



# Radiotherapy for Prostate Cancer

## *Hypoxia, Hormones and Hope*

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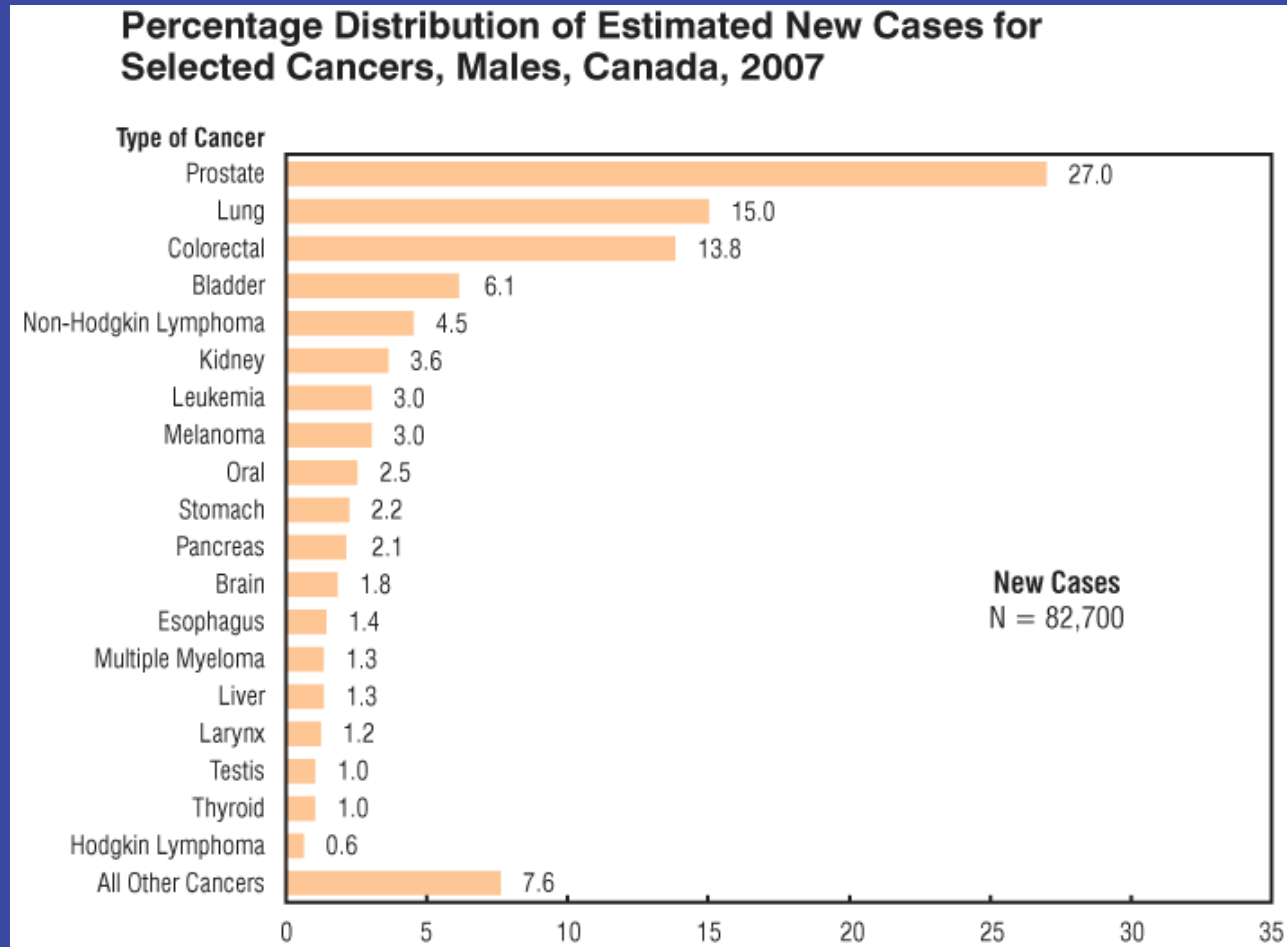


Princess Margaret Hospital

# Overview

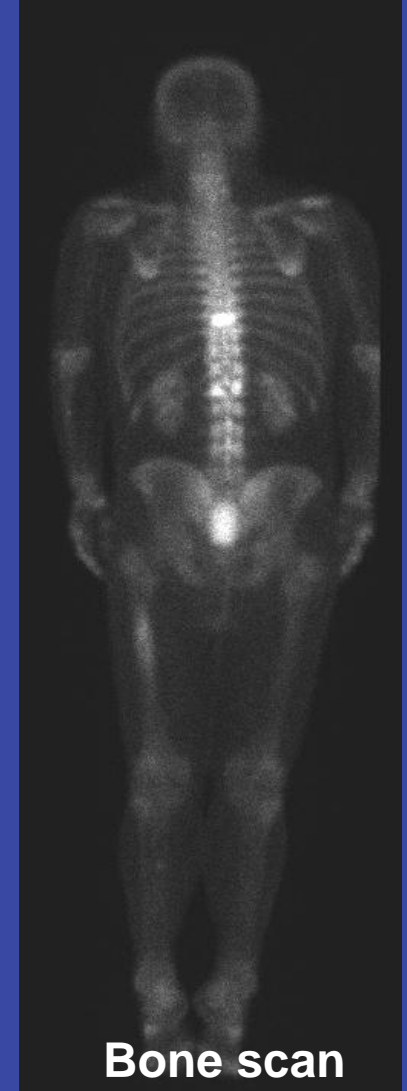
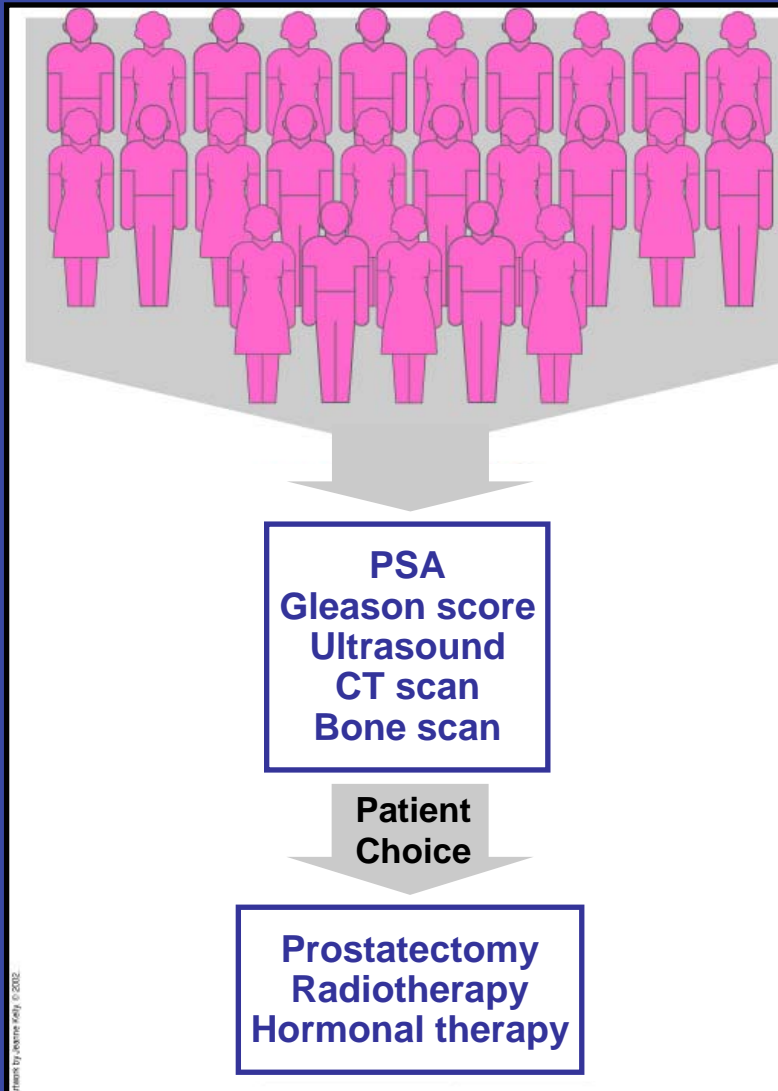
- The prostate cancer problem
- Radiotherapy 101
  - What is it and how does it work?
  - How is it delivered?
- Understanding biology to improving the success of radiotherapy and other treatments for prostate cancer.
- A plea for your help!

# The Prostate Cancer Problem



**Most common cancer in men**  
**3<sup>rd</sup> leading cause of cancer death in men**

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



# What's the “right” treatment for prostate cancer?

Prostate cancer risk groups:

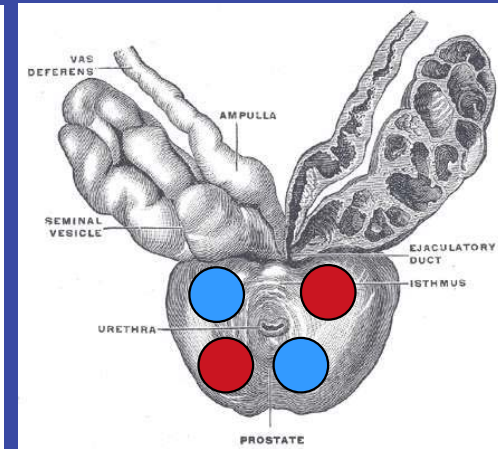
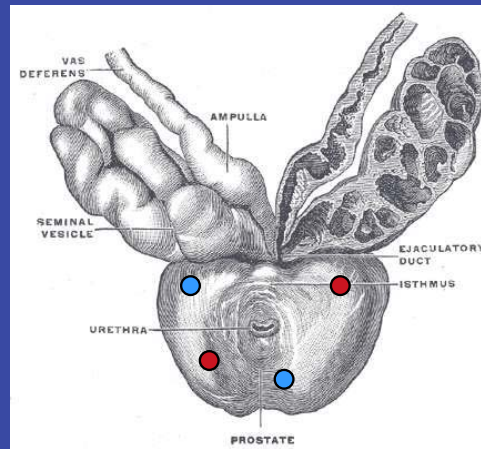
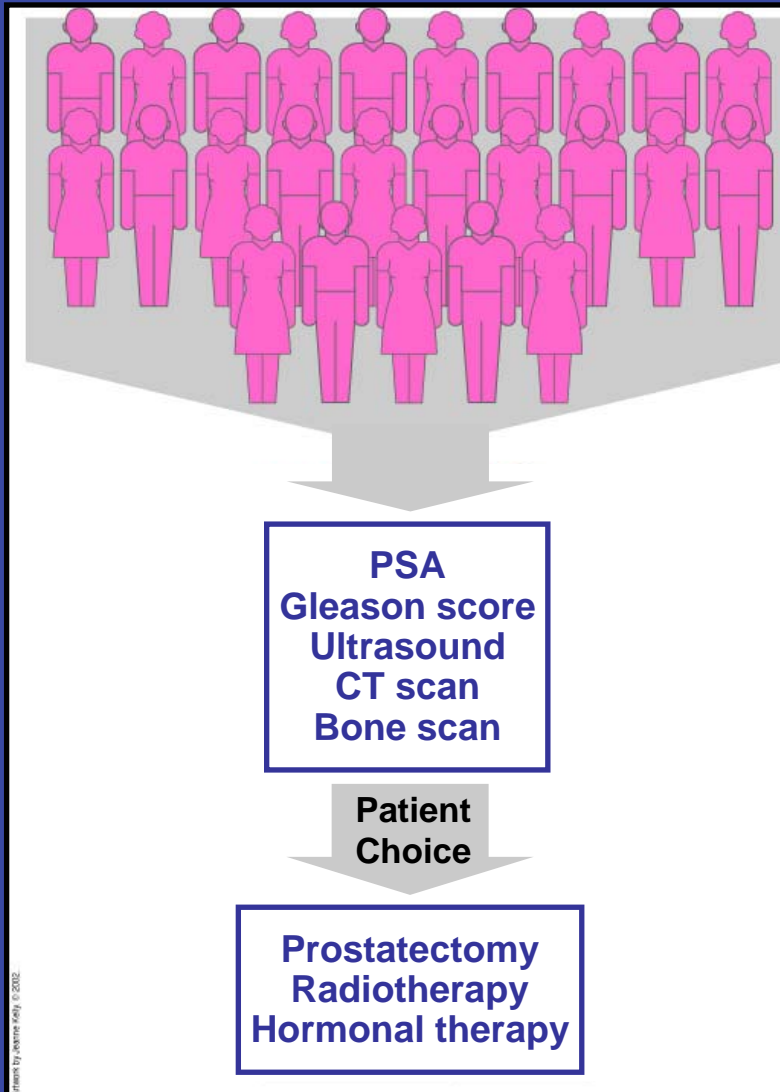
- **Low risk**
  - T1-2, PSA <10, Gleason <6
- **Intermediate risk**
- **High risk**
  - T3 or PSA >20 or Gleason  $\geq 8$

Observation  
Prostatectomy  
Radiotherapy

- External
- Brachytherapy

Hormonal therapy  
Combinations

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

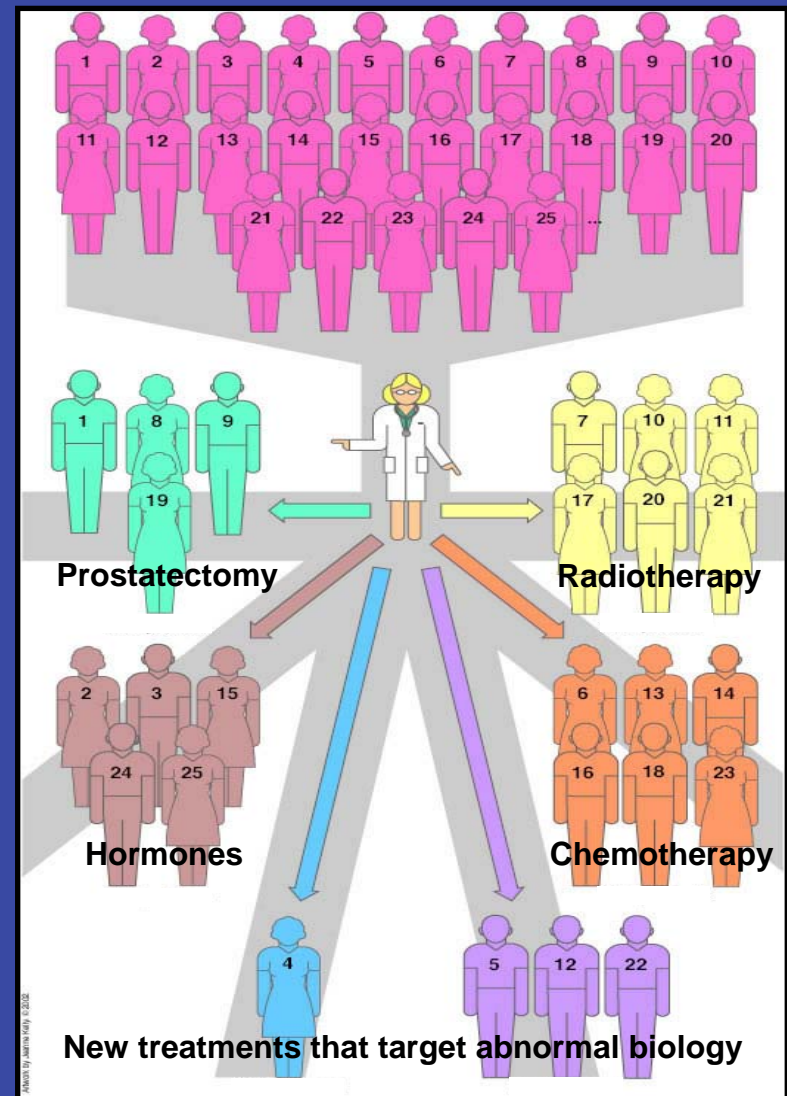
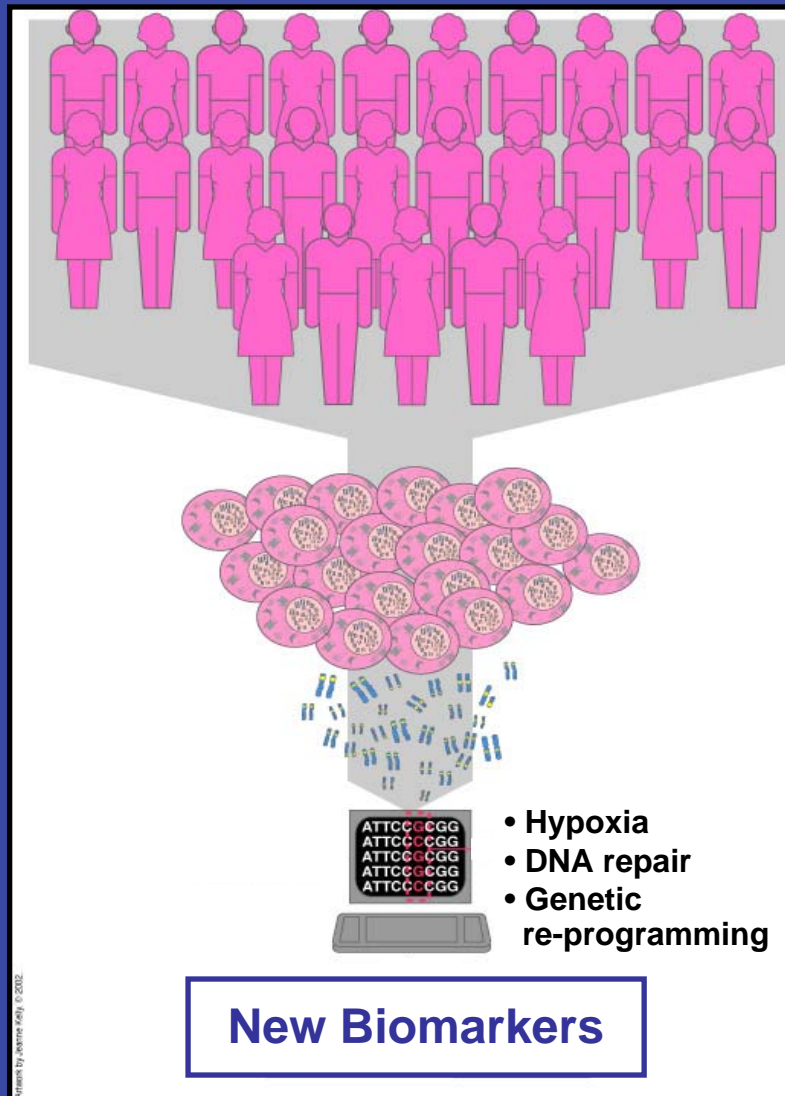


Different patients but:

- 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?

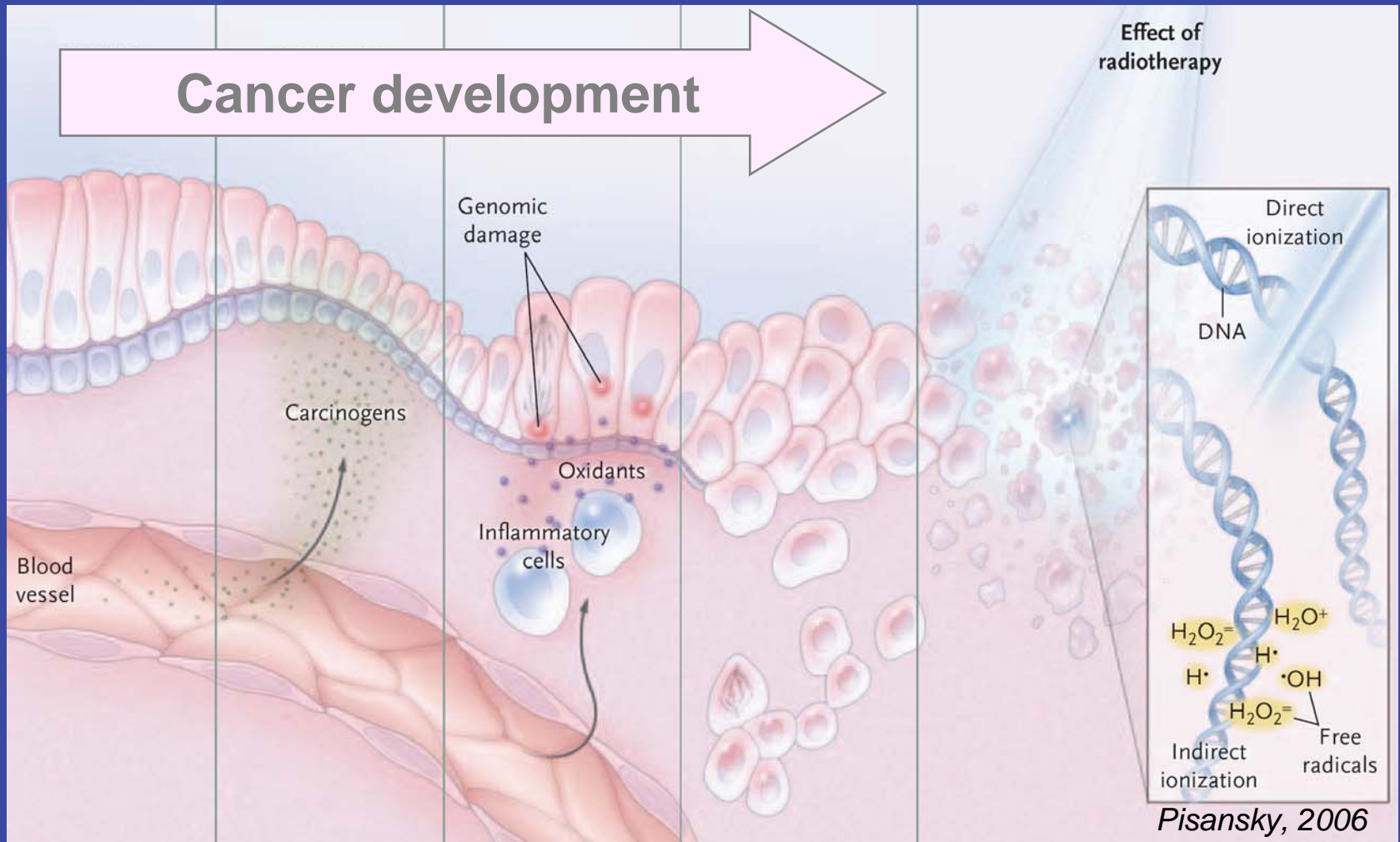


# What is Radiotherapy?

- 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%

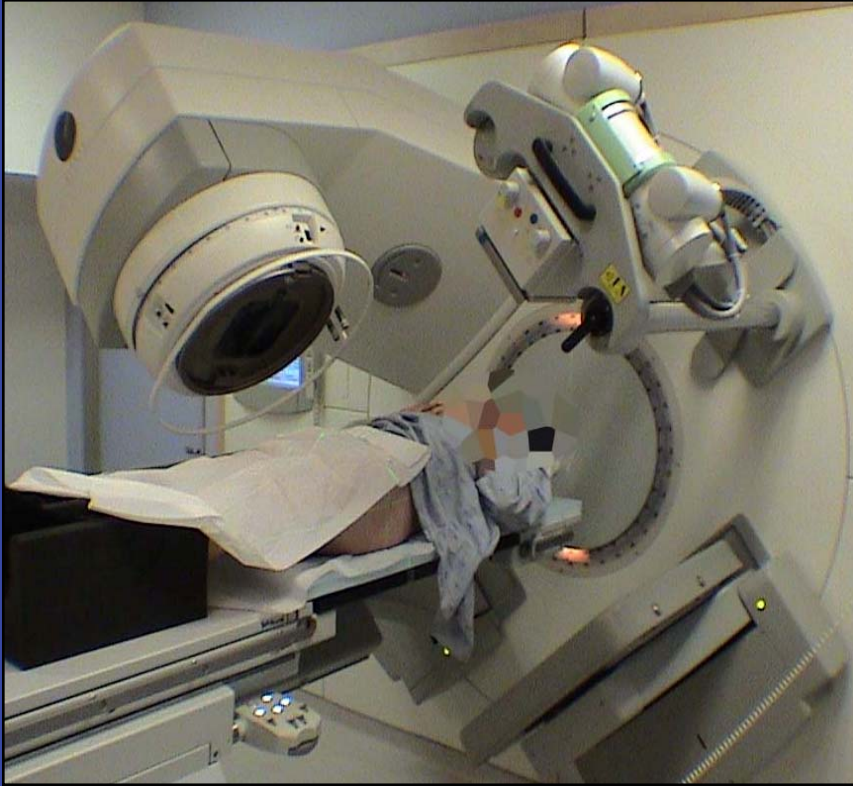


# Radiotherapy and Tumor Control

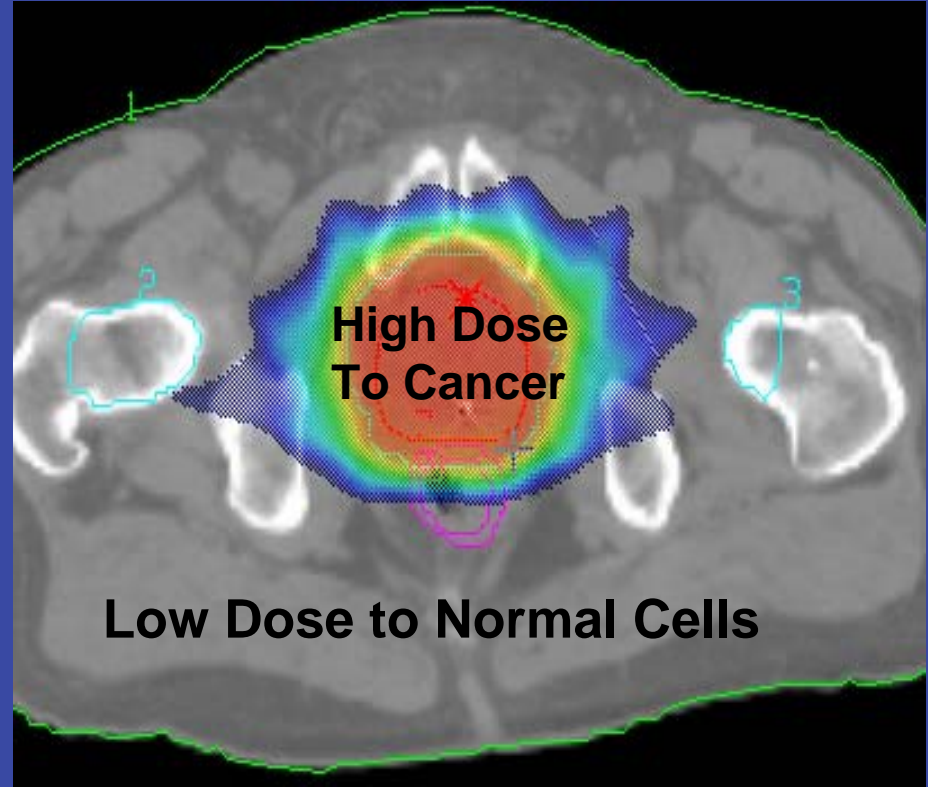


**Radiation damages DNA causing cancer cells to die.**

# Radiotherapy Delivery



**Linear accelerator**

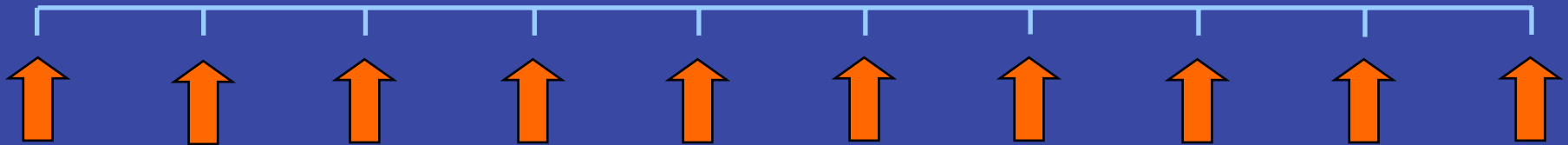


**Treat the tumor and  
avoid normal organs**

**Prevent side effects by precise targeting of the tumor**

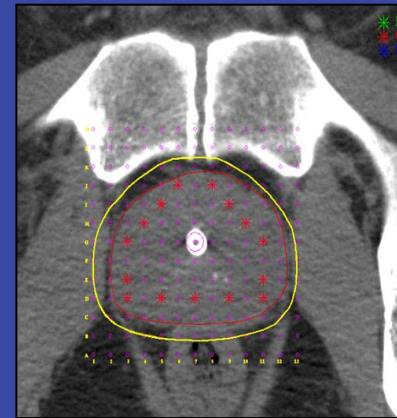
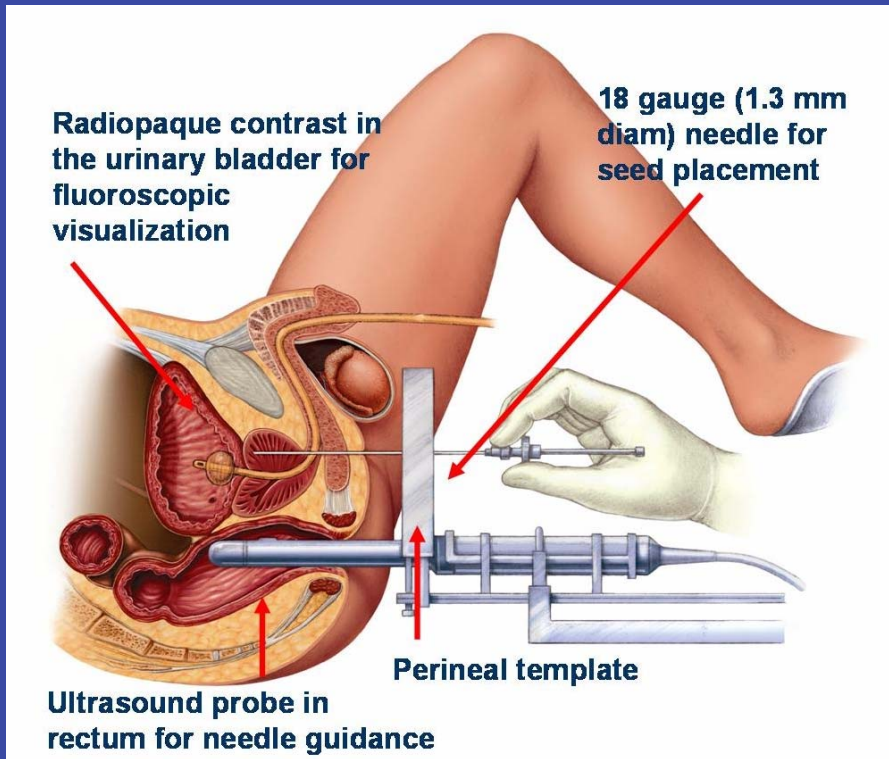
# Radiotherapy Delivery

- 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

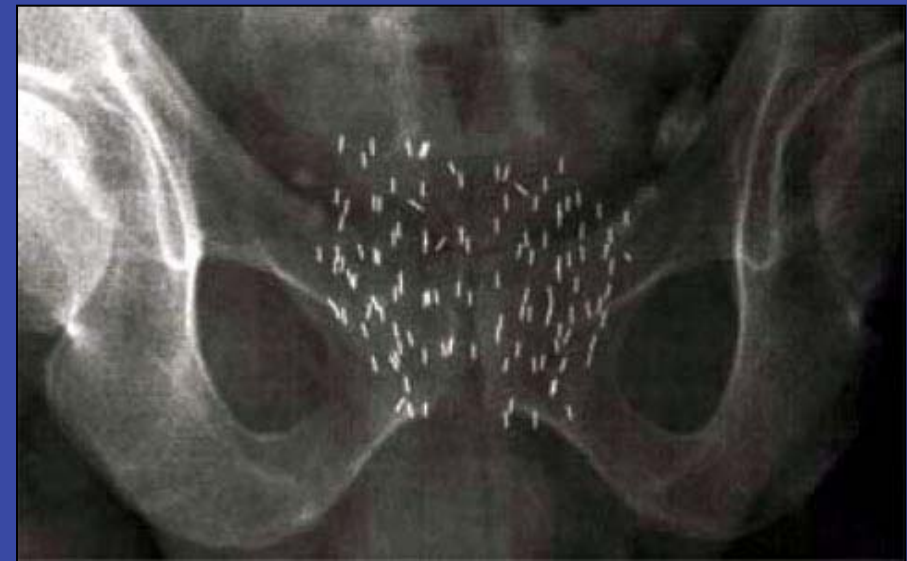


**Prevent side effects by fractionating radiotherapy**

# Prostate Brachytherapy

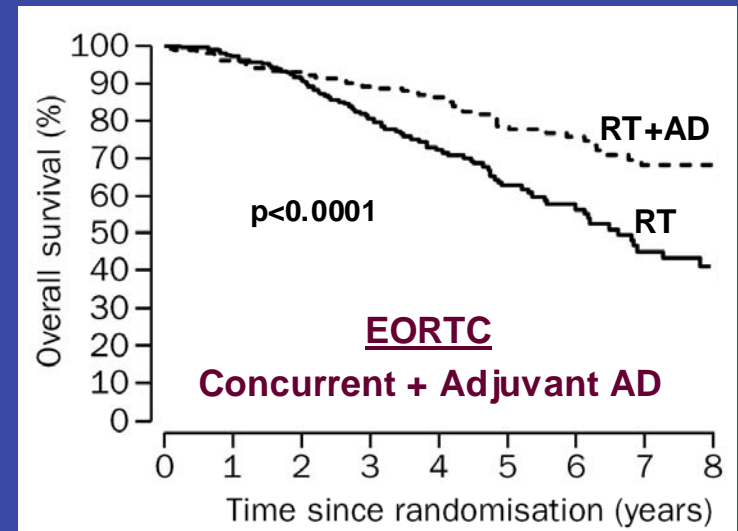
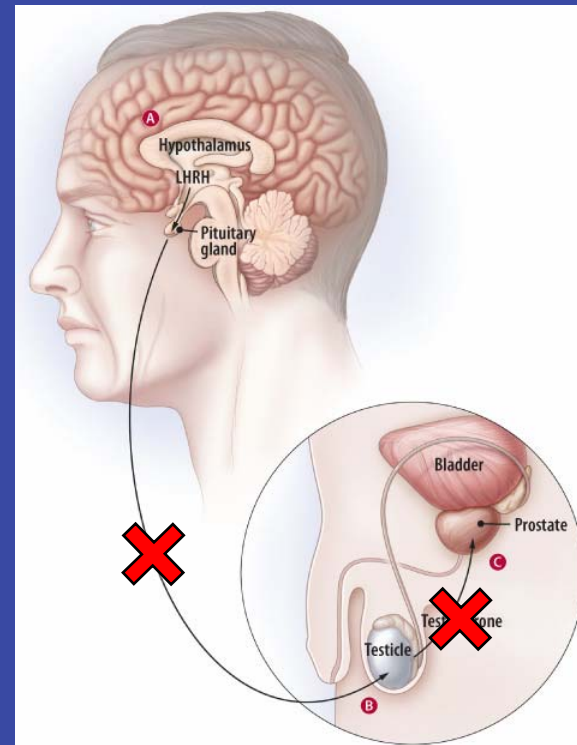


**The ultimate in high-precision radiotherapy targeting of prostate cancer**

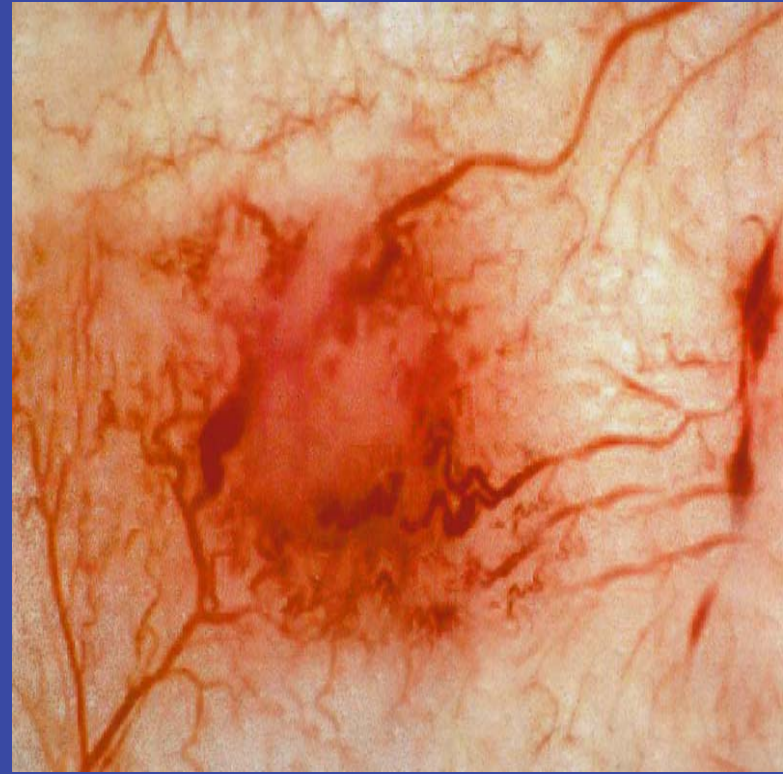
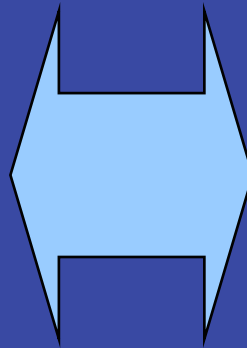
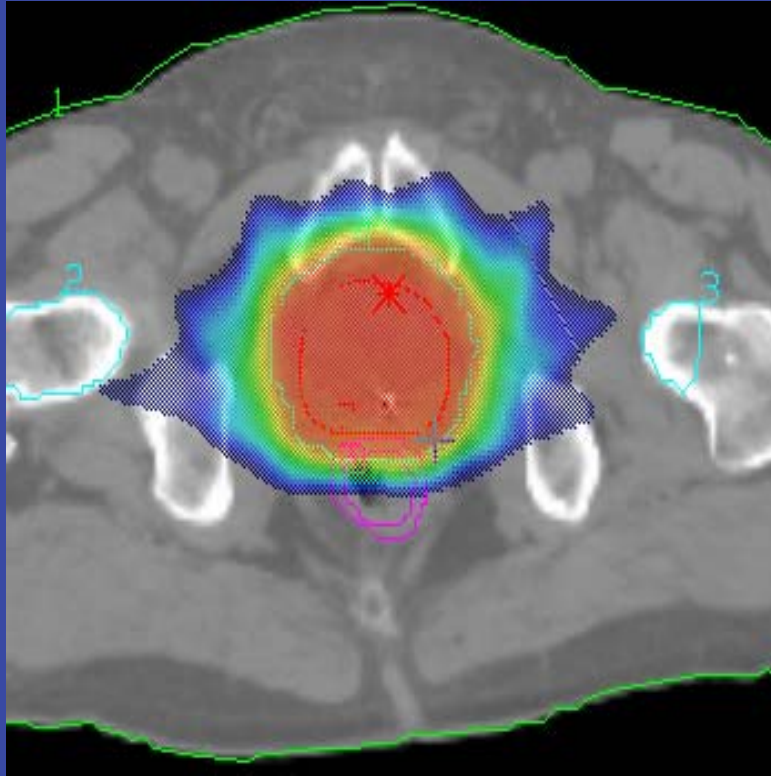


# Hormonal Therapy and Radiation

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



# Radiotherapy in the 21<sup>st</sup> Century: *Individualized Treatment*



High precision radiotherapy

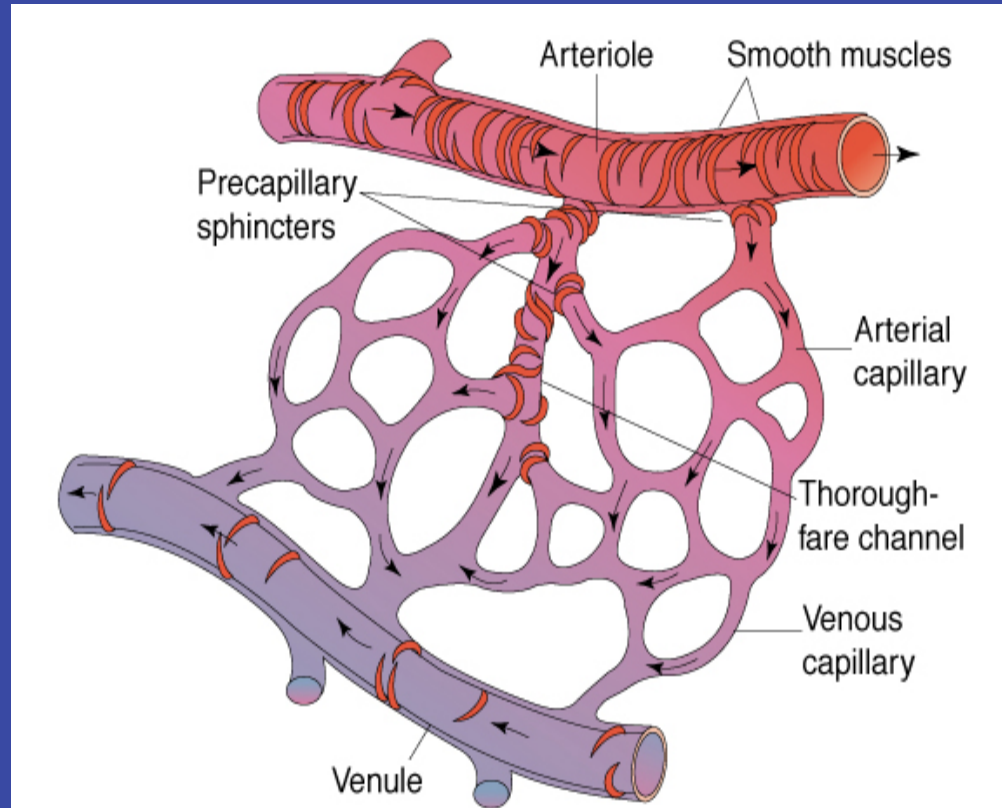
Understanding biology

**Synergistic strategies for improving tumor control  
and reducing side effects**

# Blood Vessels

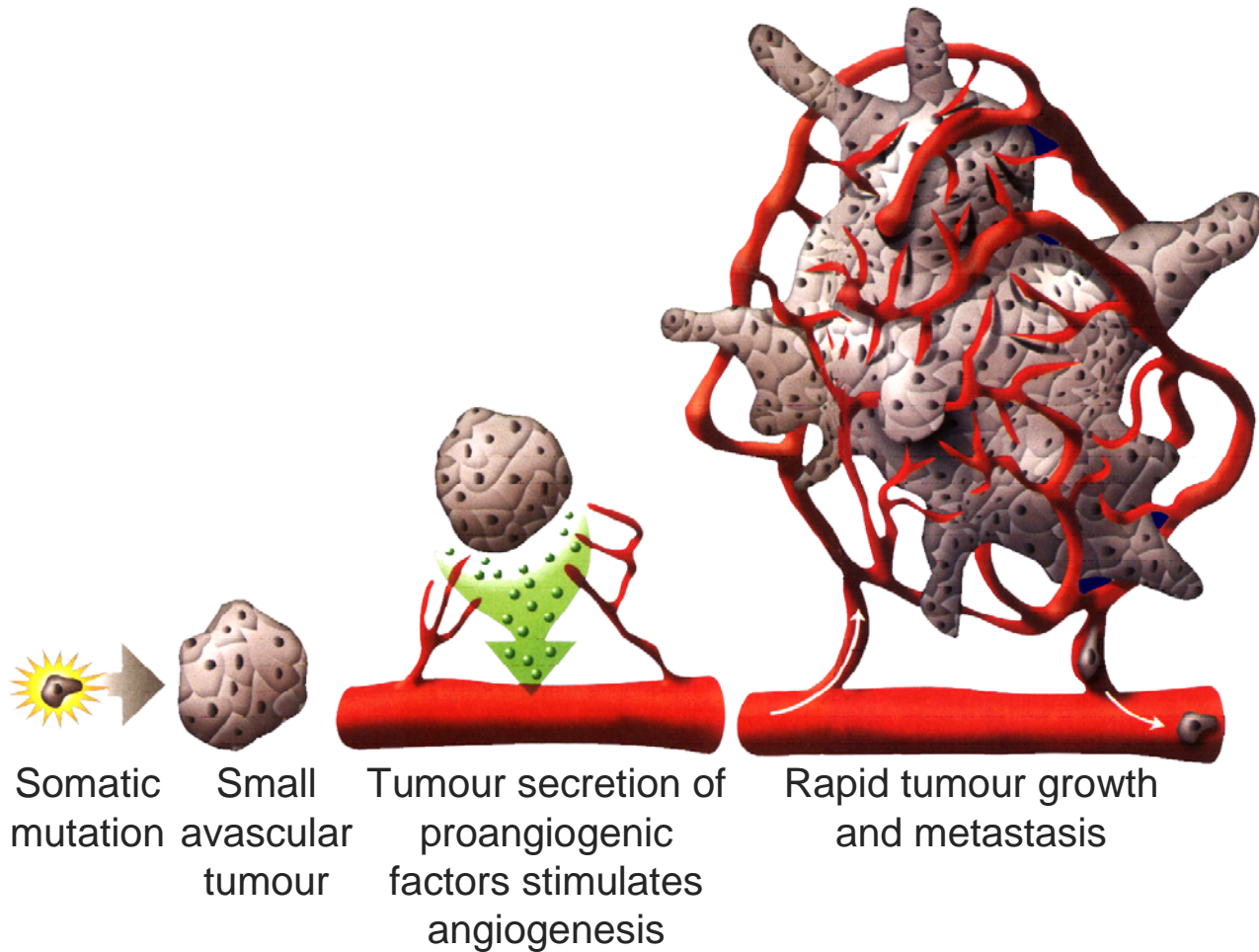
**Arteries and veins are important for:**

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



[http://connection.lww.com/Products/porth7e/documents/Ch23/jpg/23\\_023.jpg](http://connection.lww.com/Products/porth7e/documents/Ch23/jpg/23_023.jpg)

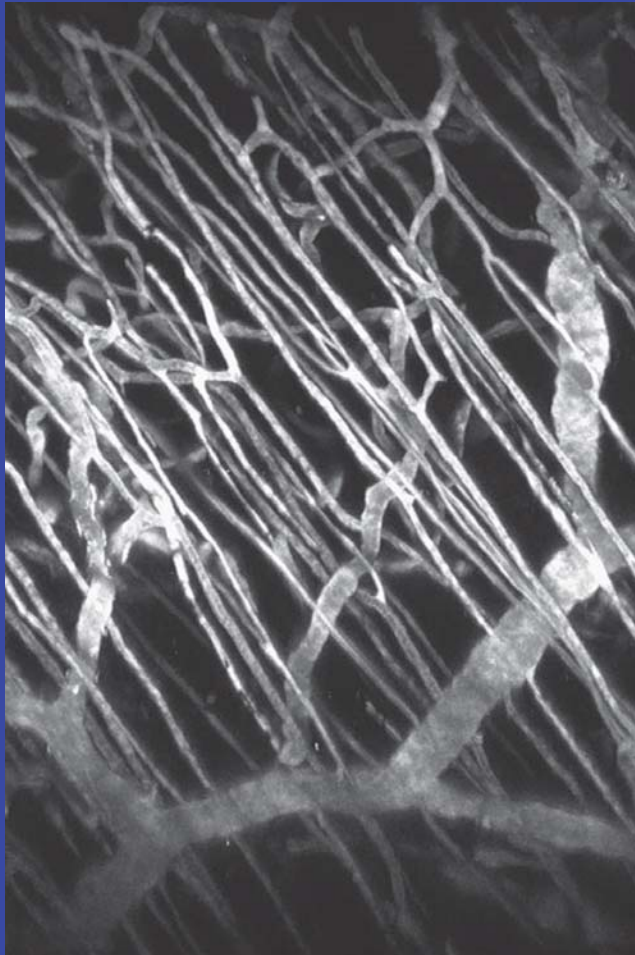
# Tumor Angiogenesis



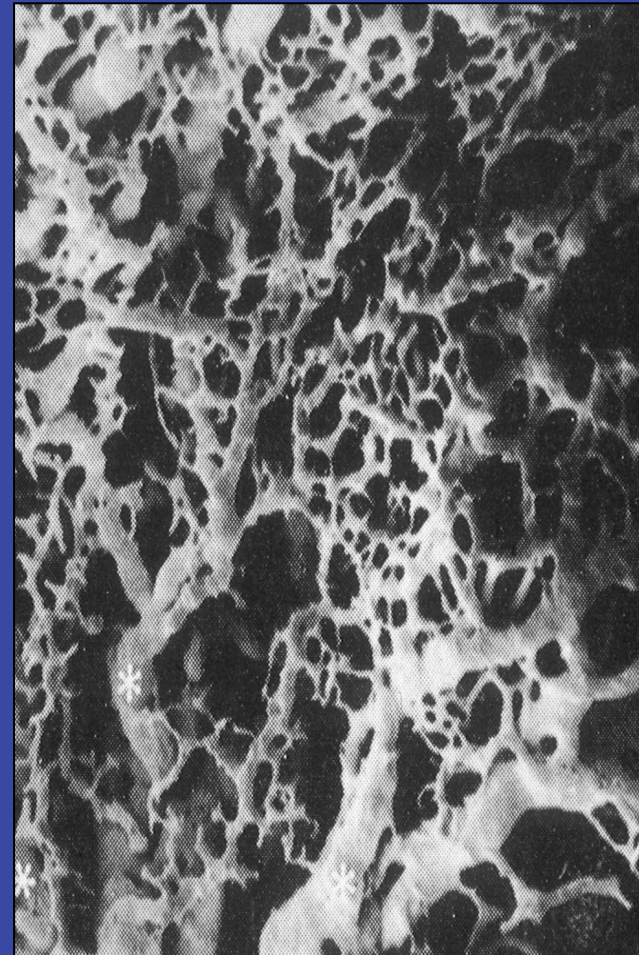
*Adapted from Bergers, 2003*



# Tumor Angiogenesis



**Normal vessels**

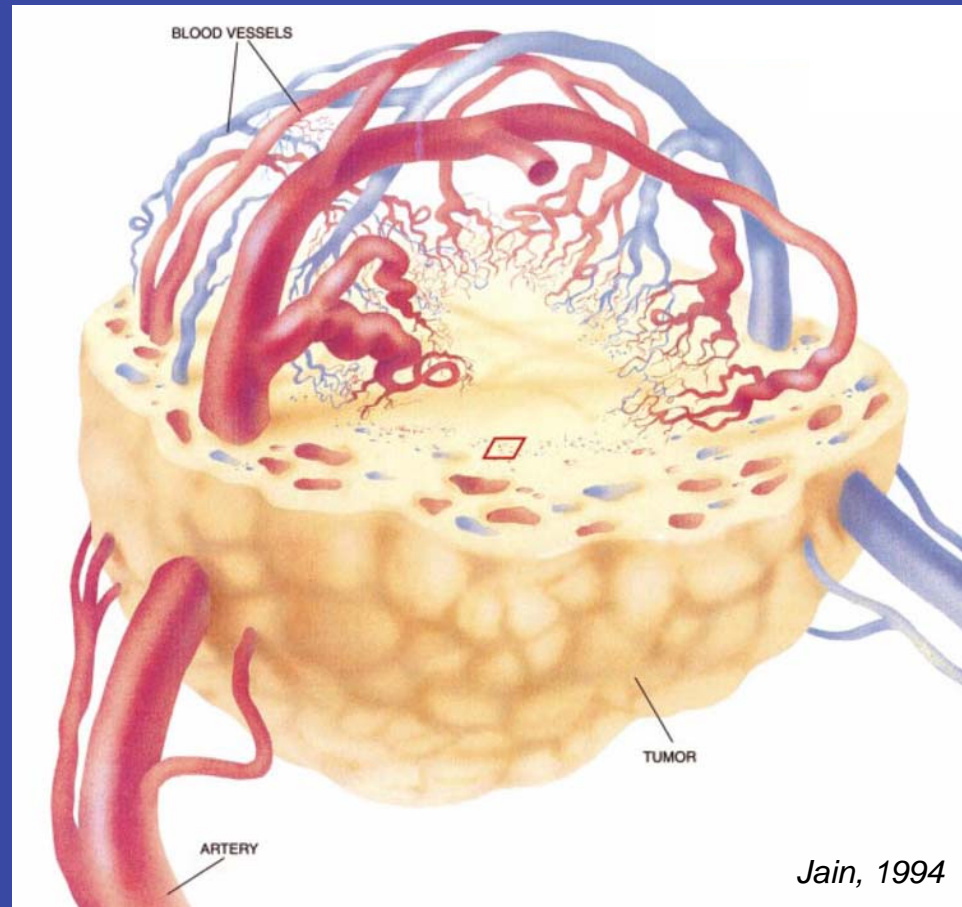


**Tumor vessels**

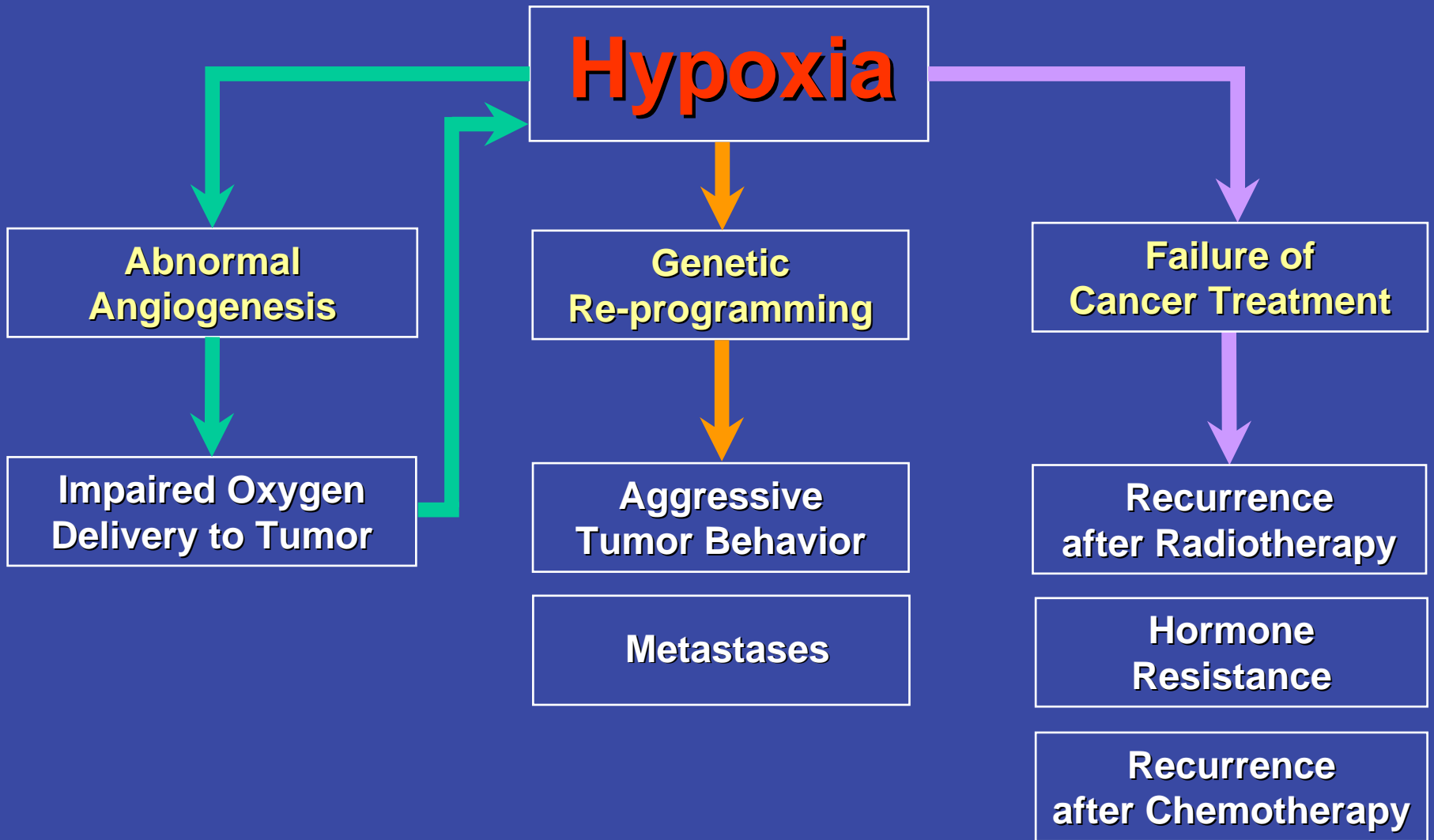
# Prostate Cancer Angiogenesis

Abnormal tumor blood vessels cause:

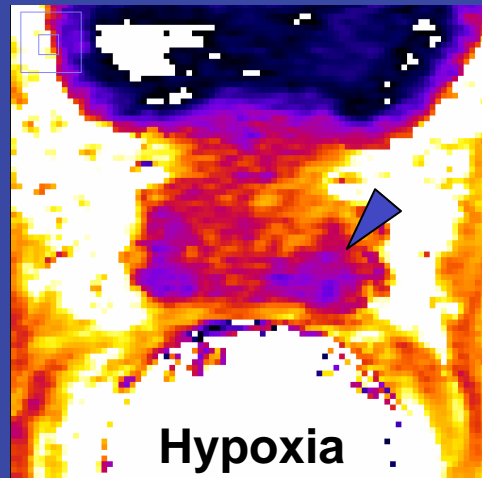
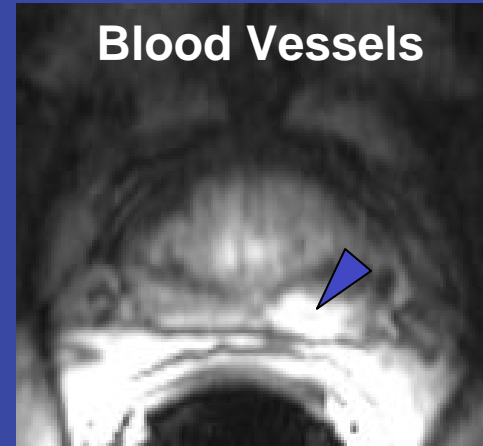
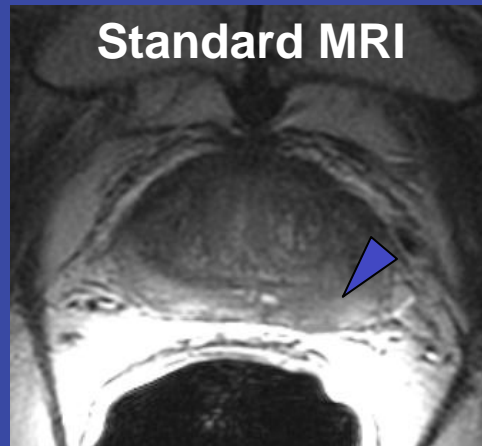
- Low oxygen levels
  - **Hypoxia**
- Genetic re-programming
- Aggressive behavior
  - Rapid growth
  - Cancer spread
  - Treatment resistance



**New treatments to kill abnormal blood vessels**

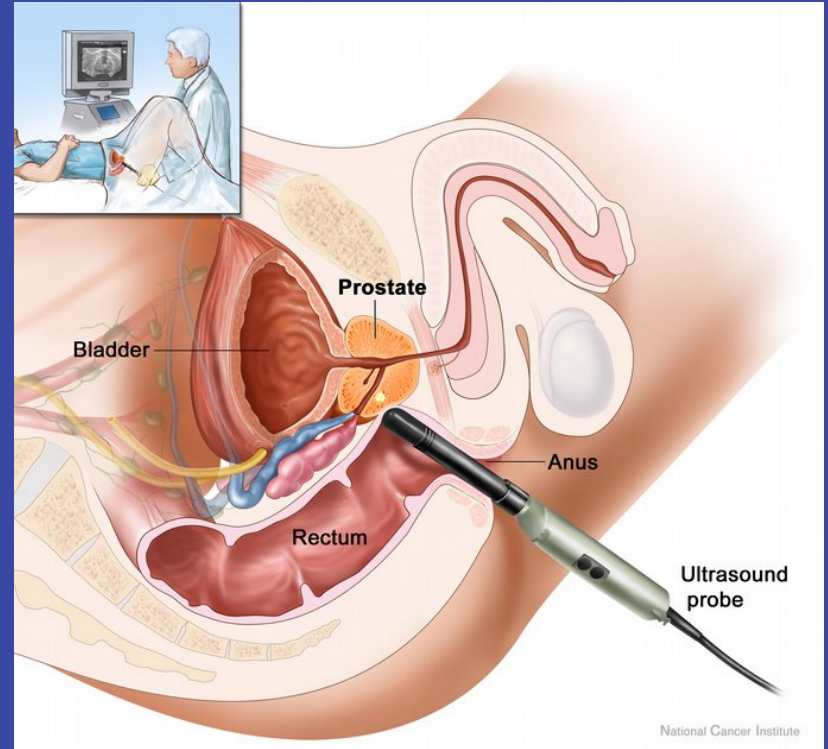
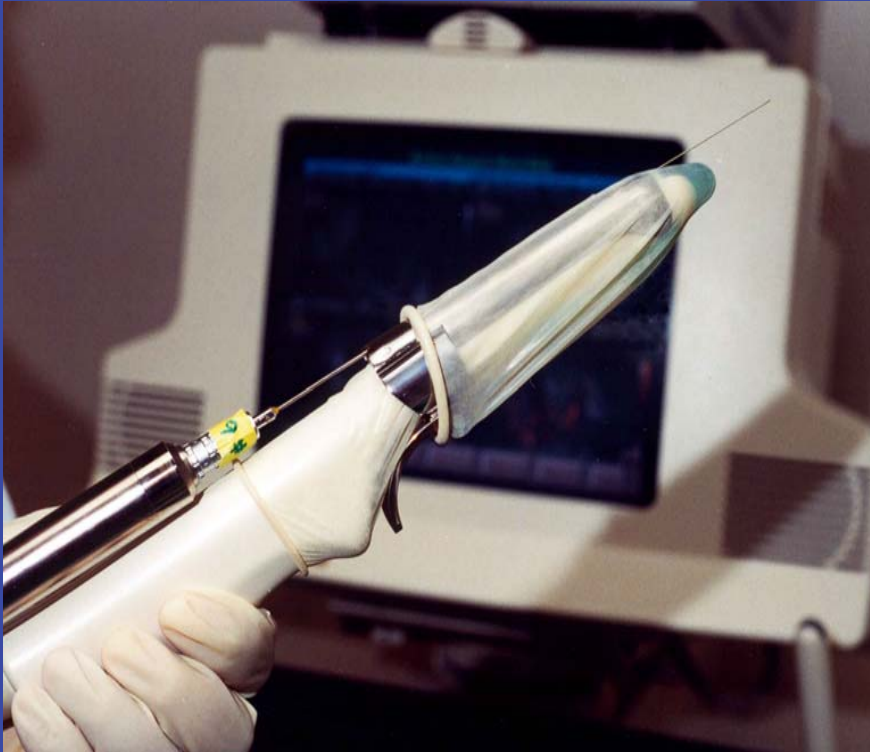


# Hypoxia in Prostate Cancer



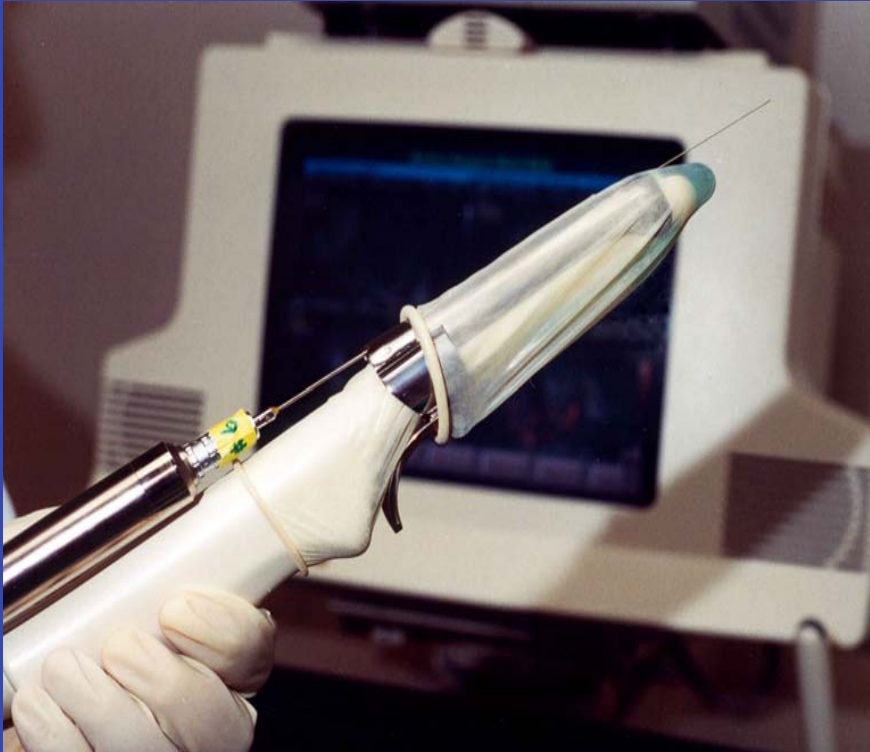
**MRI to detect hypoxia in prostate cancer**

# Hypoxia in Prostate Cancer



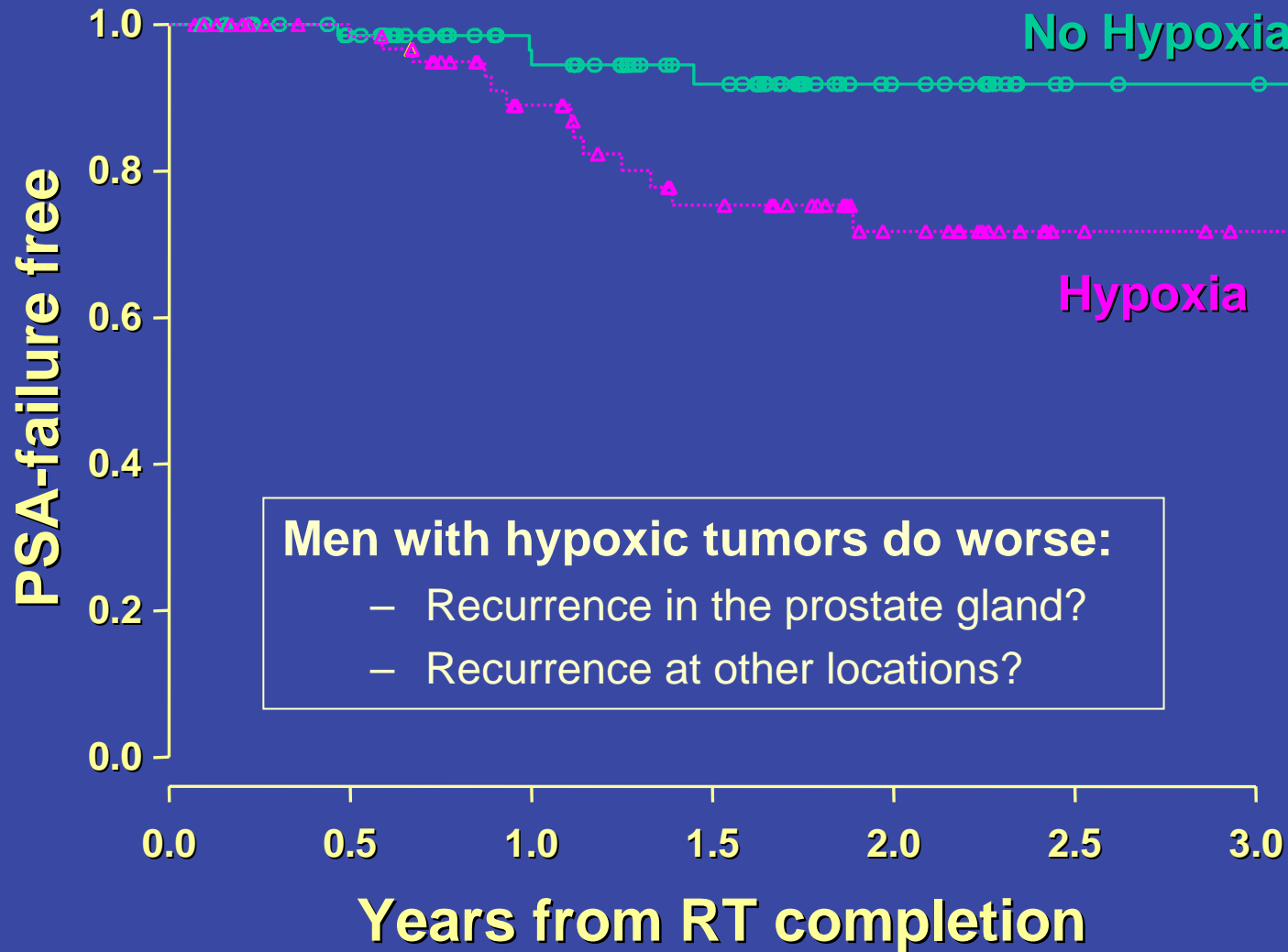
**Hypoxia measurements in 270 men with prostate cancer before radiotherapy**

# Hypoxia in Prostate Cancer

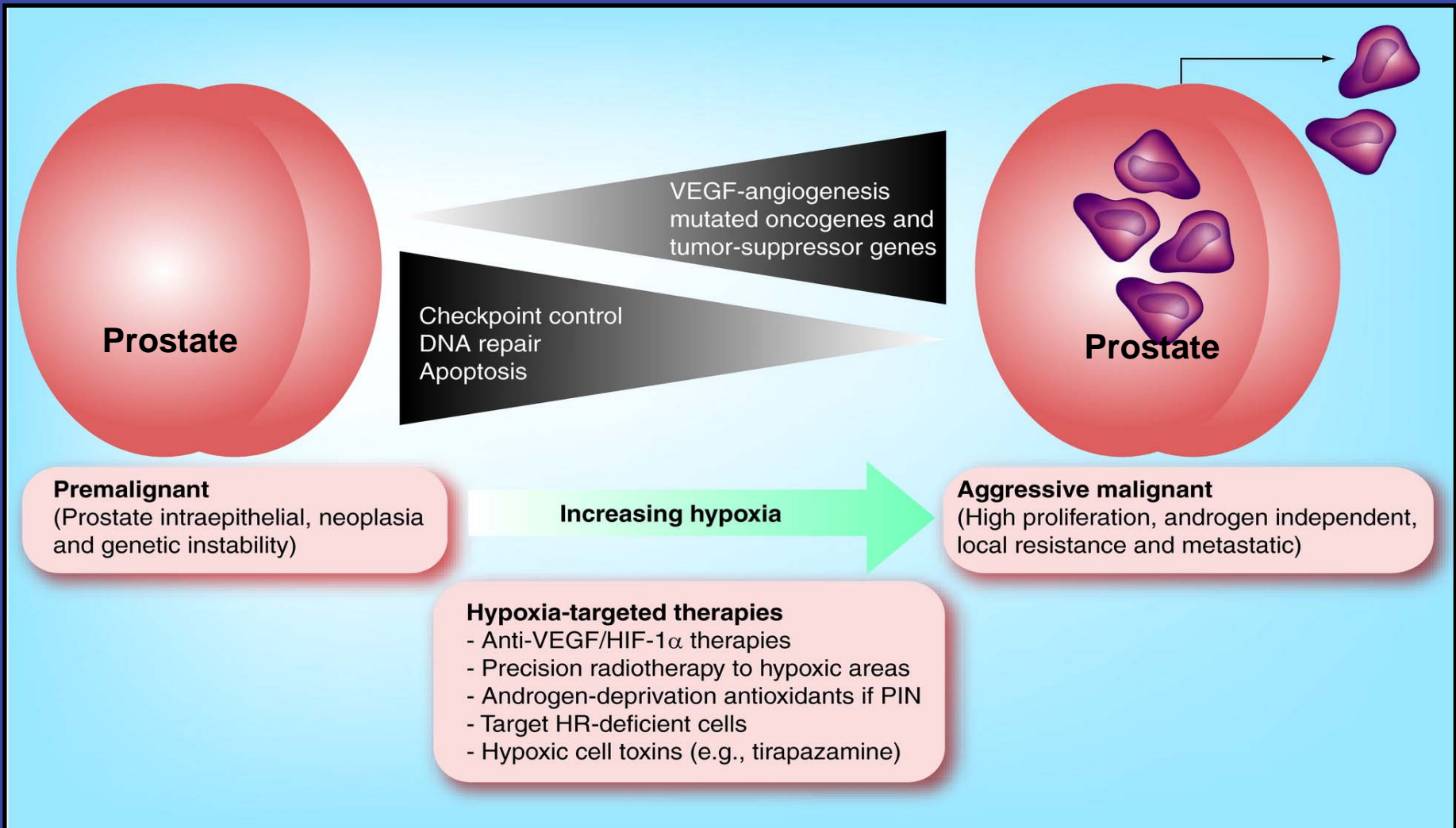


**Hypoxia measurements in 270 men with prostate cancer before radiotherapy**

# Hypoxia in Prostate Cancer



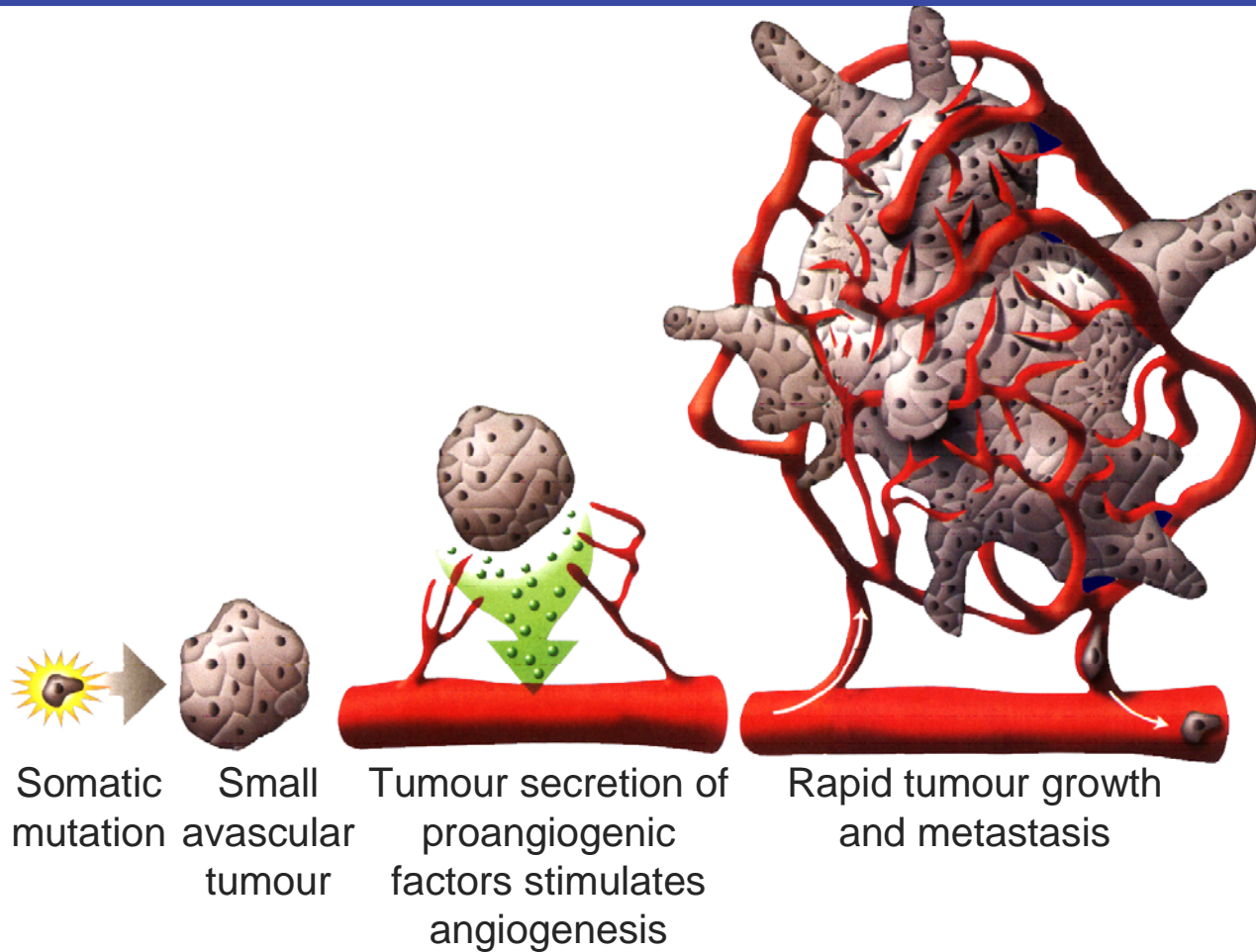
# Hypoxia in Prostate Cancer



Chan, 2007

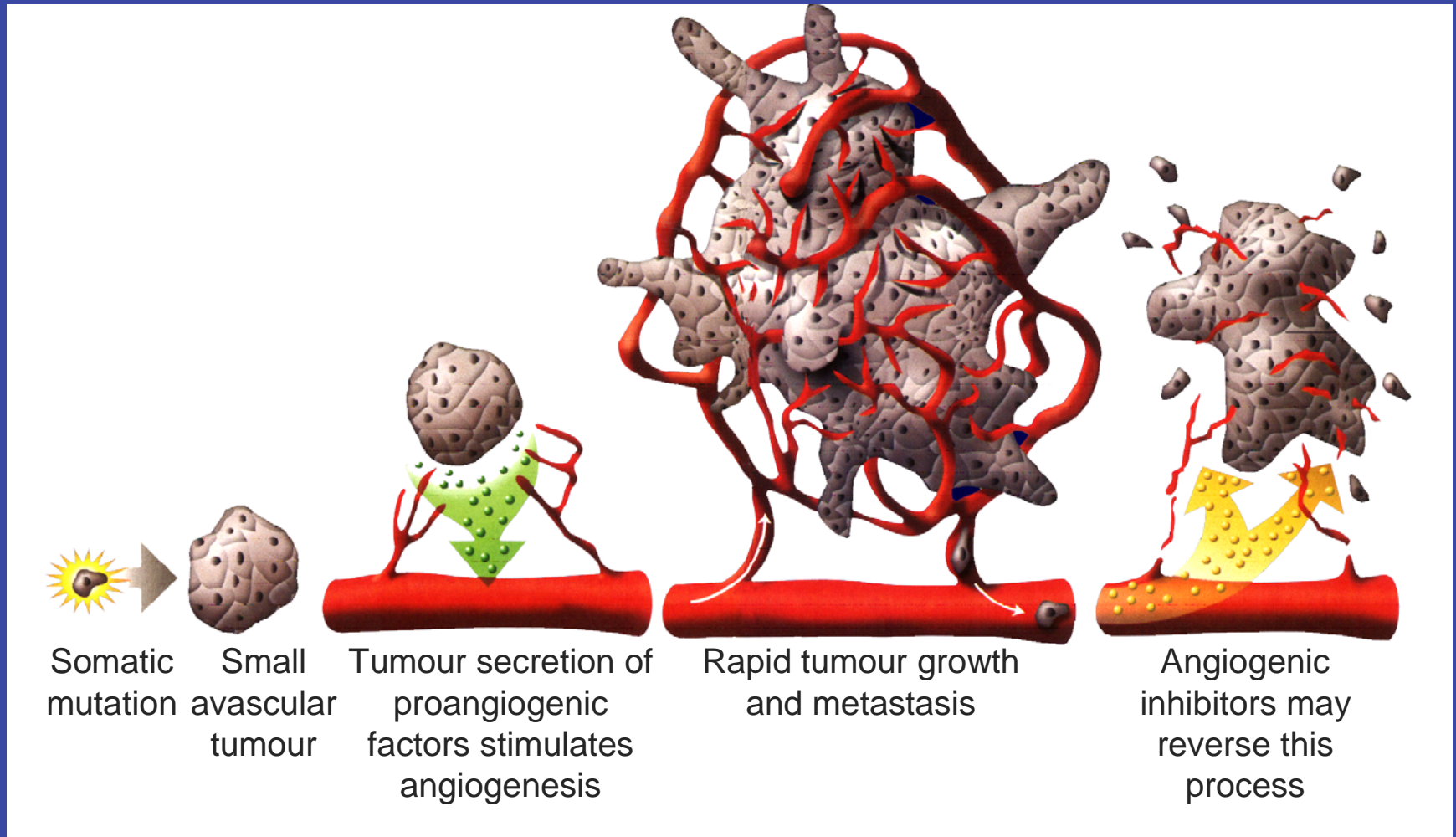


# Block Angiogenesis to Reduce Prostate Cancer Hypoxia



*Adapted from Bergers, 2003*

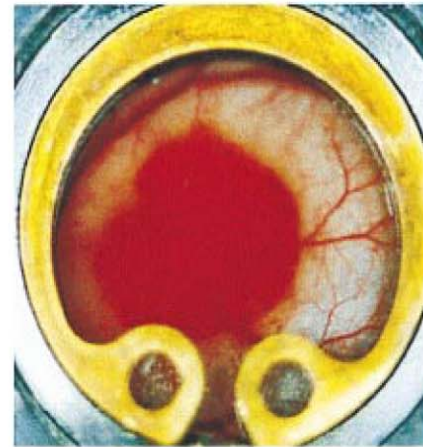
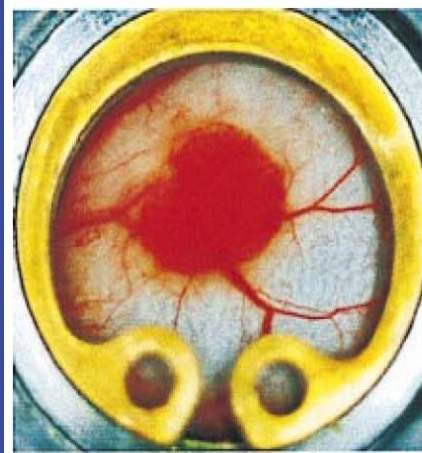
# Block Angiogenesis to Reduce Prostate Cancer Hypoxia



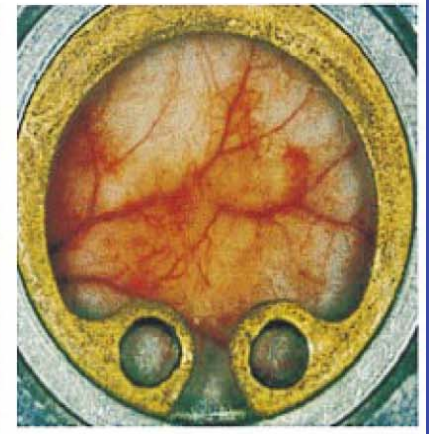
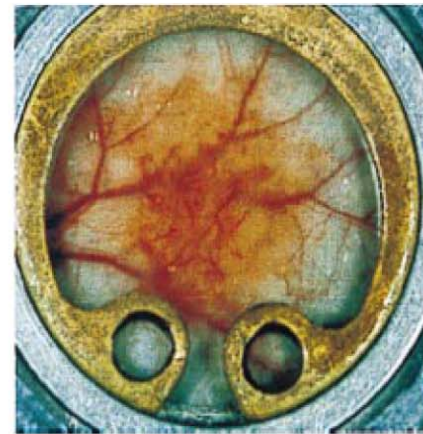
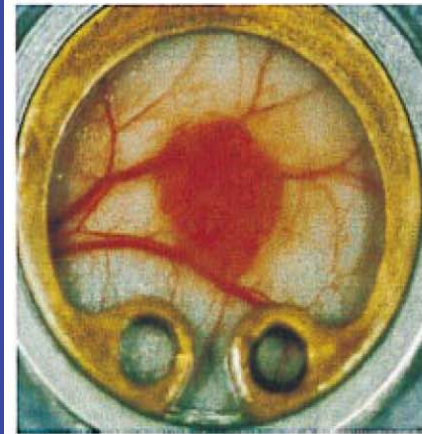
*Adapted from Bergers, 2003*

# Hormones Block Angiogenesis in Prostate Cancer

No  
Hormones



Hormones

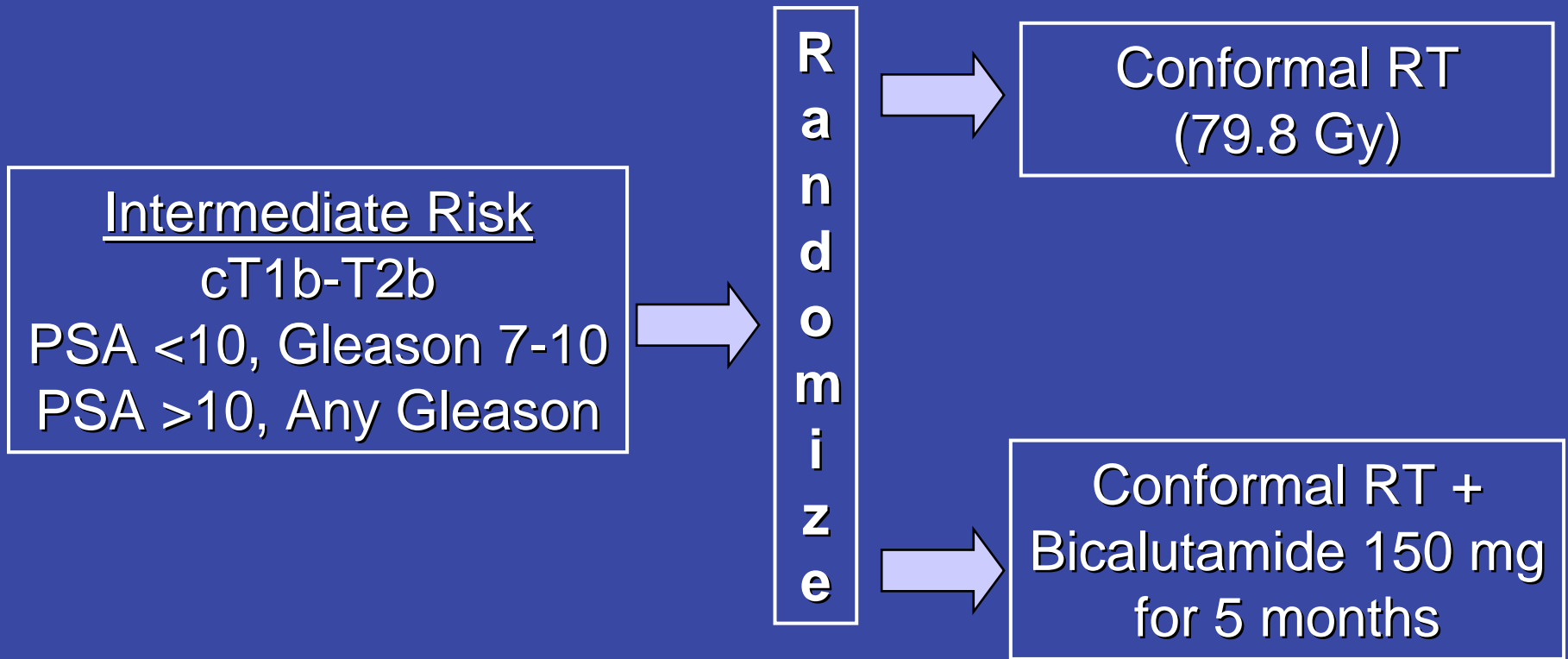


Start of experiment

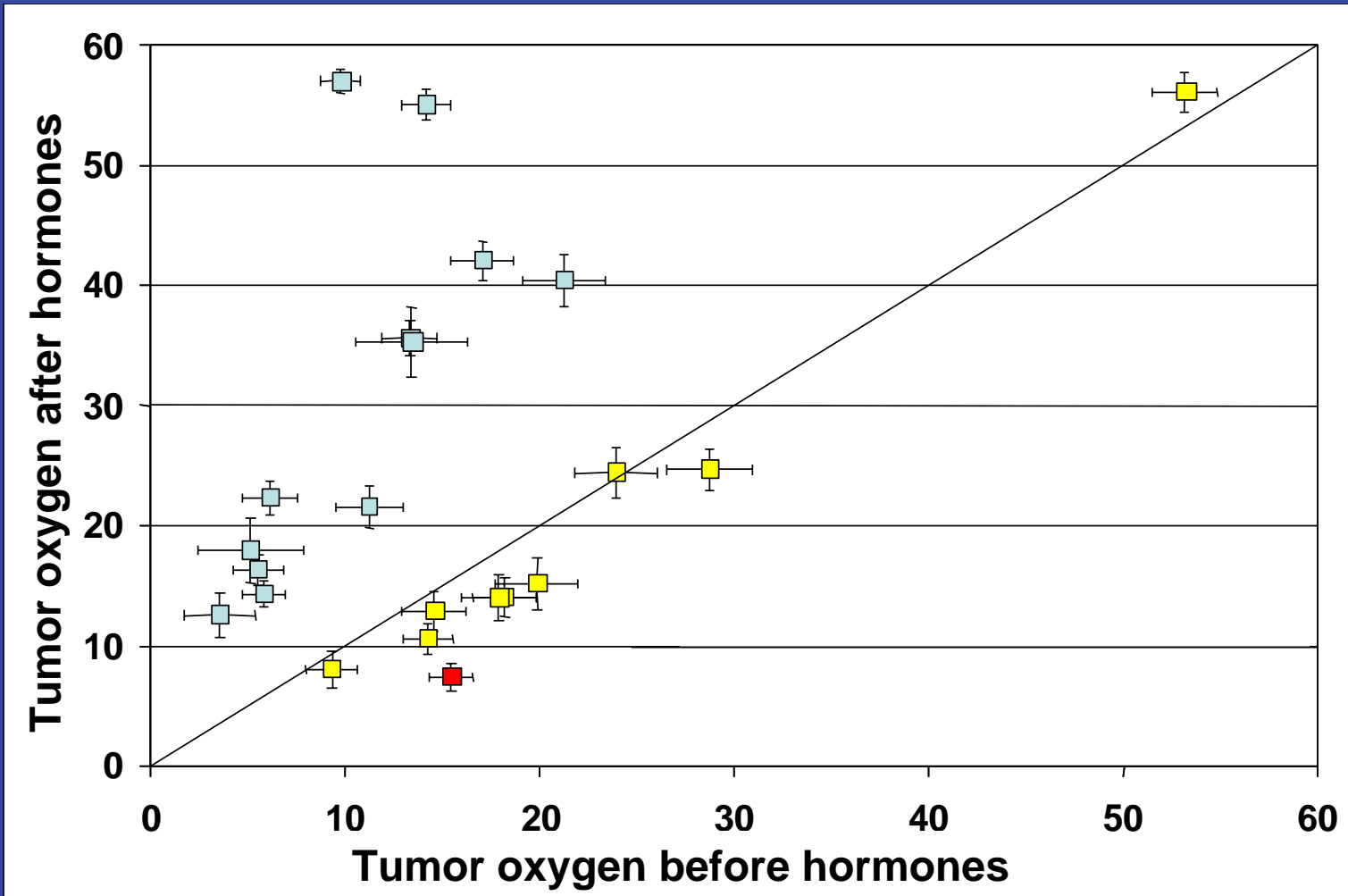
6 days later

12 days later

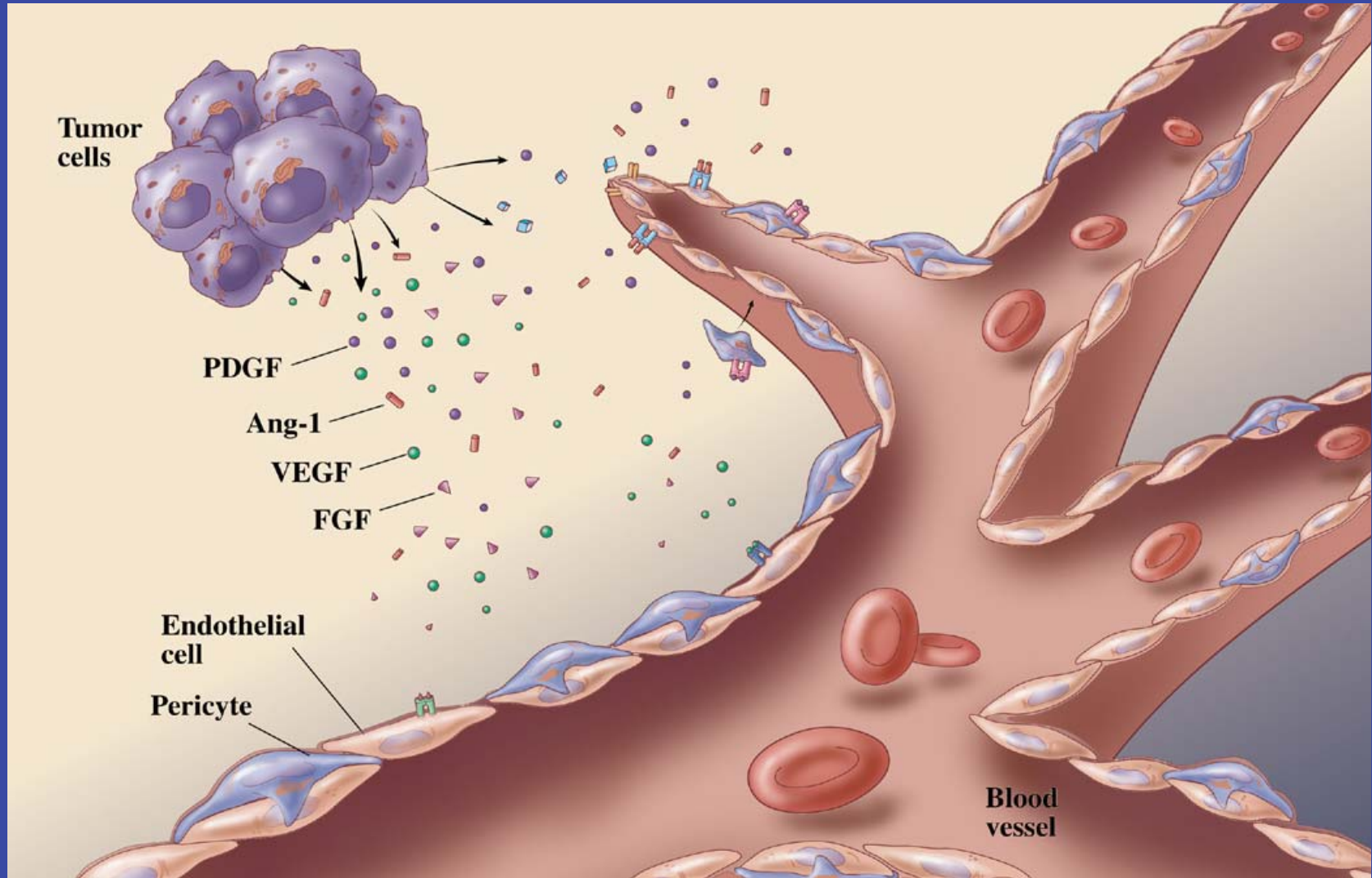
# Hormones Block Angiogenesis in Prostate Cancer



# Hormones Reduce Hypoxia in Prostate Cancer



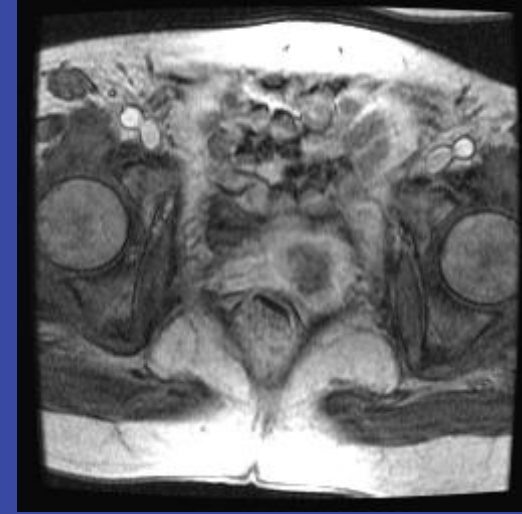
# New Drugs to Block Angiogenesis in Prostate Cancer



# New Drugs to Block Angiogenesis in Prostate Cancer

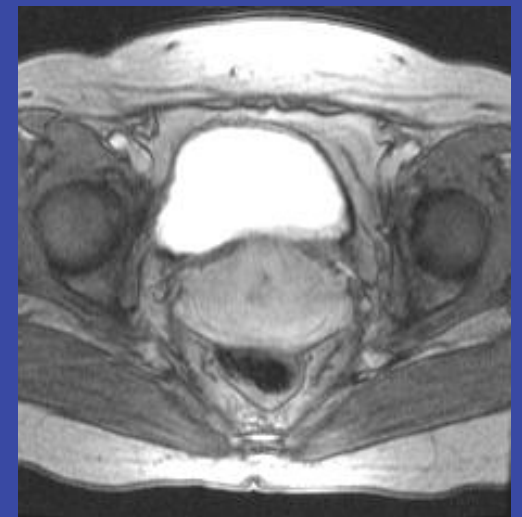
Cervix  
Cancer

Patient 1



Cervix  
Cancer

Patient 2



Baseline

Sorafenib alone

RT + Sorafenib

# 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?

**ClinicalTrials.gov**  
A service of the U.S. National Institutes of Health

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ClinicalTrials.gov is a registry of federally and privately supported clinical trials conducted in the United States and around the world. ClinicalTrials.gov gives you information about a trial's purpose, who may participate, locations, and phone numbers for more details. This information should be used in conjunction with advice from health care professionals. [Read more...](#)

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Find trials for a specific medical condition or other criteria in the ClinicalTrials.gov registry. ClinicalTrials.gov currently has **72,914 trials** with locations in **167 countries**.

## ▶ [Investigator Instructions](#)

Get instructions for clinical trial investigators/sponsors about how to register trials in ClinicalTrials.gov. Learn about mandatory registration and results reporting requirements and US Public Law 110-85 (FDAIA).

## ▶ [Background Information](#)

Learn about clinical trials and how to use ClinicalTrials.gov, or access other consumer health information from the US National Institutes of Health.

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