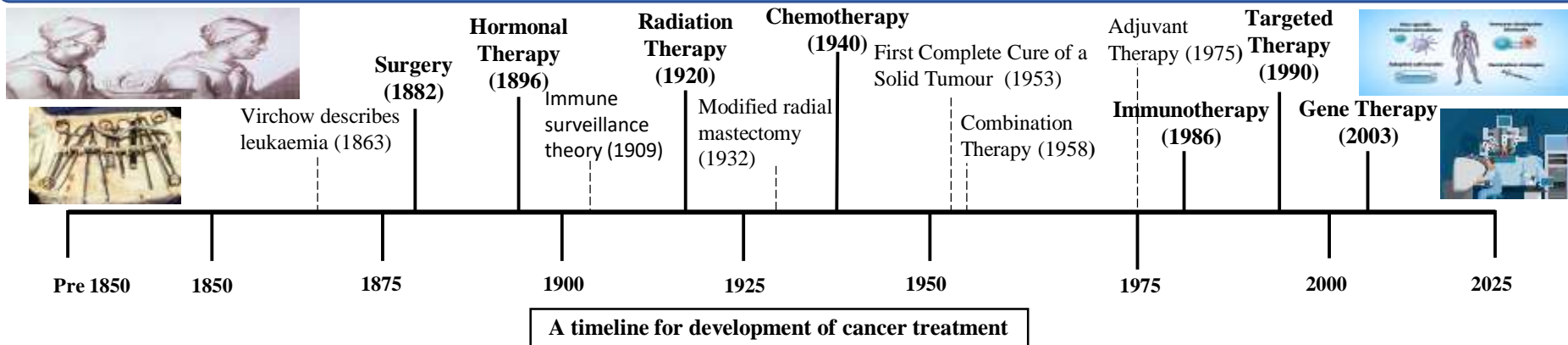


# DEVELOPMENT OF CANCER TREATMENT OVER THE YEARS



## Where did it all begin?

Hippocrates (460-375 BC), Aulus Celsus (25 BC-AD 50), Aretaeus (AD 81-138) and Claudius Galen (130-200) are few of the notable physicians that shed light to the causes and treatments of cancer. The Egyptians attempted to treat tumors with cauterization, knives, and salts, and introduced arsenic paste, "Egyptian ointment" until the 19th century. The Sumerians, Chinese, Indians, Persians, and Hebrews used herbal remedies such as tea, fruit juices, figs and boiled cabbage. They also used solutions and pastes of iron, copper, sulphur, and mercury. Many of these concoctions remained in external and internal use, in various concentrations, for more than 3000 years.

## Surgery-

In 1880s, William Halsted performed the first Radical Mastectomy for breast cancer, but an issue of female disfigurement arose. After the discovery of anaesthesia in 1840s, greater surgical feats were achieved. Today, lumpectomy is performed than radical mastectomy and bone and soft tissue tumours are excised without any amputation. Further after better understanding of cancer with the development of imaging techniques like CT scans, PET scans, MRI scans combination of surgery with chemotherapy/ radiotherapy was also experimented.

## Hormonal Therapy-

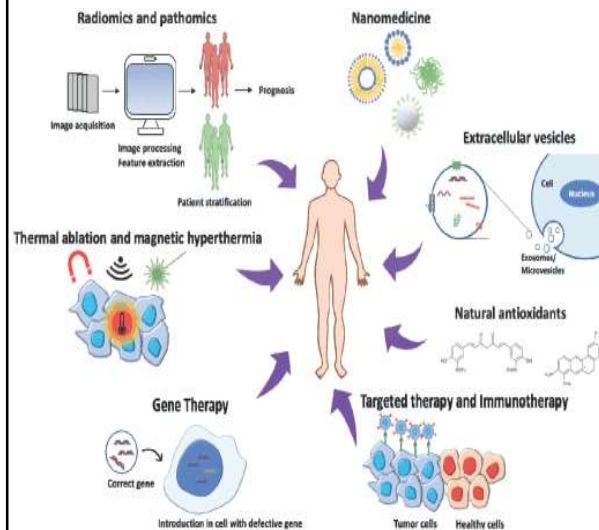
In 1896, Thomas Beatson proposed the idea of one organ holding control over the secretion of another and separate organ. His experimental oophorectomy in advanced breast cancer led to the discovery of stimulating effect of the female ovarian hormone (estrogen) on breast cancer. This laid a foundation for the modern use of hormone therapy to treat or prevent breast cancer. Hormonal therapy was introduced in 1939 by Charles Huggins, where he treated prostate cancer with hormones and was able to show responses by decreases in acid phosphatase levels. Currently, hormone therapy is widely used in breast and prostate cancers.

## Radiation Therapy-

In 1896, Emil Herman Grubbe used X-rays to treat patient with breast cancer. Later, devices that produced higher energy X-rays to deeper cancer tissues were developed. By 1920s, that physicians understood how the administration of the total radiation dose in fractionated ones was better than a singular treatment session, regarding cancers control and fewer side effects. 1930 to 1950 era (also known as Orthovoltage era) was characterized by the use of the radium-based interstitial irradiation (brachytherapy) and by the development of super voltage X-ray tubes able to deliver energy from 50 kV to 200 kV.

## Chemotherapy-

In the early 1900s, Paul Ehrlich coined the term "chemotherapy" and defined it as the use of chemicals to treat disease. After nitrogen mustard, several blockbuster molecules like methotrexate, cyclophosphamide and 6-mercaptopurine were developed between 1940s and 1960s. In 1960s it was proved that combinations of drugs were superior to single agents. In the 1970s, chemotherapy was used as an adjuvant to surgery. Today, chemotherapy is used for all almost stages of tumour and is curable in most patients. The scope has shifted from a general to a targeted approach. Current focus is on novel delivery of molecules while reducing the side effects due to chemotherapy.



## Future of cancer treatment [2]

## Targeted Therapy-

Targeted therapies work by influencing the processes that control growth, division, and spread of cancer cells, as well as the signals that cause cancer cells to die naturally. Angiogenesis Inhibitors, Monoclonal antibody and Growth signal inhibitors are types of targeted therapies. To reduce the side effects of chemotherapy and increase its efficacy, nanostructure based formulations were developed where the drug is placed in the lipid bilayer.

## Gene Therapy-

Gene therapy has been used to create cancer vaccines, target viruses to cancer cells for lysis and death, decrease the blood supply to the tumor, and introduce genes into the cancer cells that cause death or restore normal cellular phenotype.

## Immuno-Therapy-

In 1891, William Coley attempted to harness the immune system for treating bone cancer, after observing a number of cancer patients that went into spontaneous remission after developing erysipelas. Immunotherapy achieved durable and complete remission in several types of malignancies and reported over 1,000 regressions or completely cured patients. Interest in the immune system burst again after 1945, with many advances in immunity and cancer research such as the discovery of interferon.

## Viral Therapy-

Oncolytic virotherapy, which uses viral particles that replicate within the cancer cell to cause cell death, is an emerging treatment modality that shows great promise, particularly with metastatic cancers.

## Thermal ablation-

It includes hyperthermia and hypothermia to destroy neoplastic tissues. Long exposures to temperatures between 41°C and 55°C are effective for tumour cell damage. Hypothermic ablation is due to the formation of ice crystals upon cooling, which destroy cell membranes and finally kill cells.

## Future Directions-

- **Robotic Surgery-** Manipulation of surgical instruments remotely by robot arms by surgeons. It is expected that precision surgery would be able to remove tumours more completely without surgical trauma.
- **Noble Metals-** the nanoparticles of gold, silver, platinum and palladium can be used to treat tumors by inhibiting angiogenesis, hyperthermia, and loading antitumor drugs. They are also used in drug delivery systems.
- **Personalized vaccines, gene editing, cell therapy and microbiome treatments** are four technologies expected to change the way cancer is treated.
- In cancer it is seen if you look at one person's tumour and compare with others it would be highly unlikely that there would be a match, therefore 'customized tailor-made medication' would be the future of cancer treatments.

## References:

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2. Pucci Carlotta, Martinelli Chiara, Ciofani Gianni (2019) Innovative approaches for cancer treatment: current perspectives and new challenges e cancer 13 961.