

Red Marrow Dosimetry for Former Radium Workers



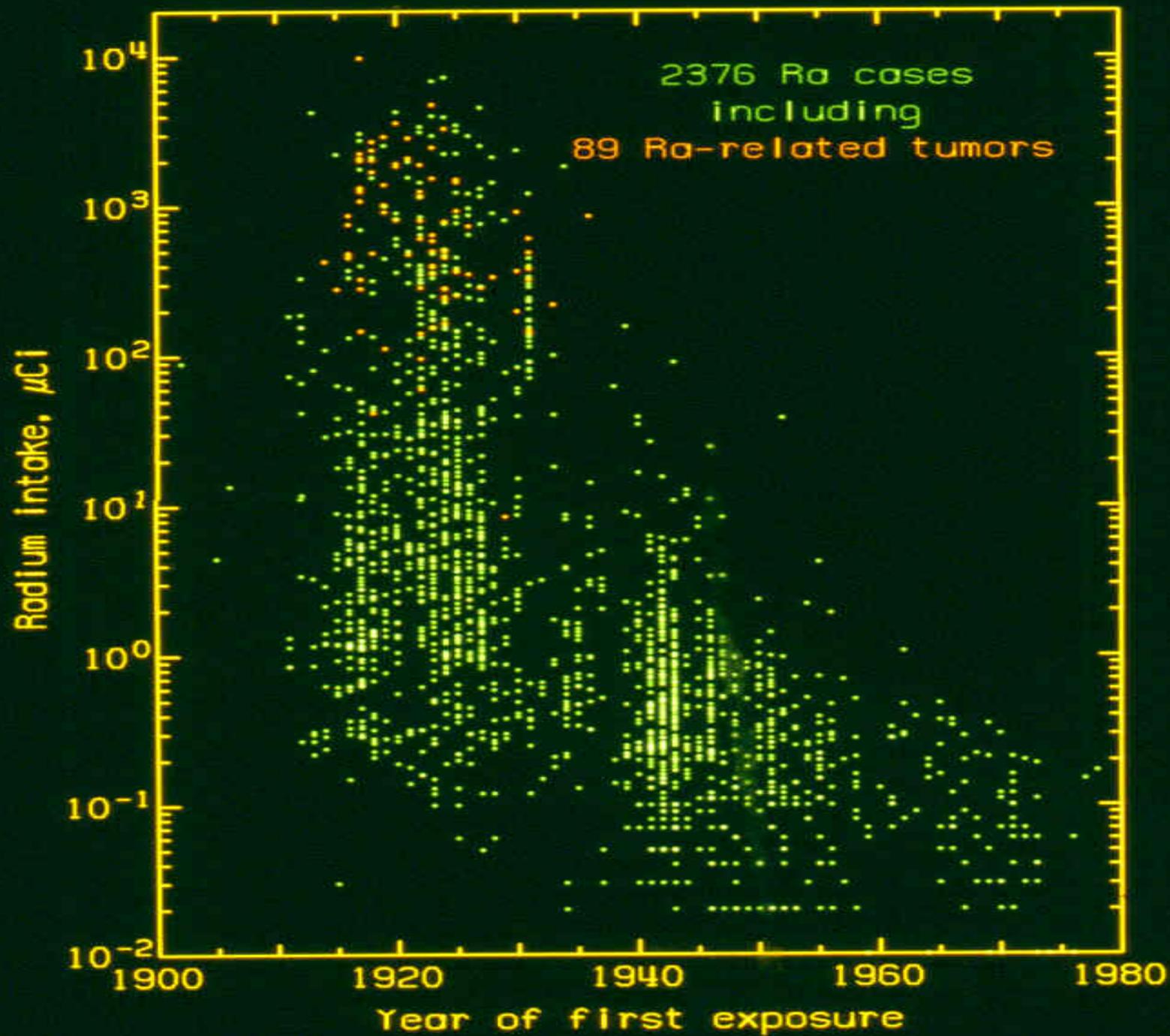
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1955: Norris function:

$$R(t) = 0.54 R(0) t^{-0.52}$$

Based on measured retention in patients
at Elgin (IL) State Hospital injected
with ^{226}Ra for treatment of
schizophrenia

However, some question as to the exact
injected amounts

$$R(50 \text{ y}) = 0.35\%$$

1973: ICRP 20 Alkaline Earth Retention Model (Ca, Sr, Ba, Ra)

$$R = (1 - p)e^{-mt} + p\varepsilon^b(t + \varepsilon)^{-b}[\beta e^{-r\lambda t} + (1 - \beta) e^{-\sigma r\lambda t}]$$

$$R(50y) = 0.9\%$$

1982: Schlenker modified 5 parameters in the ICRP 20 model for retention in soft tissue

$$R(50y) = 0.2\%$$

1993: Rowland further modified the ICRP 20 model, changing the value of λ (the apposition and resorption rate in cortical bone) from 1.5% to the originally proposed 2.5%, resulting in

$$R(50y) = 0.1\%$$

ICRP-30 model: $R(50y)^* = 0.15\%$

ICRP-78 model: $R(50y)^* = 0.5\%$

* Corrected for $f_1 = 0.2$

RM Dose Coefficients for ^{226}Ra

- ICRP 67 DC = 8.9×10^{-7} Sv/Bq adult
- ICRP 67 DC = 4.1×10^{-6} Sv/Bq 15-yr old

- ICRP 78 DC = 2.8×10^{-7} Sv/ Bq $^{-1}$ adult
- ICRP 78 DC = 1.5×10^{-6} Sv/ Bq $^{-1}$ 15-yr old

But what is the appropriate w_R value?

W_R Values

- Alpha emitters, stochastic effects: 20
- Alpha emitters, tissue reaction effects: 2
- The P-H anomaly is a specific mutation of the lamin-B receptor in leukocytes
- So we decided to stick with absorbed dose, because for a biodosimeter, that is the quantity of interest.

Summary results

<u>Parameter</u>	<u>Range</u>
Number of cases	166
Date of first exp.	1914-1950
Age at first exp.	13-40 years old
Duration of exp.	1-1800 weeks
Dates of blood draws	~1960 -- ~1975
RM absorbed dose	0--6.8 Gy