

History of the medical use of ionizing radiation

Eirik Malinen

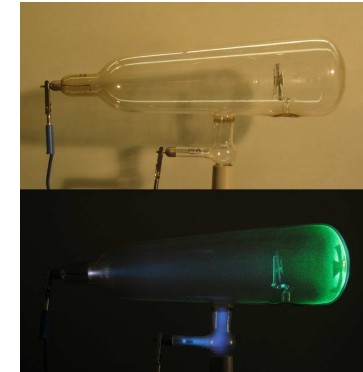


The beginning

- William Crookes studied electrical discharge in partly evacuated tubes around 1870

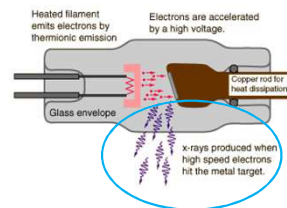


William Crookes
(1832-1919)



Röntgen's discovery

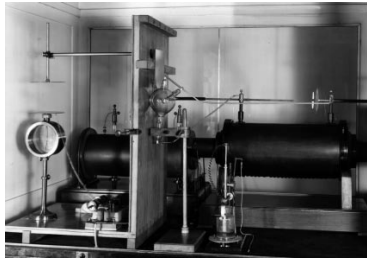
- Wilhelm Conrad Röntgen (1845-1923)



Röntgen's discovery

- Röntgen's X-rays:
 - ✓ Moved in straight lines
 - ✓ Showed no refraction, could not be focused
 - ✓ Were insensitive to magnetic field
 - ✓ Could pass through optically dense matter
 - ✓ Exposed photographic plates

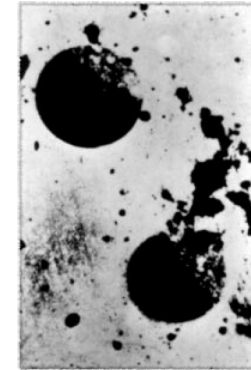
Röntgen's discovery



- New-York Times, 1896: "transformation of modern surgery by enabling the surgeon to detect the presence of foreign bodies."

X-rays....

- A.W. Goodspeed and photographer William Jennings could have discovered X-rays in 1890!



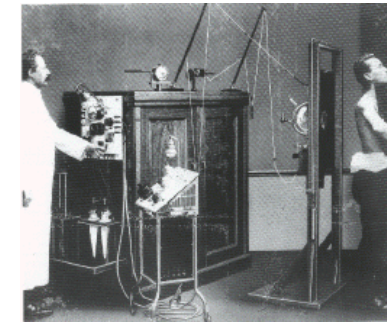
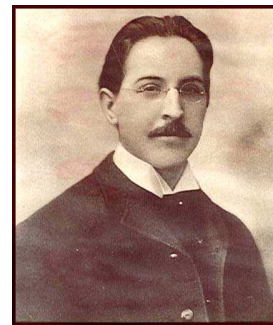
X-rays

- Applications started < 1 month after Röntgen's discovery
- Mummified cat:

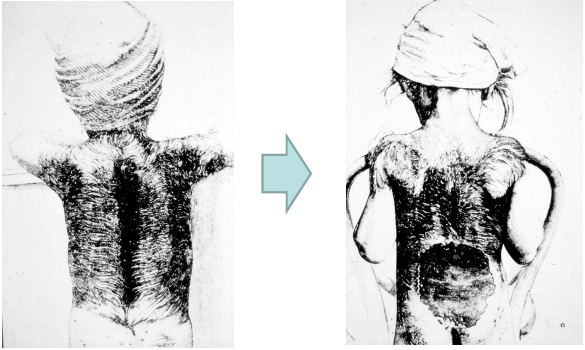



Emil Grubbé, 1896

- First treatment of cancer – at a homeopathic clinic (!)



Leopold Freund (1896)




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Victor Despeignes (1896)

- Did fractionated treatment of stomach cancer


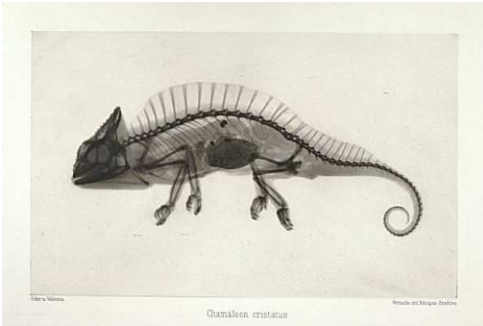


M. LE DOCTEUR
V. DESPEIGNES

UIO Department of Physics
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Oslo University Hospital

Josef Eder & Eduard Valenta




Chamaeleon cristatus


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Various 'grams



Arteriogram (1896)

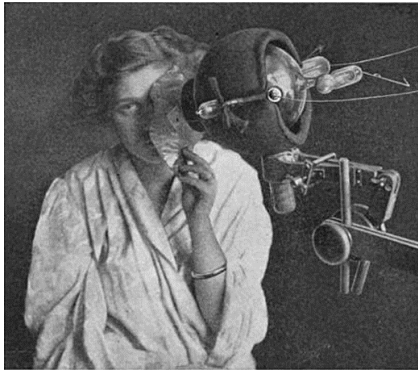


Child-"skiagram" (1896)

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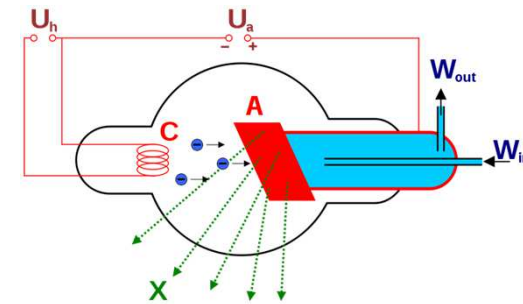
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X-ray therapy 1915

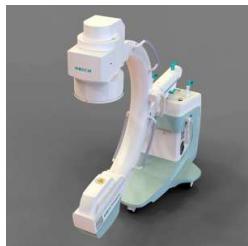


Coolidge's X-ray tube

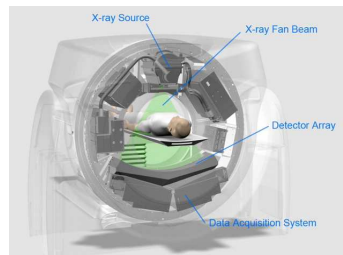
- William Coolidge invented the 'hot' cathode in 1913; Coolidge tube:



X-ray units today



Mobile C-arm x-ray unit



CT



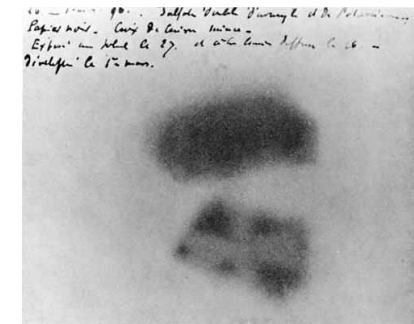
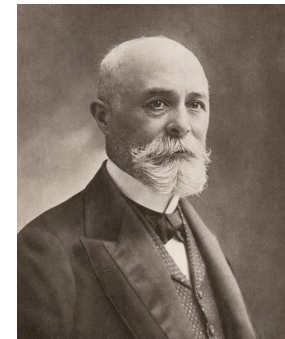
Allan Cormack



Godfrey Hounsfield

Discovery of radioactivity

- Henri Becquerel (1852-1908)



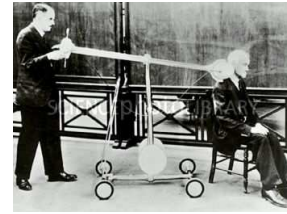
Discovery of radioactivity

- Marie Sklodowska Curie (1867-1934)
- Pierre Curie (1859-1906)



- Used electrometers to measure radioactivity

Radium therapy



Absurd applications



SHOE-FITTING TEST DATA FOR

1. ANKLE ROLL GOOD FAIR POOR

2. WEIGHT DISTRIBUTION

3. X-RAY FITTING TEST

LEFT RIGHT GOOD FAIR RIGHT LEFT RIGHT GOOD FAIR RIGHT LEFT RIGHT

RIGHT WAY % BALL % % OUTER % % % % % % % % %

WRONG WAY % HEEL % % % % % % % % % % %

This scientific way of approaching the problem of poorly-fitted shoes eliminates guesswork. Now you can see for yourself!

Absurd applications

Ich - der ganz feine Putzkörper
- mache die Zähne blendend
weiß, schon den Schmelz!


*Das ist die radioaktive biologisch wirksame
Zahncreme*

Doramad
Radioaktive Zahncreme

KLEINE TUBE 45g
GROSSE TUBE 75g

EIN ERZEUGNIS DER
AUERBESELLSCHAFT A.G. BERLIN N. 63


Absurd applications




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Absurd applications



ARTHRITIS RHEUMATISM NEURITIS

Whether it be Arthritis in its several forms, rheumatism, or gout, more than 30 per cent of all people past fifty are afflicted with disturbances of some sort in the joints. Though such conditions have resisted all other treatment, results are now possible with


RADITHOR

(Not a Drug)
The Modern Weapon of Curative Science

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Radium girls



The Power of Radium at Your Disposal
Twenty-three years ago radium was unknown. Today, thanks to constant laboratory work, the power of this most unusual of elements is at your disposal. Through the medium of Undark, radium serves you safely and surely. Does Undark really contain radium? Most certainly, it is radium, combined in exactly the proper manner with fine sulphur, which gives Undark its ability to shine continuously in the dark.


Manufacturers have been quick to recognize the value of Undark. They apply it to the dials of watches and clocks, to electric hand lanterns, to the buckles of bed room slippers, to house numbers, flashlights, compasses, gasoline gauges, sextants and many other articles which you frequently wish to see in the dark.

The next time you fumble for a lighting switch, bark your skin on furniture, wonder vainly what time it is because of the date-rememberer Undark, *Flasher in the dark*. Undark can supply you with Undarked articles.

For interesting little factory visitings of the production of radium and the uses of Undark address

RADIUM LUMINOUS MATERIAL CORPORATION
NEW YORK CITY

UNDARK
Radium Luminous Material
Shines in the Dark



To Manufacturers
The number of manufactured radium in each Undark will add several million to your output. From extra radium and sulphur, we gladly receive inquiries from manufacturers and, when it seems advisable, will try an experiment with the Undark. Undark may be applied either at your plant, or at our own.

The application of Undark is simple. It is furnished in a paste form, which is applied to any surface. The paste then dries to a hard, smooth, and adhesive. It adheres firmly to any surface.

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Radium girls

- Factory started in 1917
- Daily amount of Radium
- High doses to bone (10 Gy →)
- Bone necrosis in the jaw
- Developed bone cancer
- Lawsuit in 1928



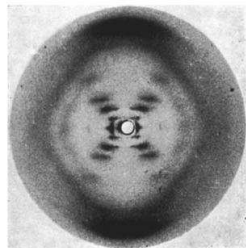
Herman Muller

- Worked on X-ray mutagenesis in flies

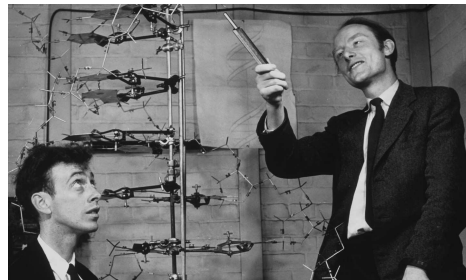


Watson and Crick

- Used X-ray diffraction to uncover the structure of DNA



«Photo 51»



Radiation measurement

- 1900: Photographic plates and **electrometers**
- 1900: Therapeutic dose: irradiate to dermatitis
- 1908: “Liberation electricity”
- 1914: Dose = “intensity multiplied by time”
- 1928: R – ionizations in dry air

Gray

- Louis Harold Gray (1905-1965)

$$1 \text{ Gy} = 1 \text{ J/kg}$$

(1975)



- Worked on dose measurements and radiobiology
- Developed RBE concept

Radiation protection

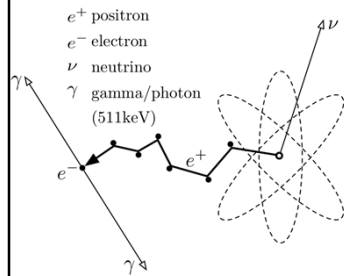


1910

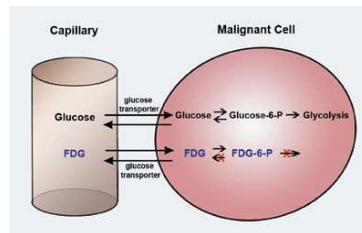
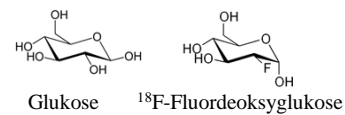


1950

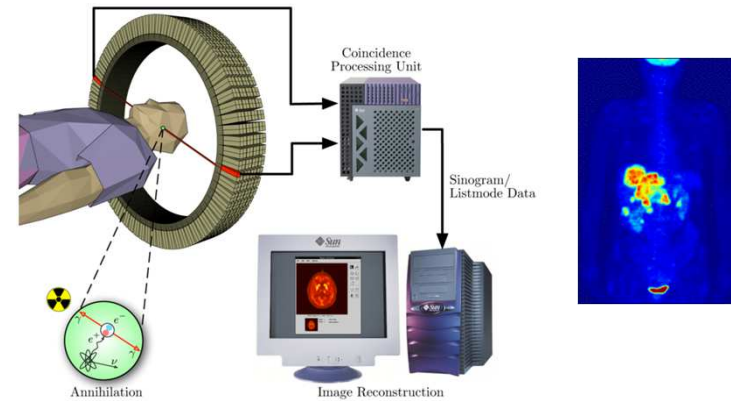
Positron emission tomography



Paul Dirac Carl Anderson



Positron emission tomography

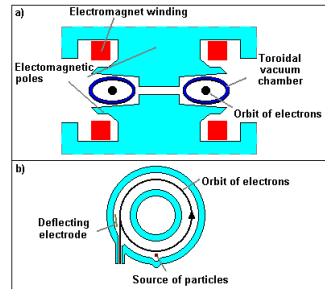


Betatron

- Developed by Donald Kerst in 1940, but concept outlined by Rolf Widerøe



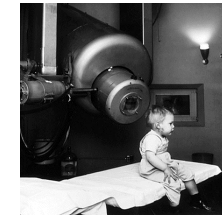
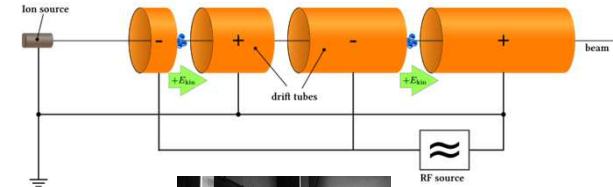
First clinical use in 1948



Betatron a) Cross-section b) Section through the toroidal vacuum chamber

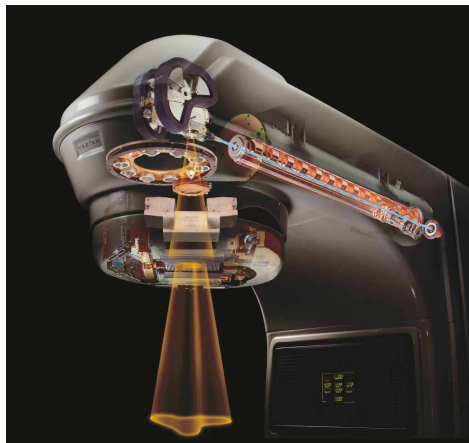
Linear accelerator

- Concept and design by Leó Szilárd, Rolf Widerøe and Gustav Ising; 1924-1928

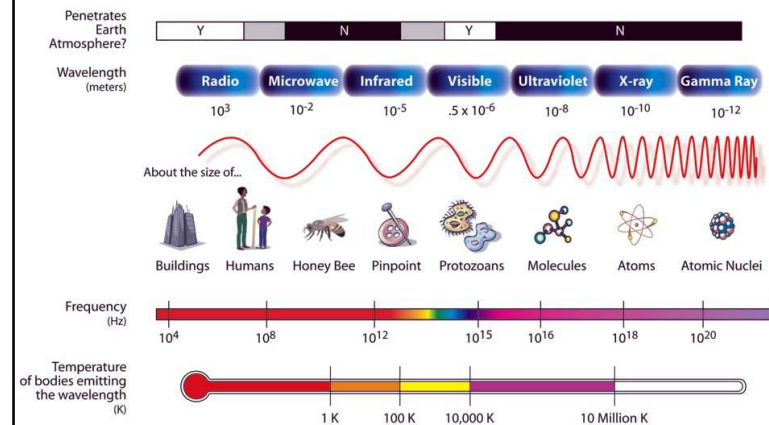


First clinical use in 1953

Linear accelerator today

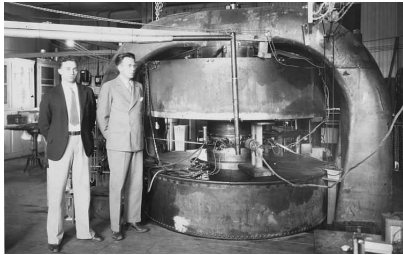
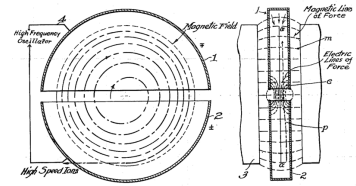


Electromagnetic spectrum



Cyclotron

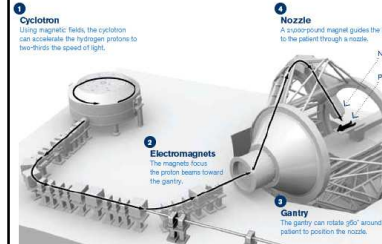
- Concept and design by Ernest Lawrence; 1932



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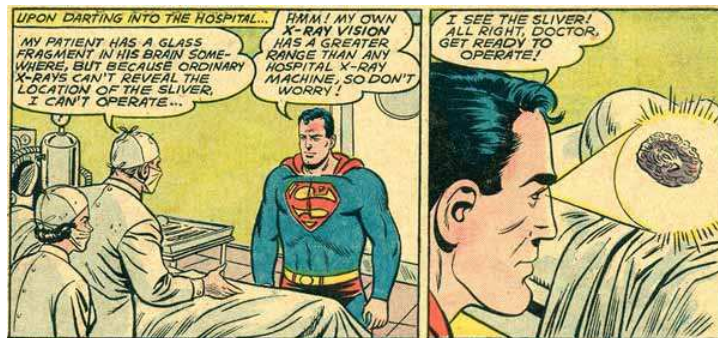
Cyclotron and proton therapy



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Superman's X-ray vision....



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