

# History of the medical use of ionizing radiation

Eirik Malinen

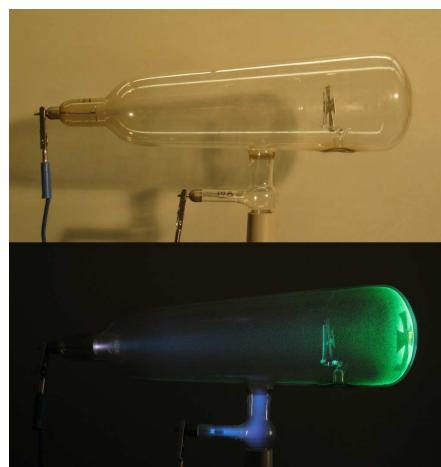


## The beginning

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

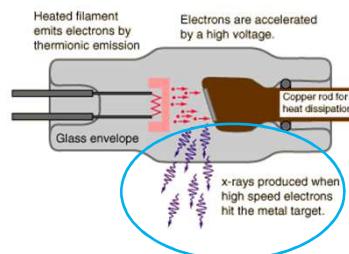


William Crookes  
(1832-1919)



# Röntgen's discovery

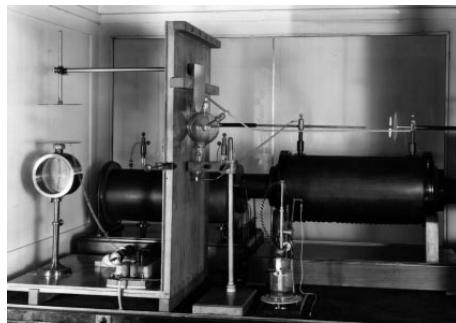
- Wilhelm Conrad Röntgen (1845-1923)



# 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

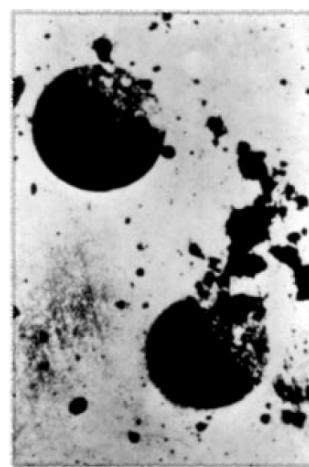
## Röntgen's discovery



- 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:

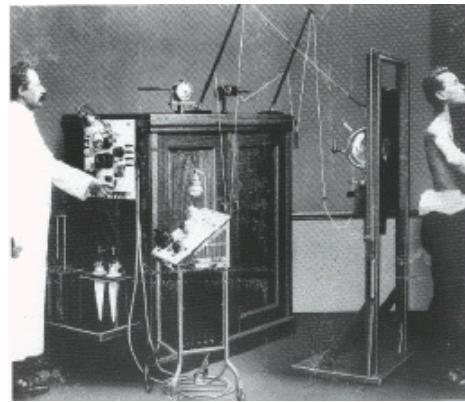


UiO Department of Physics  
University of Oslo

 Oslo University Hospital

## Emil Grubbé, 1896

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

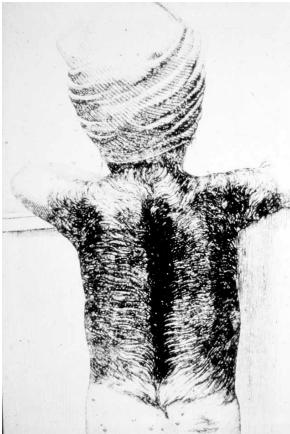


UiO Department of Physics  
University of Oslo

 Oslo University Hospital



# Leopold Freund (1896)



A blue arrow points from the first X-ray to the second, indicating a progression or comparison.

UiO Department of Physics  
University of Oslo

 Oslo University Hospital

# Victor Despeignes (1896)

- Did fractionated treatment of stomach cancer

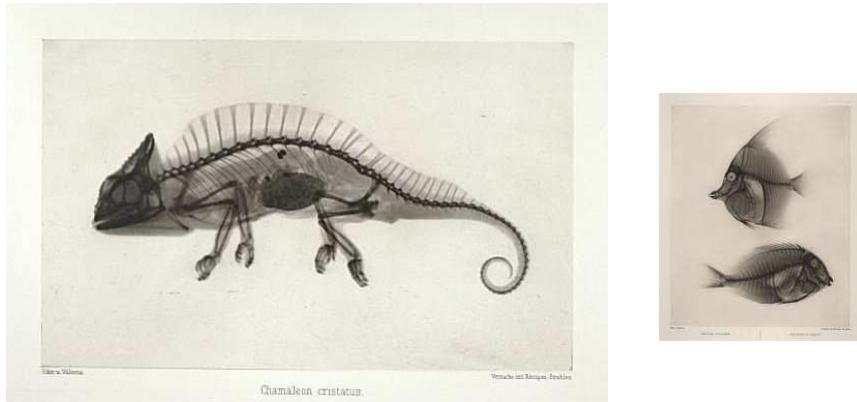


M. LE DOCTEUR  
V. DESPEIGNES

UiO Department of Physics  
University of Oslo

 Oslo University Hospital

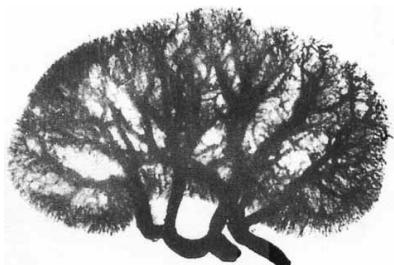
## Josef Eder & Eduard Valenta



UiO Department of Physics  
University of Oslo

Oslo University Hospital

## Various 'grams



Arteriogram (1896)



Child-“skiagram” (1896)

UiO Department of Physics  
University of Oslo

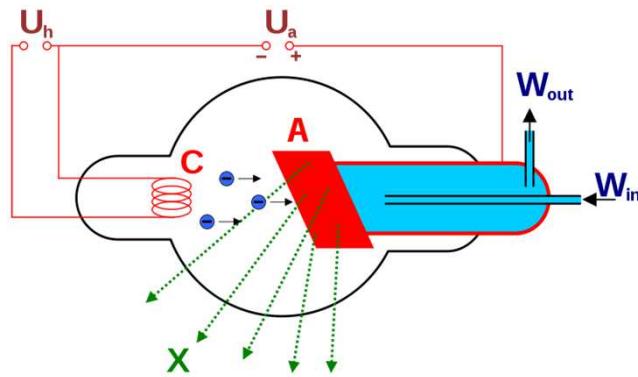
Oslo University Hospital

## X-ray therapy 1915

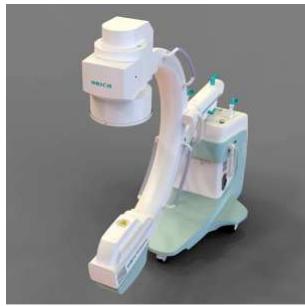


## Coolidge's X-ray tube

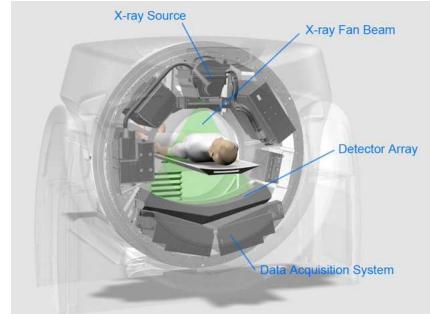
- William Coolidge invented the 'hot' cathode in 1913; Coolidge tube:



## X-ray units today



Mobile C-arm x-ray unit



CT



Allan Cormack

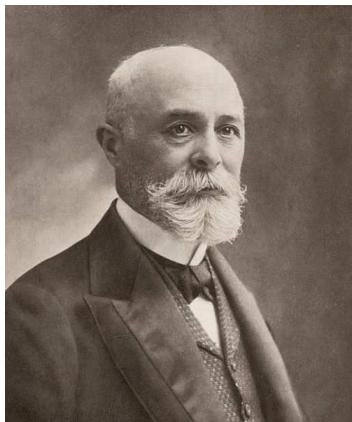


Godfrey Hounsfield



## Discovery of radioactivity

- Henri Becquerel (1852-1908)



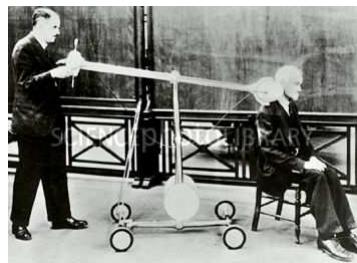
# Discovery of radioactivity

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

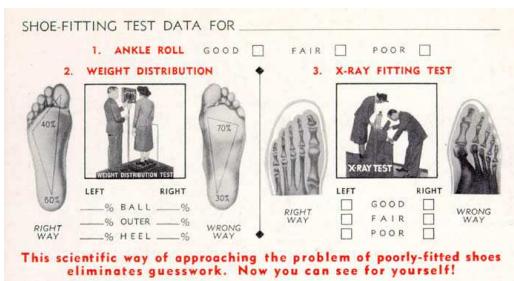


- Used electrometers to measure radioactivity

# Radium therapy



## Absurd applications



UiO Department of Physics  
University of Oslo

Oslo University Hospital

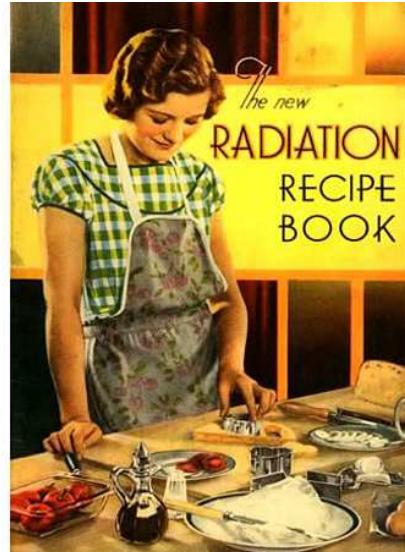
## Absurd applications



UiO Department of Physics  
University of Oslo

Oslo University Hospital

## Absurd applications



UiO Department of Physics  
University of Oslo

 Oslo University Hospital

## Absurd applications



UiO Department of Physics  
University of Oslo

 Oslo University Hospital

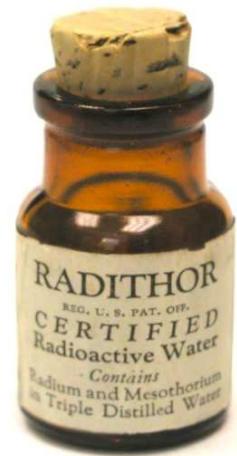
## Absurd applications



UiO Department of Physics  
University of Oslo

 Oslo University Hospital

## Absurd applications



### ARTHRITIS RHEUMATISM NEURITIS

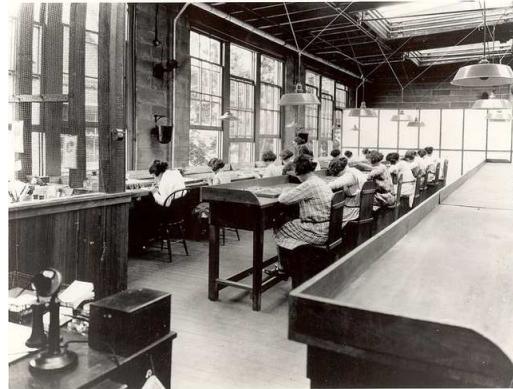
Whether it be Arthritis in its several forms, rheumatism, or gout, more than 30 per cent of all people past fifty are afflicted with disturbances of some sort in the joints. Though such conditions have resisted all other treatment, results are now possible with

**RADITHOR**  
(Not a Drug)  
The Modern Weapon of Curative Science

UiO Department of Physics  
University of Oslo

 Oslo University Hospital

## Radium girls



UiO Department of Physics  
University of Oslo

Oslo University Hospital

## 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



UiO Department of Physics  
University of Oslo

Oslo University Hospital

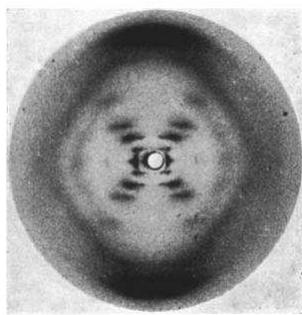
## Herman Muller

- Worked on X-ray mutagenesis in flies

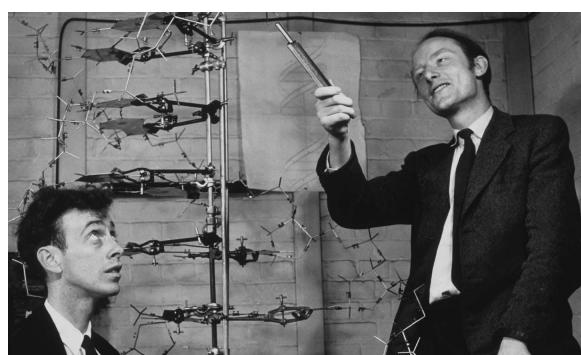


## Watson and Crick

- 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

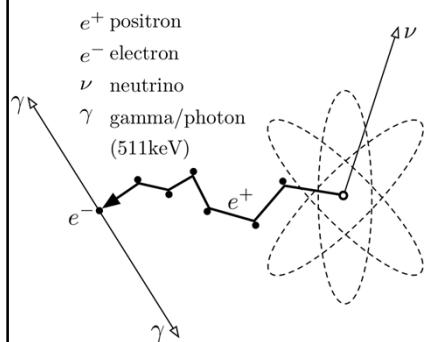


1910



1950

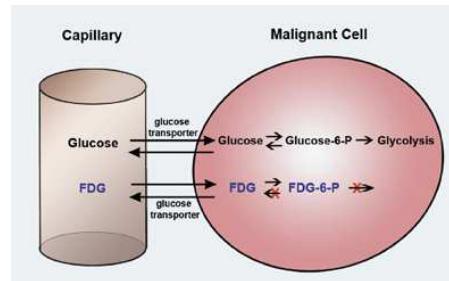
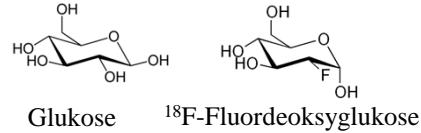
# Positron emission tomography



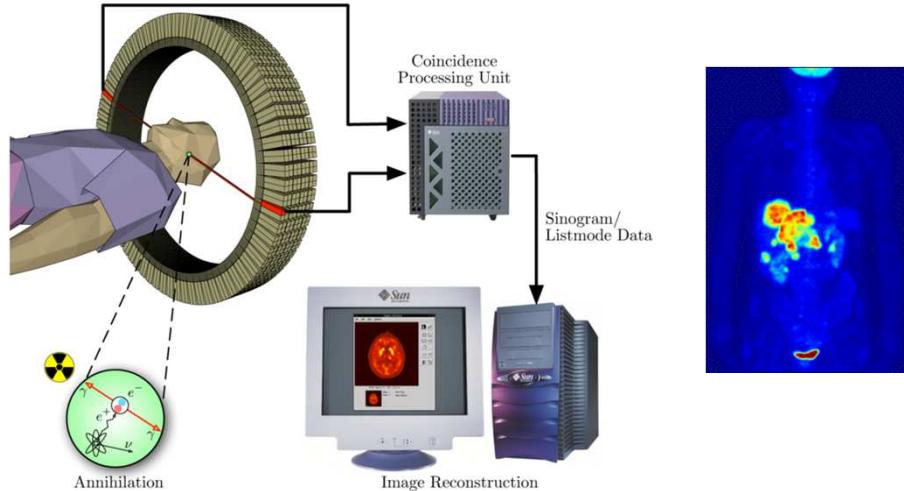
Paul Dirac



Carl Anderson



## Positron emission tomography



UiO Department of Physics  
University of Oslo

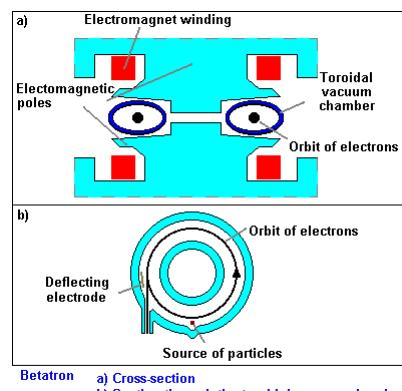
Oslo University Hospital

## Betatron

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



First clinical use in 1948

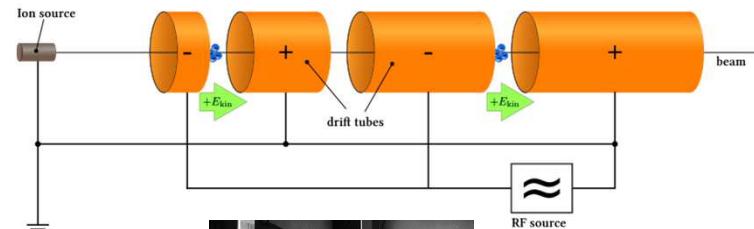


UiO Department of Physics  
University of Oslo

Oslo University Hospital

## Linear accelerator

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



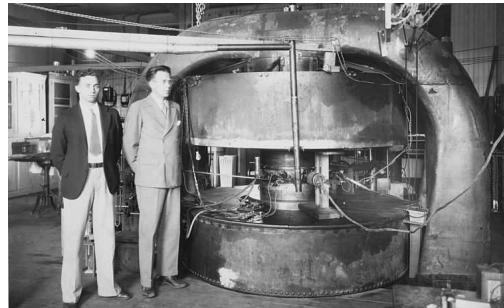
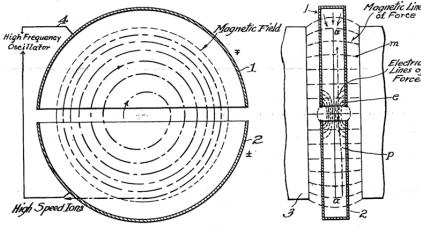
First clinical use in 1953

## Linear accelerator today



# Cyclotron

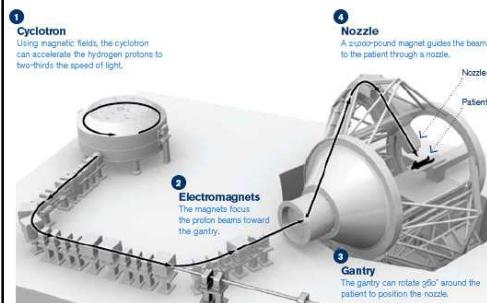
- Concept and design by Ernest Lawrence; 1932



UiO Department of Physics  
University of Oslo

 Oslo University Hospital

# Cyclotron and proton therapy



UiO Department of Physics  
University of Oslo

 Oslo University Hospital

## Superman's X-ray vision....

