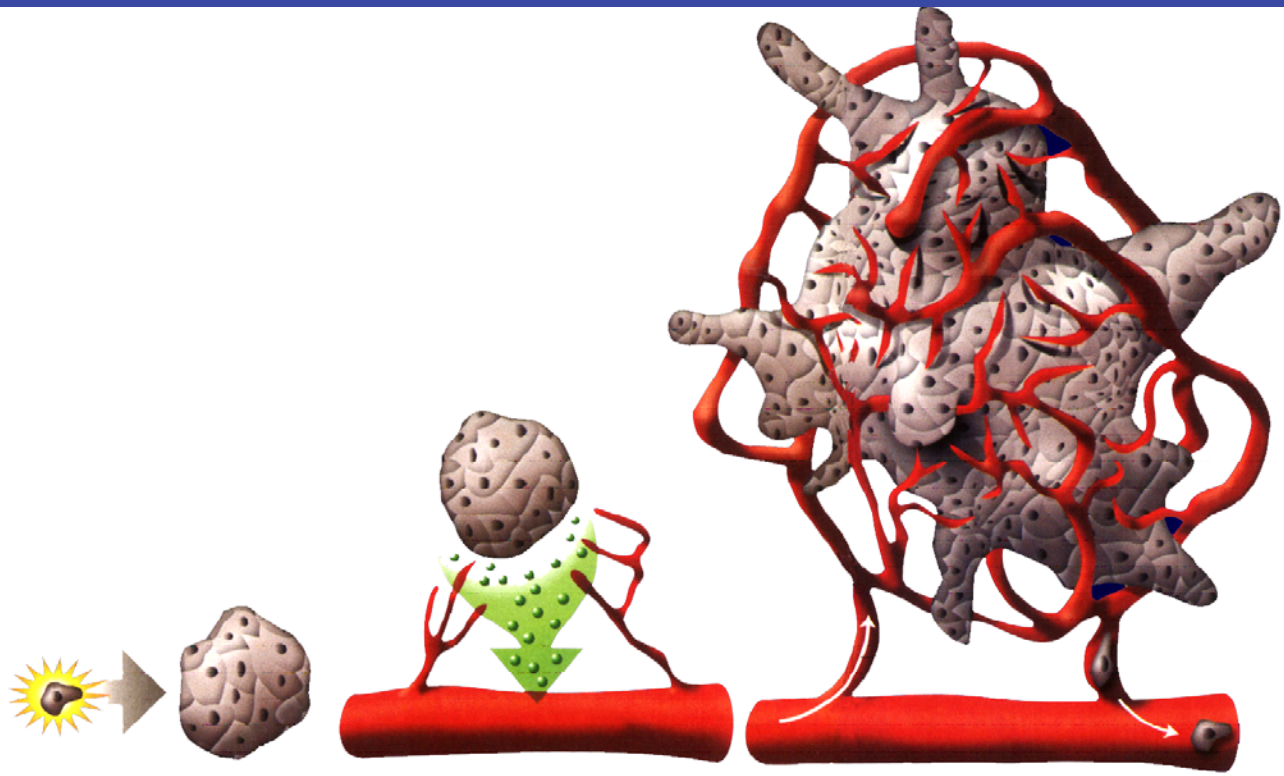
Block Angiogenesis to Reduce Prostate Cancer Hypoxia



Adapted from Bergers, 2003

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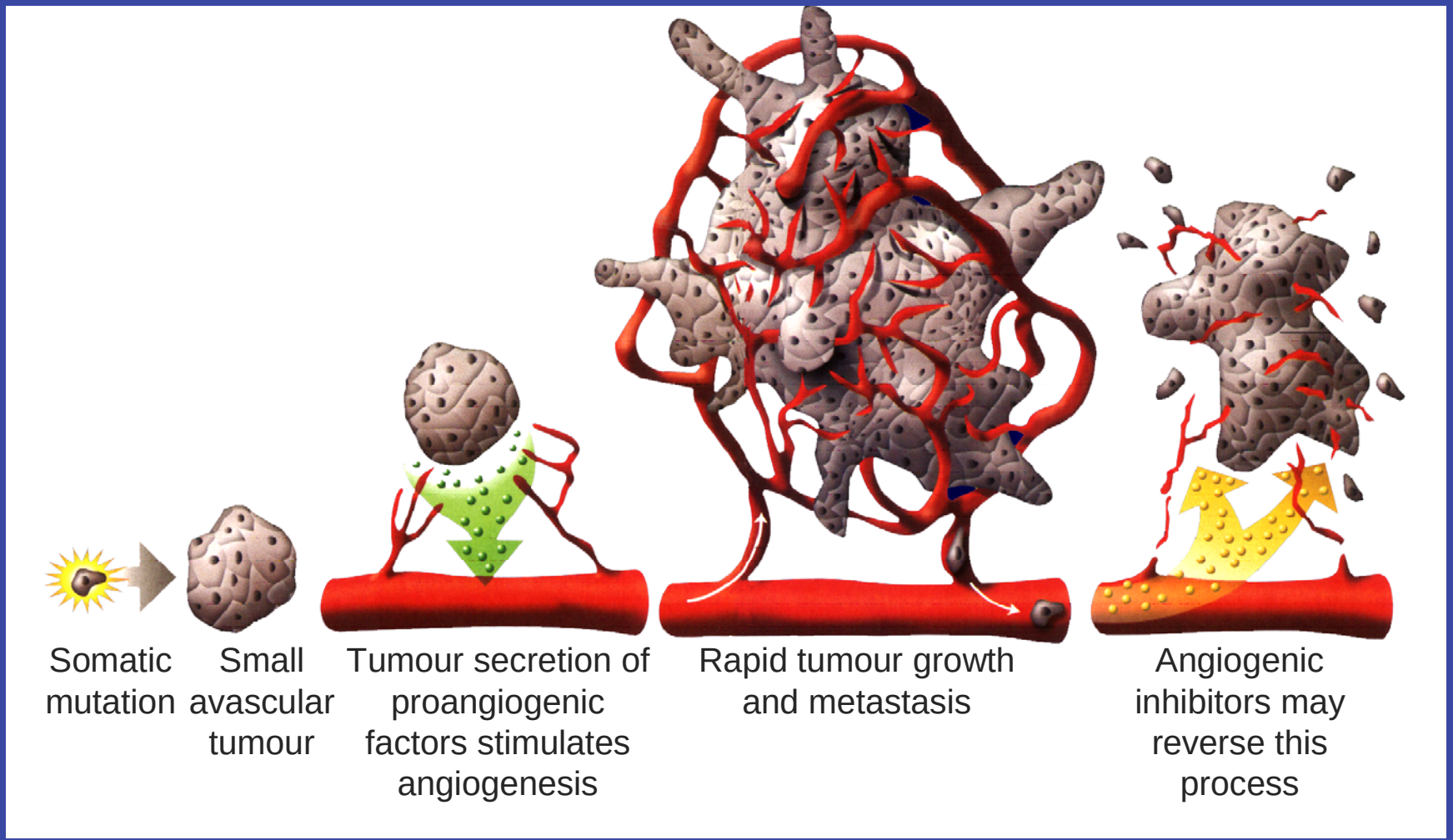

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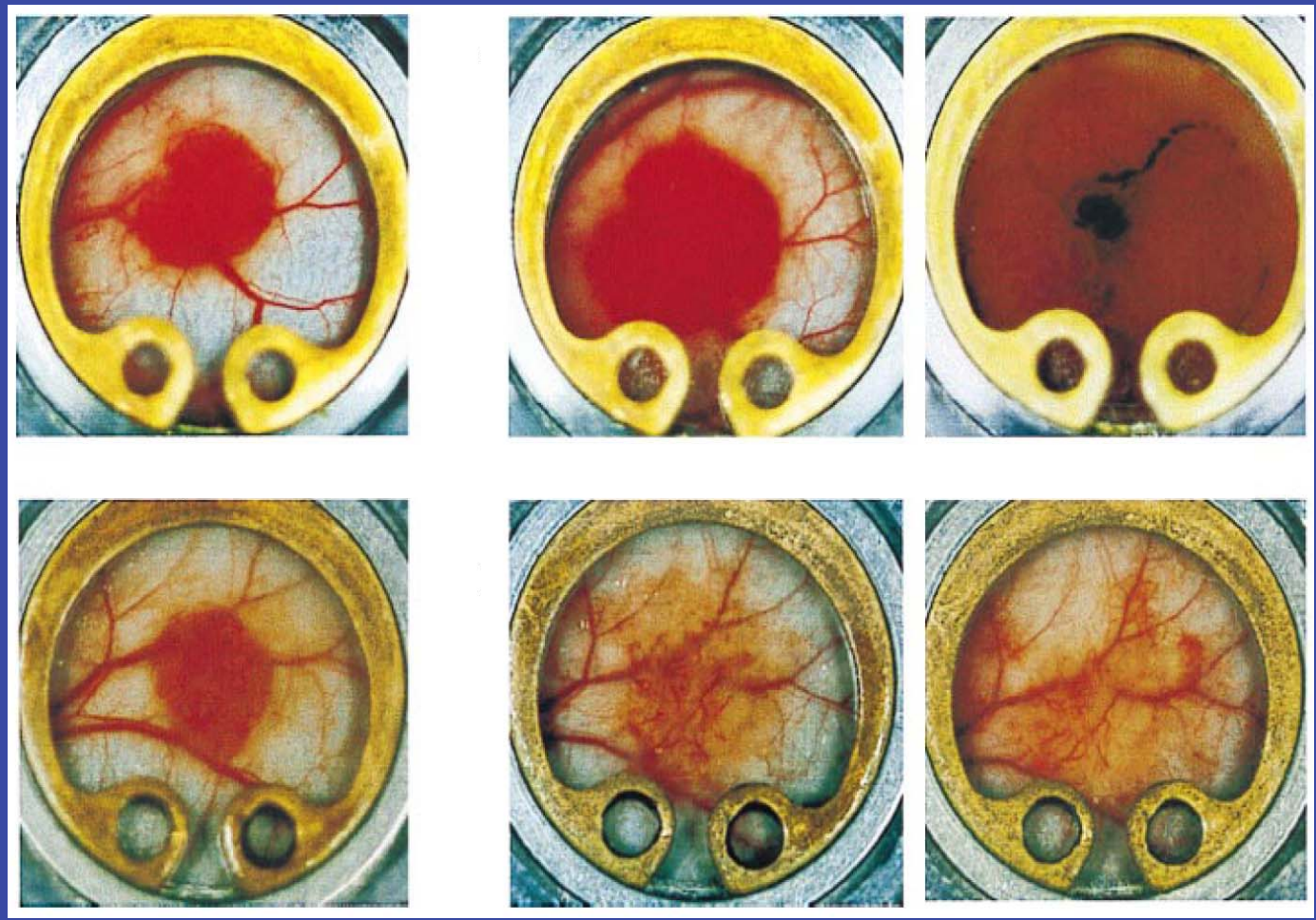
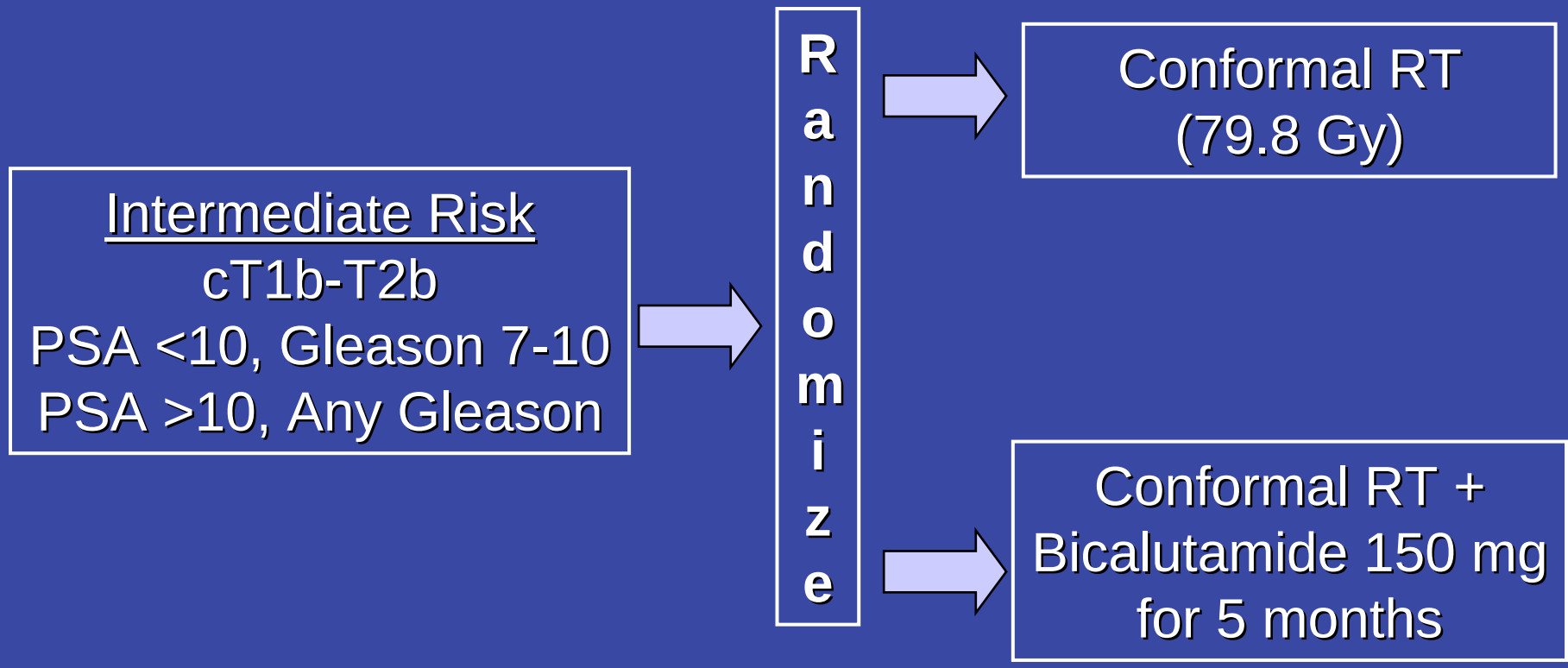
Hormones Block Angiogenesis in Prostate Cancer



Jain, 1998

Hormones Block Angiogenesis in Prostate Cancer



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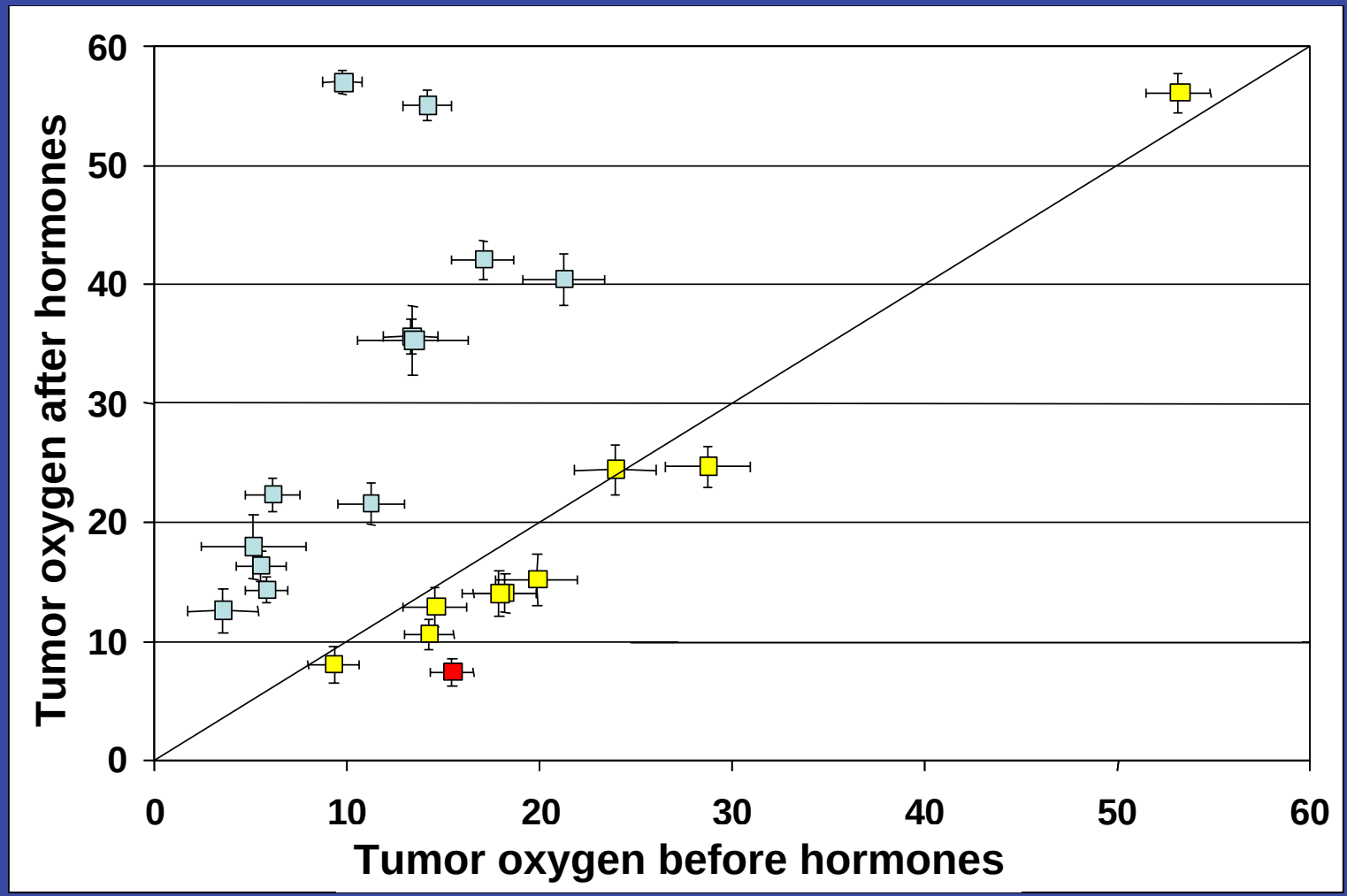
Hormones Reduce Hypoxia in Prostate Cancer



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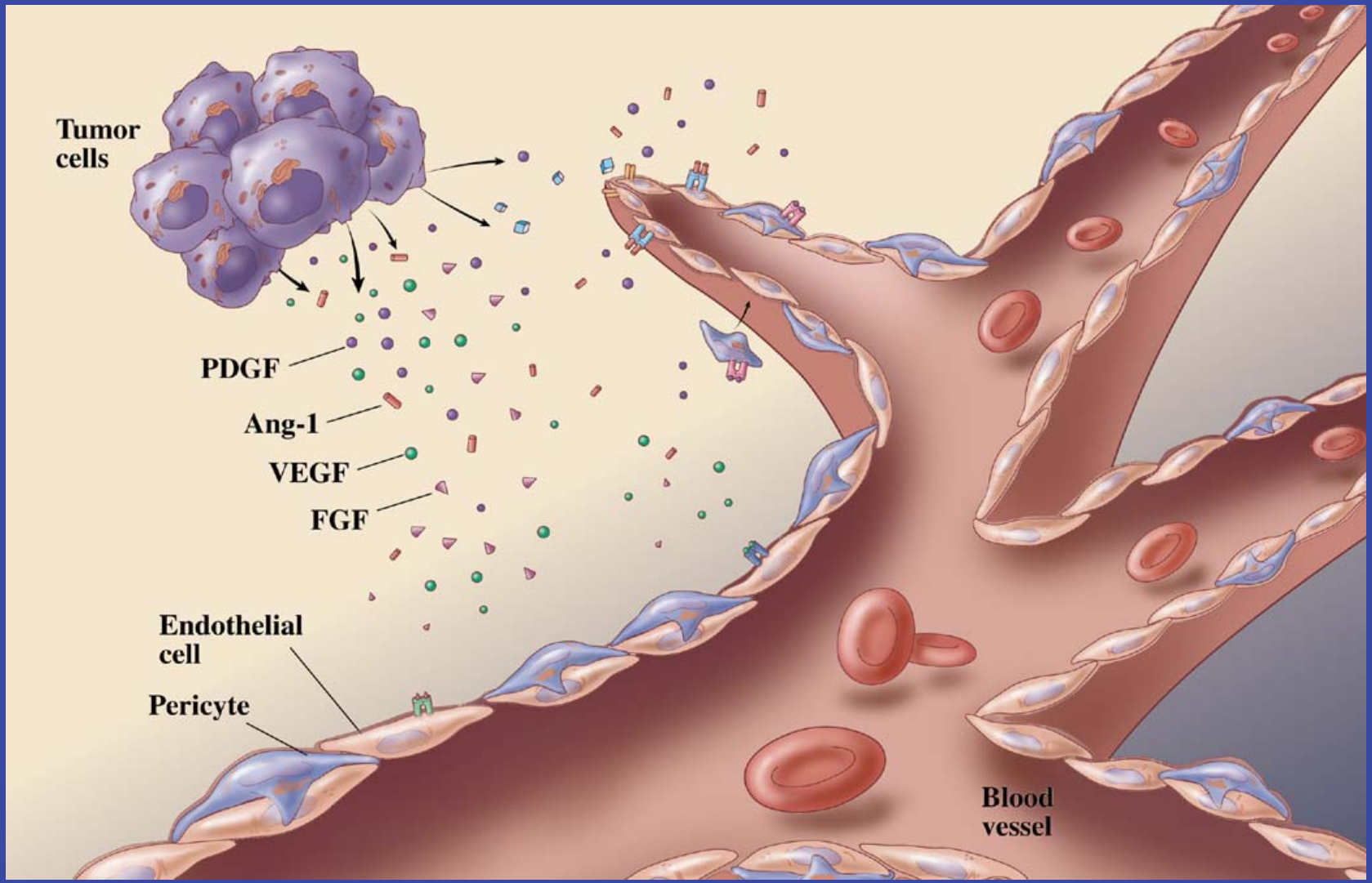
New Drugs to Block Angiogenesis in Prostate Cancer



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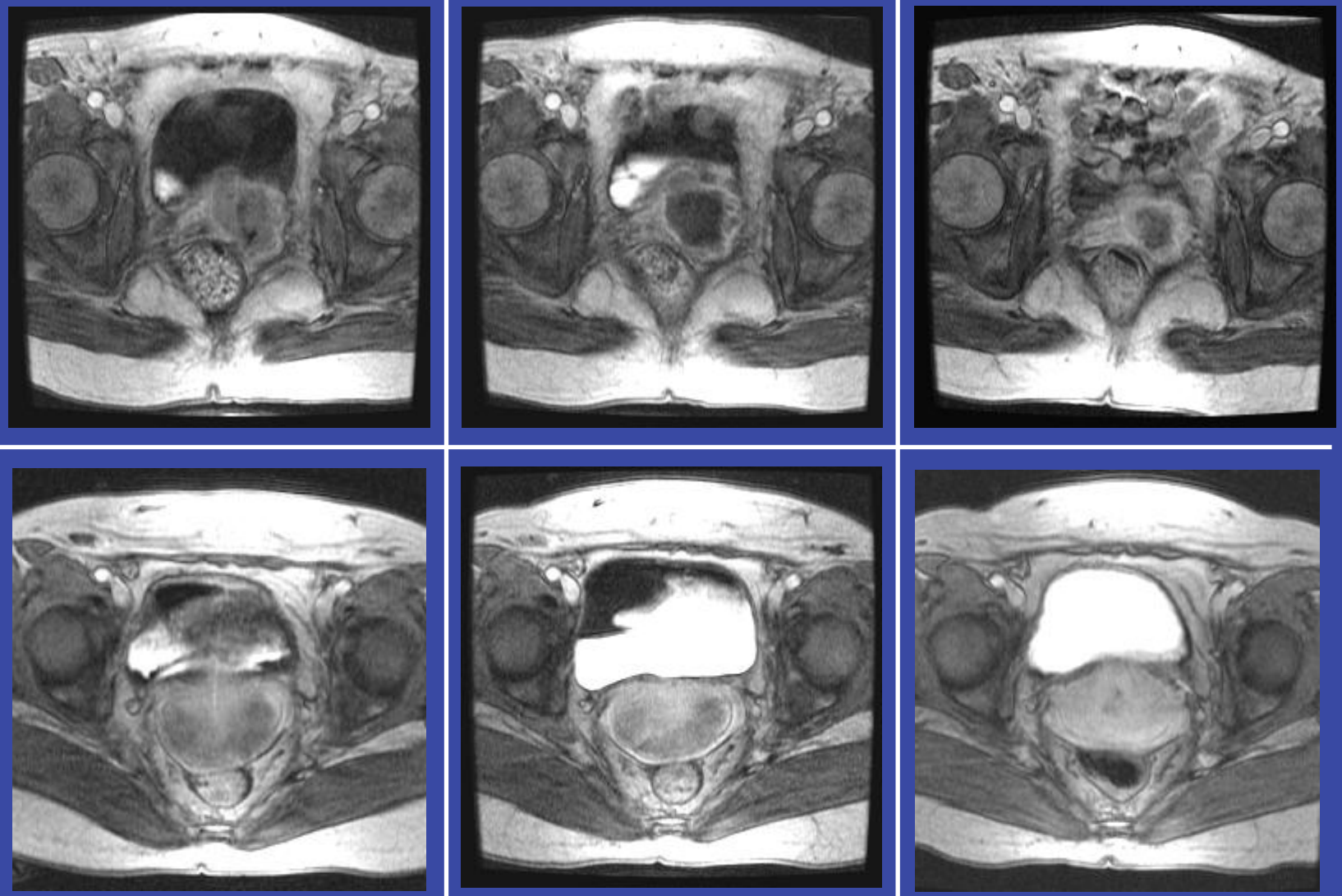

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Summary

- New biomarkers are being discovered that will allow patients to be treated more appropriately.
- Hypoxia in prostate cancer is bad and may influence the success of prostatectomy, radiotherapy and other treatments.
- Hormonal therapy reduces hypoxia in some patients and may improve treatment success.
- New drugs are being tested to overcome the effects of hypoxia and improve treatment success.

What Can I Do?

Think about participating in research studies to expand knowledge, help yourself and help others.

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