History of the medical use of ionizing radiation

Eirik Malinen

The beginning

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

Victor Despeignes (1896)

- Did fractionated treatment of stomach cancer
Josef Eder & Eduard Valenta

Various ‘grams

Arteriogram (1896)

Child-“skiagram” (1896)
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 Składowska Curie (1867-1934)
- Pierre Curie (1859-1906)

- Used electrometers to measure radioactivity

Radium therapy
Absurd applications
Absurd applications

Absurd applications
Absurd applications

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
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
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

Glucose $^{18}$F-Fluordeoxyglukose
Positron emission tomography

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

Betatron

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

First clinical use in 1948
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

Cyclotron and proton therapy
Superman’s X-ray vision....

UPON ENTERING THE HOSPITAL...

MY PATIENT HAS A GLASS FRAGMENT IN HIS EYE. SOMEBODY... BUT BECAUSE ORDINARY X-RAYS CAN’T REVEAL THE LOCATION OF THE SLIVER, I CAN’T OPERATE...

WELL, I’M MY OWN X-RAY VISION HAS A GREATER RANGE THAN ANY ROCITAL X-RAY MACHINE, SO DON’T WORRY!

I SEE THE SLIVER! ALL RIGHT, DOCTOR, GET READY TO OPERATE!