

Cancer Treatments and Possible Side Effects



BODY SCANS
SURGERY
CHEMOTHERAPY
TARGETED THERAPY
RADIATION THERAPY
PART 2



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Chemotherapy



- Chemotherapy (also known as chemo) is a therapy in which toxic drugs are given to the cancer patient to interfere with the growth of the cancer cells.
- The goal of chemotherapy is to cure cancer (eliminate all cancer cells), control cancer (slow the growth of cancer and prevent spreading), or to provide palliative care (to shrink the tumor to relieve pressure), depending on the stage and grade of the cancer.

Chemo Drugs - **Characterized by How They Kill Cancer Cells** and Other Fast Growing Cells



- **Cell-cycle specific agents** work by targeting the microtubules which form spindle fibers thus interfering with cell division and resulting in cell death.
- **Cell-cycle nonspecific agents** damage the DNA by causing the DNA double-helix to break and/or interfere with the DNA repair mechanism.

Chemo Drugs – Characterized by the Derivation of the Drug



Chemotherapy drugs characterized by the derivation of the drug are:

- A) Alkylating agents
- B) Platinums
- C) Antitumor antibiotics
- D) Antimetabolites
- E) Plant alkaloids

Alkylating Agents



NDC 0703-5075-03

Rx only

DACARBAZINE
for Injection, USP

200 mg

Prepared as the citrate salt

For IV Use Only
Single Dose Vial

10 Vials

TEVA

When reconstituted with 19.7 mL of sterile water for injection, USP, each mL of solution will contain 10 mg dacarbazine; 10 mg citric acid; and 3.75 mg mannitol.

Usual Dosage: See Package Insert.

PROTECT FROM LIGHT. STORE
BETWEEN 2°–8°C (36°–46°F).
USE WITHIN 8 HOURS OF
RECONSTITUTION.

DISCARD UNUSED PORTION.

Teva Parenteral Medicines, Inc.
Irvine, CA 92618



Y10336

Platinums



NDC 0703-3249-11

Rx only

CARBOplatin

Injection (aqueous solution)

600 mg/60 mL

(10 mg/mL)

Multiple Dose Vial
For Intravenous Use

CAUTION: Cytotoxic Agent

TEVA

Each mL of Carboplatin Injection (Aqueous Solution) contains 10 mg of carboplatin in Water for Injection.

CONTAINS NO PRESERVATIVES.

Sterile, non-pyrogenic, aqueous solution.

Usual Dosage: READ ACCOMPANYING PACKAGE INSERT FOR COMPLETE DIRECTIONS FOR USE.

Store at 25°C (77°F); excursions permitted from 15°–30°C (59°–86°F) [See USP Controlled Room Temperature].

Protect from light.

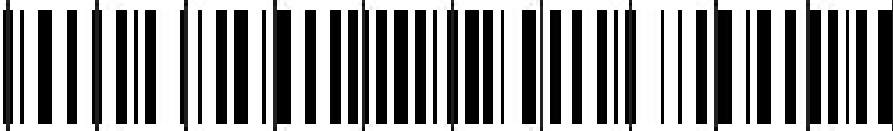
Teva Parenteral Medicines, Inc.
Irvine, CA 92618



YJ0377

Antitumor Antibiotic



									
NDC 0015-3010-20									
BLENOXANE® (bleomycin sulfate for injection, USP)									
EQUIVALENT TO					Rx only				
15 units bleomycin									
Read package insert for detailed indications, dosage, and precautions. Store dry powder under refrigeration 2° C (36° F) to 8° C (46° F).					Manufactured by Nippon Kayaku Co. Ltd., Tokyo, Japan Distributed by Bristol-Myers Squibb Oncology A Bristol-Myers Squibb Company Princeton, NJ 08543 USA PRODUCT OF JAPAN				
					1136560				
lot: UNVARNISHED EXMPRINT AREA									

Antimetabolites



NDC 49884-922-02

Mercaptopurine Tablets, USP

50 mg

Rx only

Cytotoxic Agent

60 Tablets



Each scored tablet contains:

Mercaptopurine 50 mg

**KEEP THIS AND ALL DRUGS
OUT OF REACH OF CHILDREN.**

WARNING: This drug is only to be taken under close medical supervision. Do not take in larger doses or more frequently or for a longer time than specifically directed by the physician. Periodic blood counts are necessary to determine proper dose and to avoid ill effects.

Dispense in a tight container as defined in the USP.

Store at 20° to 25°C (68° to 77°F) in a dry place. See USP controlled room temperature.

Control No.:

Exp. Date:

R03/09

LA922-02-1-02
MR003A09

Distributed by:

Par Pharmaceutical Companies, Inc.
Spring Valley, NY 10977



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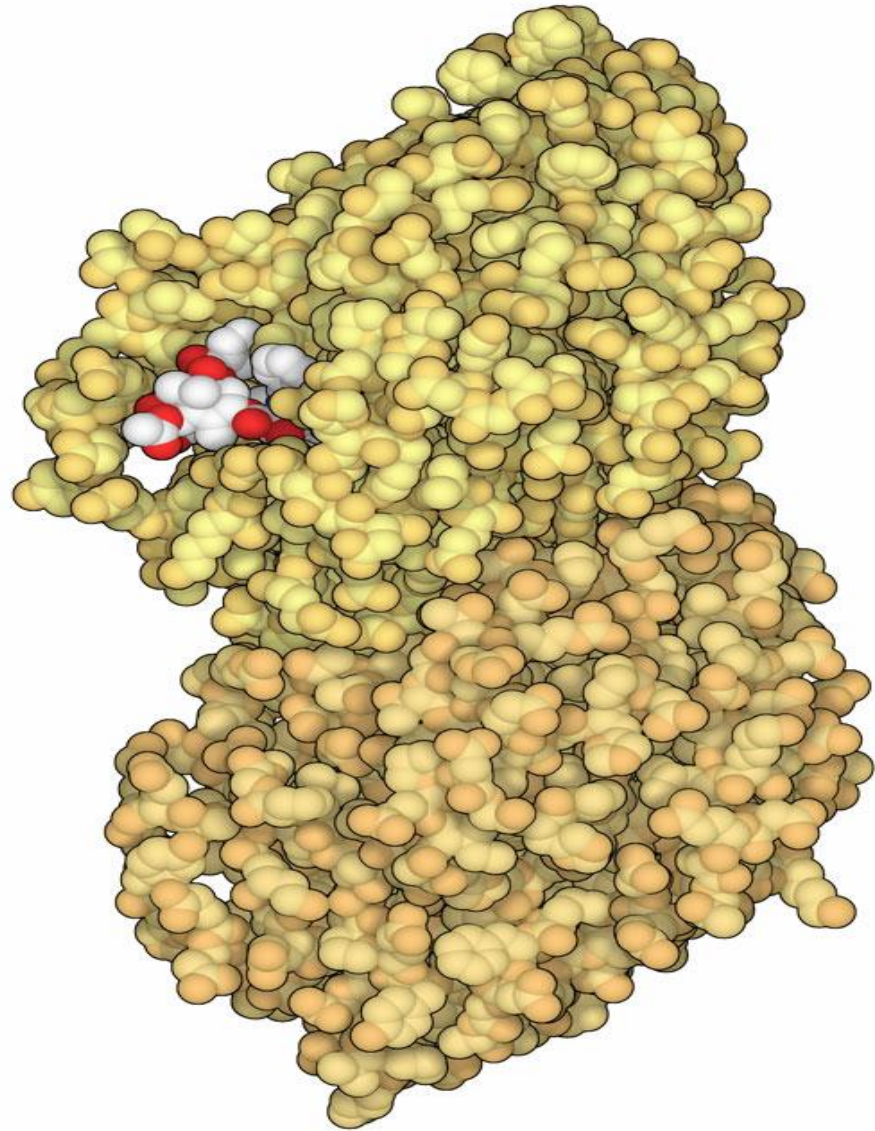
Plant Alkaloids



Pacific Yew Tree

Tubulin with Taxol

Paclitaxel (Taxol- shown in red and white), which is prescribed for breast, ovarian and other cancers, works by binding to the tubulin protein (shown in yellow), inhibiting the formation of microtubules that are needed for cell division.



Administering Chemotherapy



Chemotherapy can be administered by the following methods:

- Orally by pill
- Subcutaneous injection - a shot under the skin
- Intra-arterial - into an artery
- Intraperitoneal - into the peritoneal cavity
- Intravenously (IV) – into a vein..

Intravenous (IV) Line Inserted for Chemotherapy



Cancer Patient Receiving Chemotherapy Intravenously



[http://en.wikipedia.org/wiki/Chemotherapy#mediaviewer/File:Chemotherapy with acral cooling.jpg](http://en.wikipedia.org/wiki/Chemotherapy#mediaviewer/File:Chemotherapy_with_acral_cooling.jpg)

<http://creativecommons.org/licenses/by-nc-nd/3.0/us/legalcode> No changes have been made.

Cancer Patient With Port Surgically Implanted for IV Chemotherapy Delivery



The Chemotherapy Process

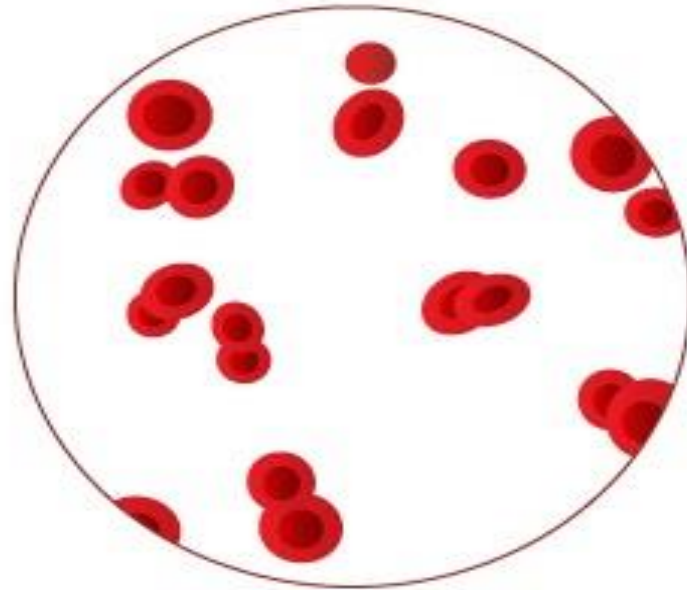


- The *chemo phase* begins on Day 1 and includes the 1st week following the administering of the first dose of chemo. The drug(s) are coursing through the body and this is when the patient begins to experience the short-term side effects. In addition to the chemo drugs, other drugs are given orally, subcutaneously, and/or through the chemo IV to control each of the side effects.
- The *rebuilding phase* occurs during the 2 weeks following the chemo phase when the body works to recover from the toxins in the drugs and the patient begins to feel better and regain strength.
- The 1st chemo and rebuilding phases constitute Cycle 1.

Short-Term Side Effect of Chemotherapy - Hair Loss



Short-Term Side Effect of Chemotherapy – Anemia and Fatigue



Long-Term Side Effects of Chemotherapy Affecting Fertility



- Infertility and onset of menopause due to the damage to the primordial and primary follicles can occur in females. In men, chemotherapy can lower the sperm count and make the sperm less able to move or can cause other damage to the sperm.
- The alkylating agents cause the most harm to fertility, such as Cytosan (cyclophosphamide) used to treat breast cancer, lymphoma, and some leukemias.
- Adriamycin (doxorubicin), antitumor antibiotic anthracycline used to treat breast cancer, is considered to be a moderate risk for women over 40 and minimal risk for women under 40.
- Methotrexate and 5-fluorouracil, antimetabolites used to treat many cancers, tend to pose very little risk to fertility.
- Taxol (paclitaxel) and Taxotere, plant alkaloids, and oxaliplatin, a platinum, used to treat ovarian and colon cancer, don't appear to damage fertility.

Targeted Therapies



Targeted therapies are either a) small molecules or b) monoclonal antibodies.

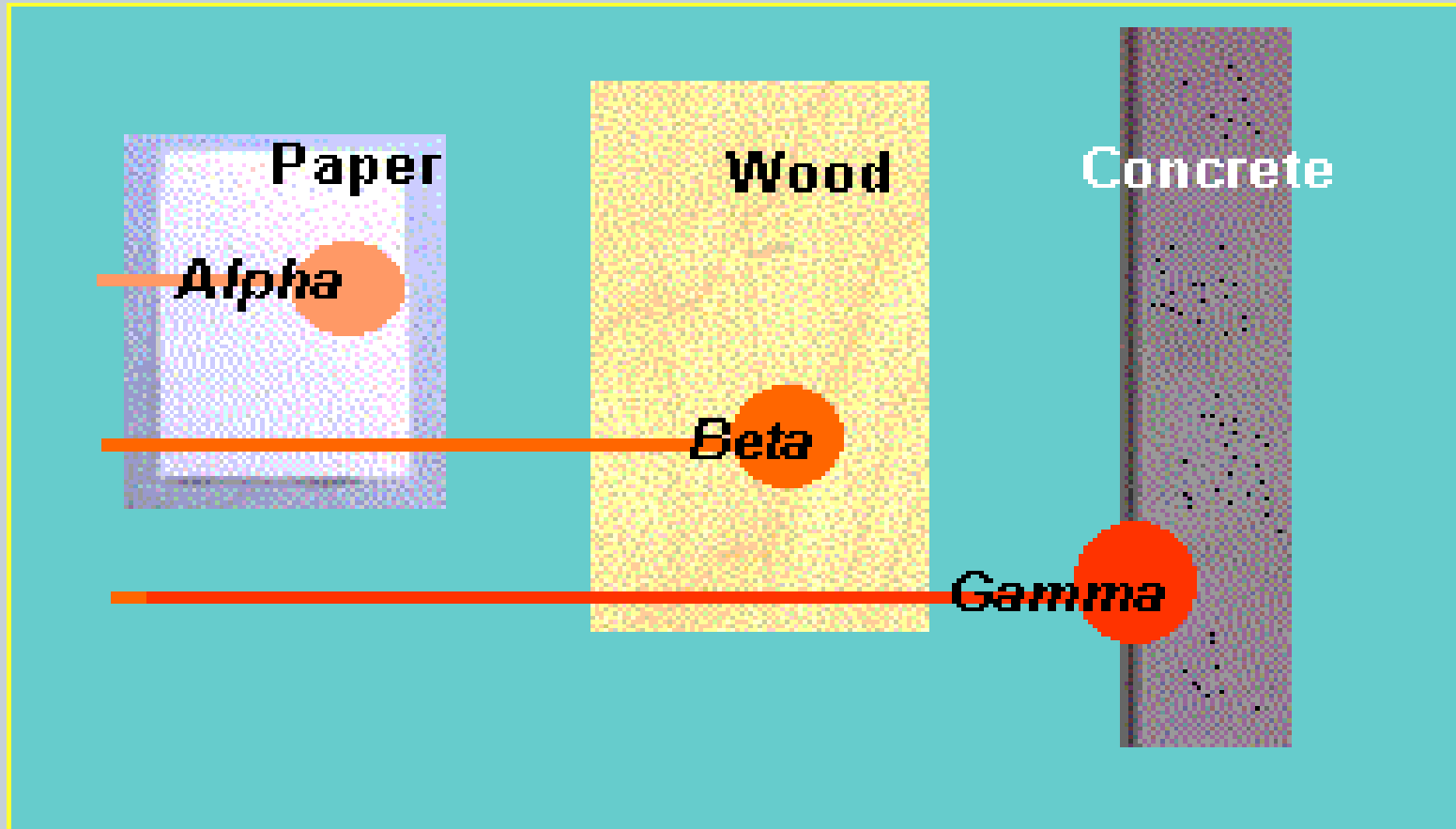
a) **Small molecules** are ones that are able to diffuse into the cell and act on targets found within the cell. **Gleevec**, first used to treat chronic myelogenous leukemia (CML) in 2001, is an example of a very effective small molecule.

b) **Monoclonal antibodies** are man-made versions of very specific immune system proteins which cannot penetrate the cell membrane and work against targets that are found on the cell surface.

Some monoclonal antibodies work by attaching to tumor-specific antigens on the cancer cells which make them recognized as 'not-self' by the body's immune system while others work by blocking the cell receptors to growth factors on the cancer cell surface thus preventing the cancer cell from growing.

An example is **Herceptin**, first used in 1997, which binds to human epidermal growth factor receptor 2 (HER-2) in certain types of breast cancer.

What Blocks Radiation – The Relative Penetration Power of Radiation Types



In addition, skin can block alpha particles, thin sheets of metal can block beta particles, and thick lead can block gamma radiation.

Radiation Therapy

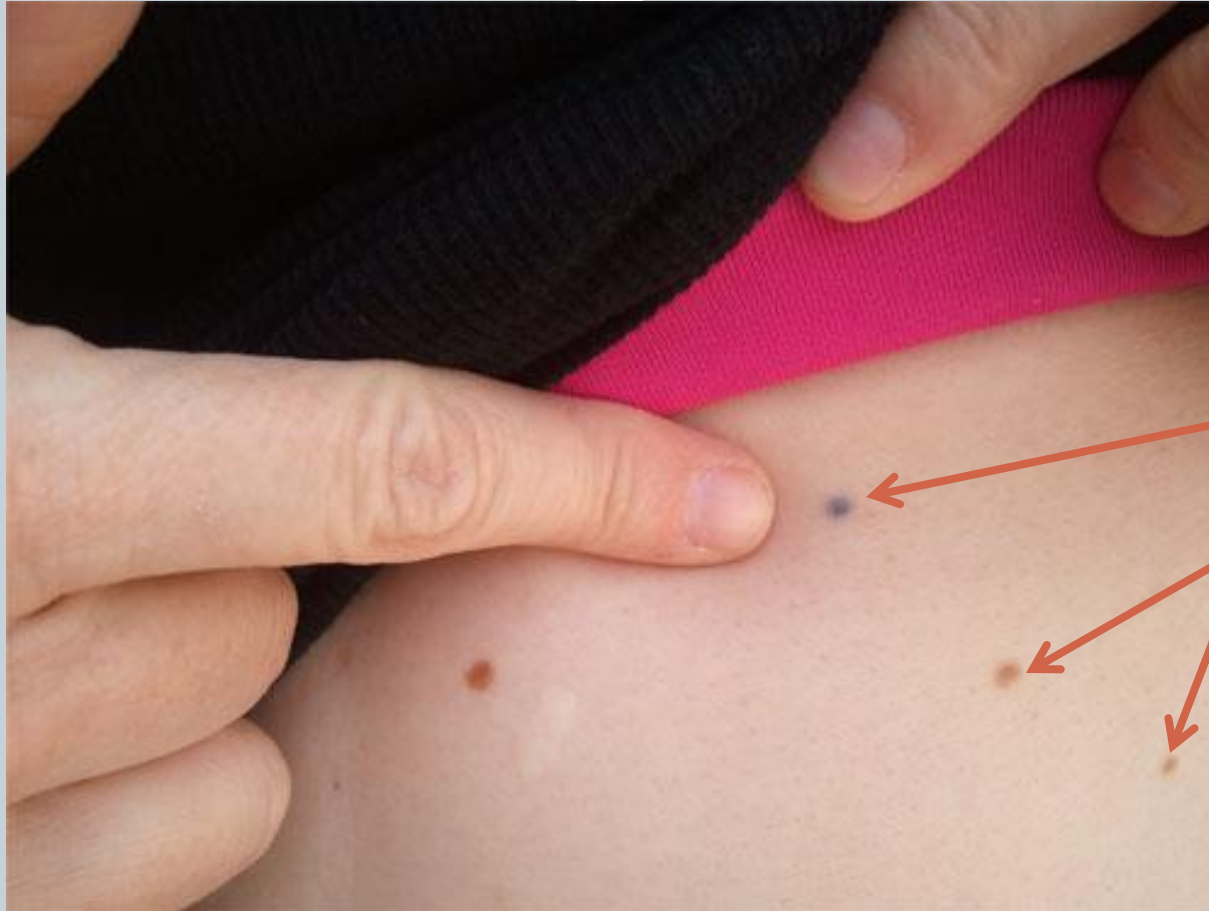


- Radiation therapy uses high-energy electromagnetic radiation to shrink tumors and to kill cancer cells by directly damaging the DNA and/or by creating free radicals within the cell ultimately damaging the DNA.
- The radiation can be delivered:
 - a) externally by external-beam radiation
 - b) internally by internal radiation
(also called brachytherapy)
 - c) systemically by systemic radiation.

Linear Accelerator Used for **External-Beam** Radiation Therapy



Actual Size of Radiation Therapy Tattoo Used for Aiming External Beam Radiation

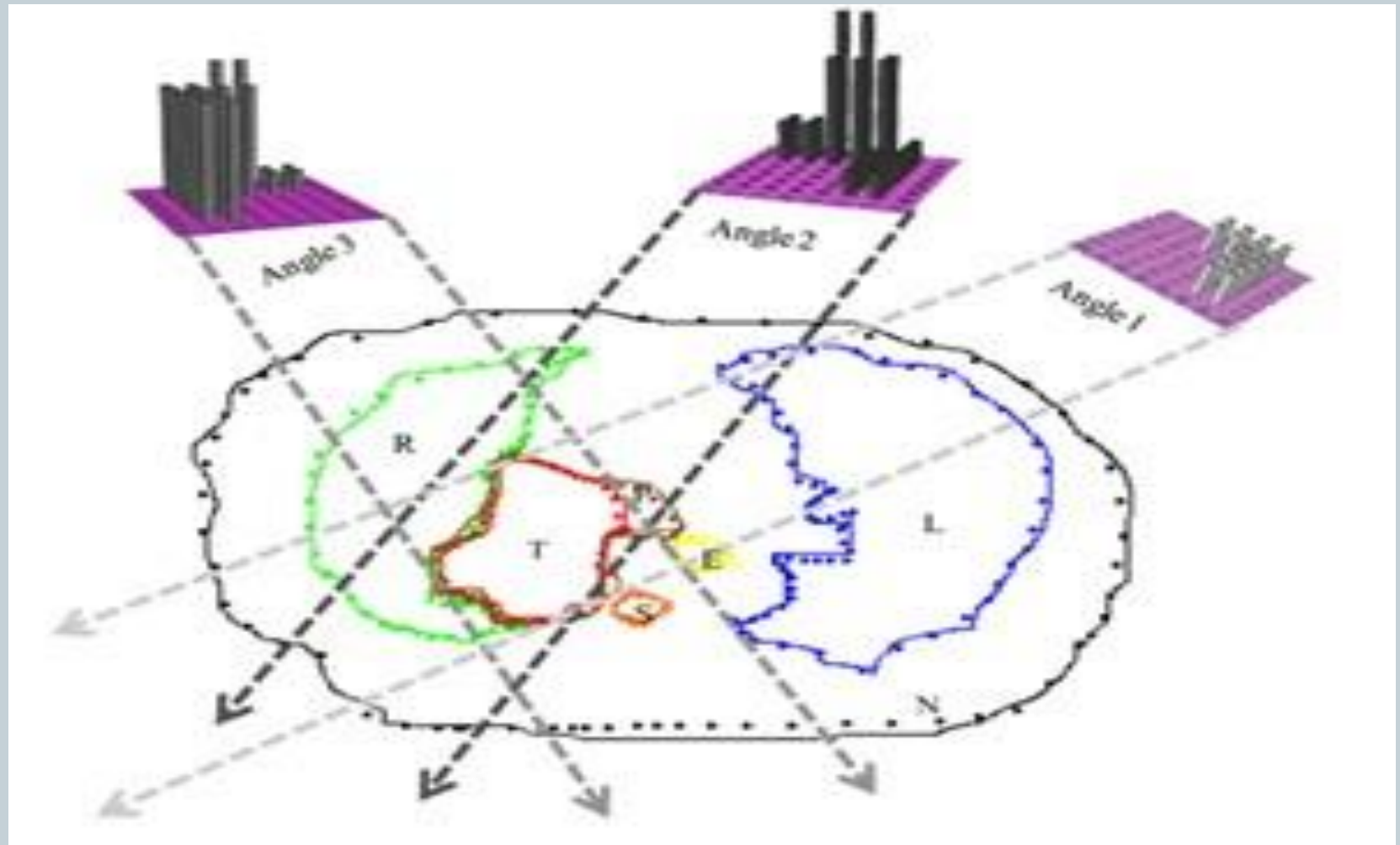


Tattoo

Moles

This tattoo is the largest radiation tattoo; others are like tiny pin pricks. The tattoos are used to help machines line up without any variation during each treatment.

Intensity Modulated Radiation Therapy (IMRT)

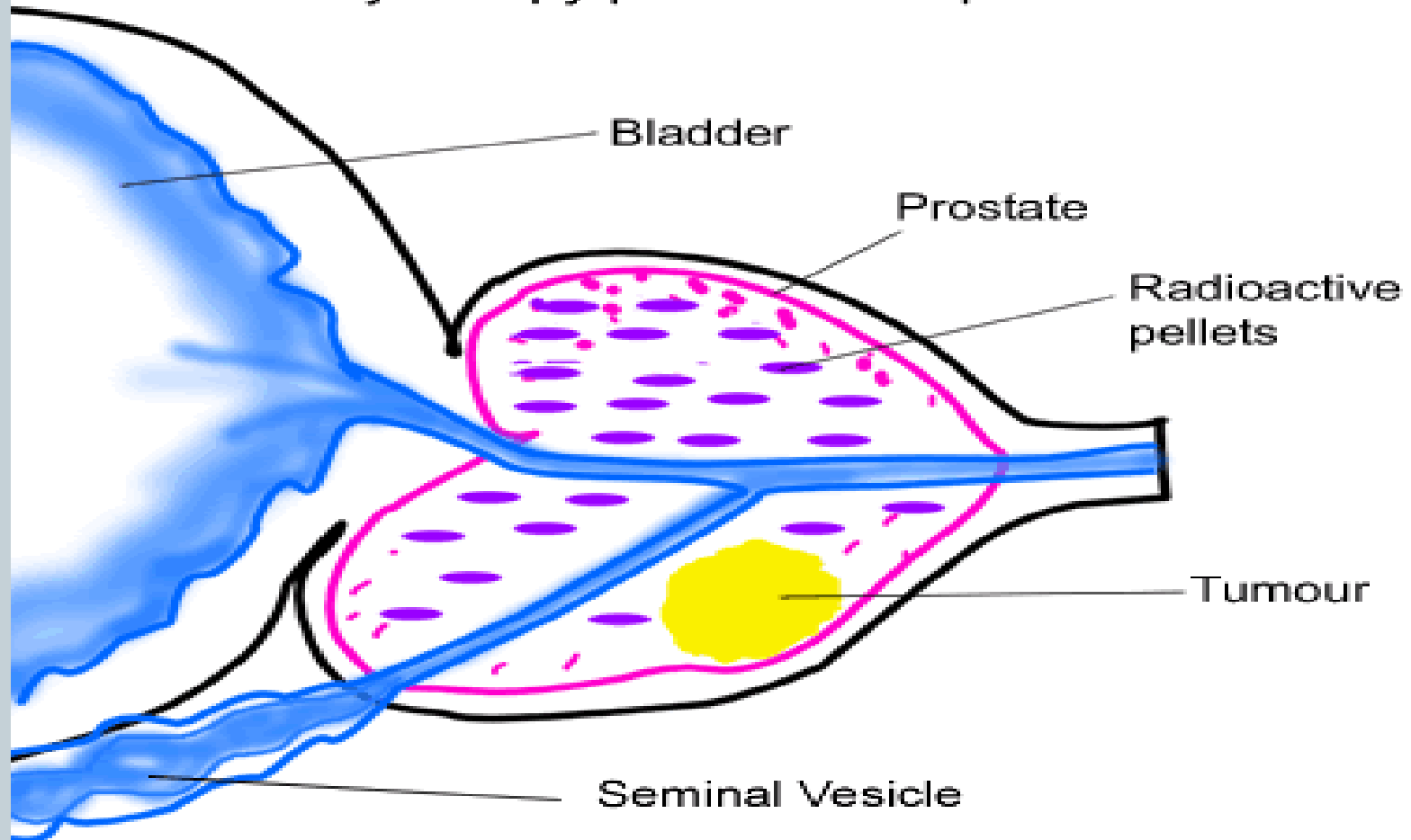


Internal Radiation Therapy

Low-Dose Rate Brachytherapy



Brachytherapy pellets in the prostate



Low-Dose Rate Brachytherapy Seeds



Size of Seeds Placed in Your Prostate



Size of Seed Implant

Robotic Machine Used for High-Dose Rate Brachytherapy



Systemic Radiation



- The patient receives an injection of a radioactive substance or swallows the substance.
- Examples are iodine-131, (half life = 8.02 days, beta emitter) for thyroid cancer and a radioactive substance bound to a monoclonal antibody for B-cell non-Hodgkin lymphoma.
- Side effects are minimal.

Short-Term Side Effect of Radiation Treatment - Fatigue



<http://www.jeanscream.com/blog/tag/radiation-therapy/>

Short-Term Side Effect of Radiation Treatment – Blistering of the Skin



Long-Term Side Effects of External-Beam Radiation Treatment



- Radiation to the brain can cause changes to the brain that can include memory loss, trouble thinking and doing math problems, problems with movement and incontinence, or personality changes.
- Scar tissue and weakness forming in the area treated can lead to loss of motion in your joints, such as jaw, hip, or shoulder. In the area of the mouth, problems include dry mouth, cavities, or bone loss in the jaw.
- Infertility can result due to permanent damage to follicles in the ovary or sperm producing cells in the testes. Shields over the ovaries and testes are used whenever possible.

Clinical Trials



- Clinical trials are used for research to determine the most effective treatment for certain cancers. The trials may include the introduction of a new drug or a new combination of treatments.
- There are risks since the new therapy may not be better or even as good as the standard treatment but it could also be much better.
- Studies run about 2 years from the administration of the treatment through follow-up care.
- Clinical trials are especially useful if standard treatment has not worked or if the cancer is beyond the stage where usual treatments have worked.

Post Cancer Treatment



- Once cancer treatment has ended, the patient would be seen by the oncologist every 3 months for the first few years, depending on the type of cancer. At each appointment, blood tests and further biopsies are done to see if the cancer has returned.
- If the cancer does appear to have recurred, additional chemotherapy, targeted therapy, and/or radiation would begin.
- If no evidence of cancer is found, the patient would eventually be seen every six months. Usually after the 5 year cancer-free mark has been reached, the patient is seen only once a year for another 5 years.

Celebrate!



- There are some cases of recurrence of cancer after the 5 year cancer-free mark but the likelihood of recurrence decreases sharply with time.
- Because of this, the 5 year cancer-free mark is usually considered a time for celebration!