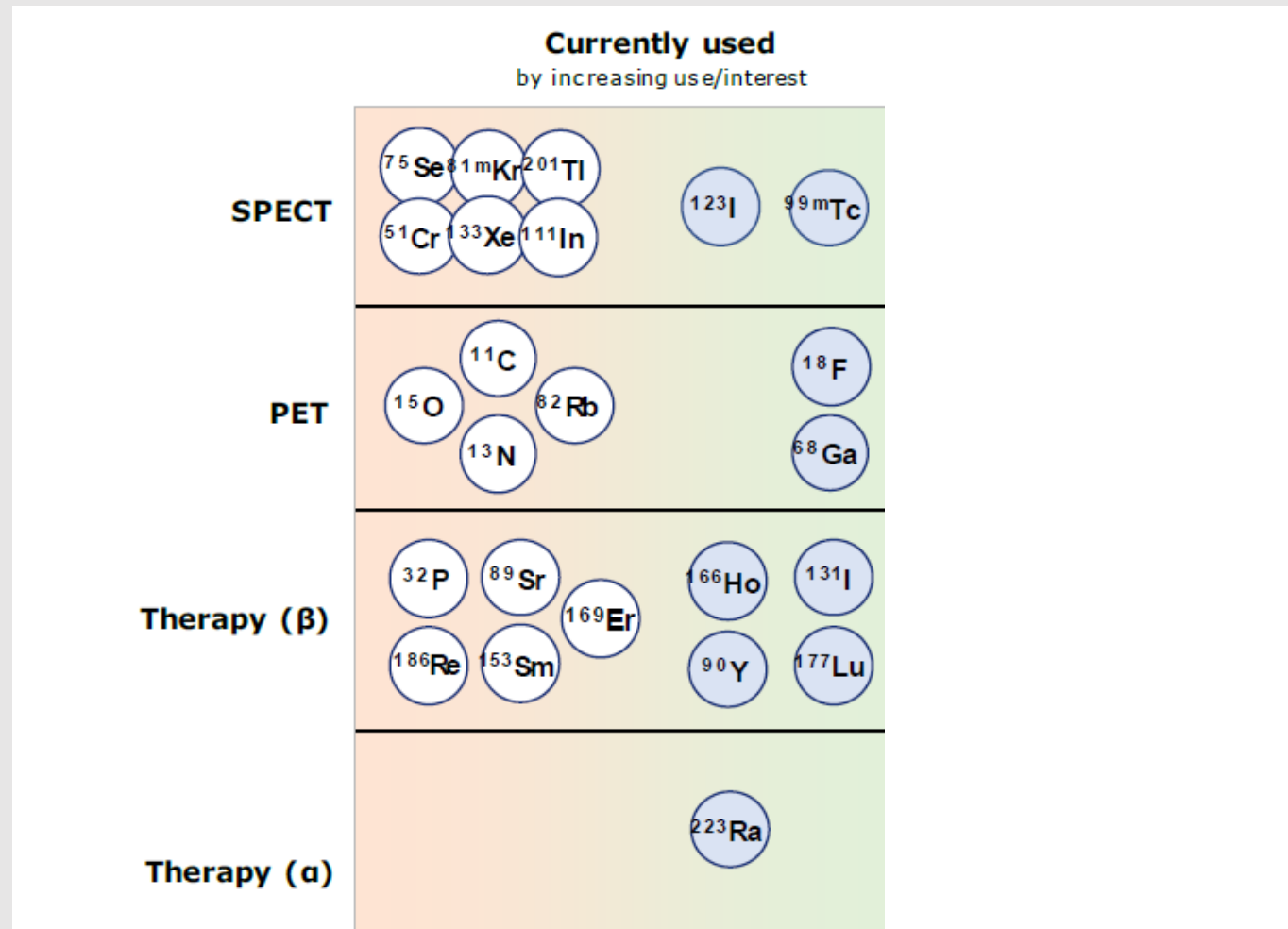


Emerging radioisotopes in radiopharmaceutical research – a preclinical perspective

Dr Veronika Rosecker

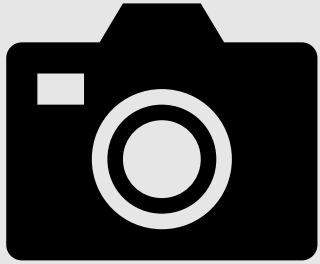
Department of Imaging Chemistry & Biology, King's College London, St. Thomas' Hospital, London,
United Kingdom

Radioisotopes in clinical use



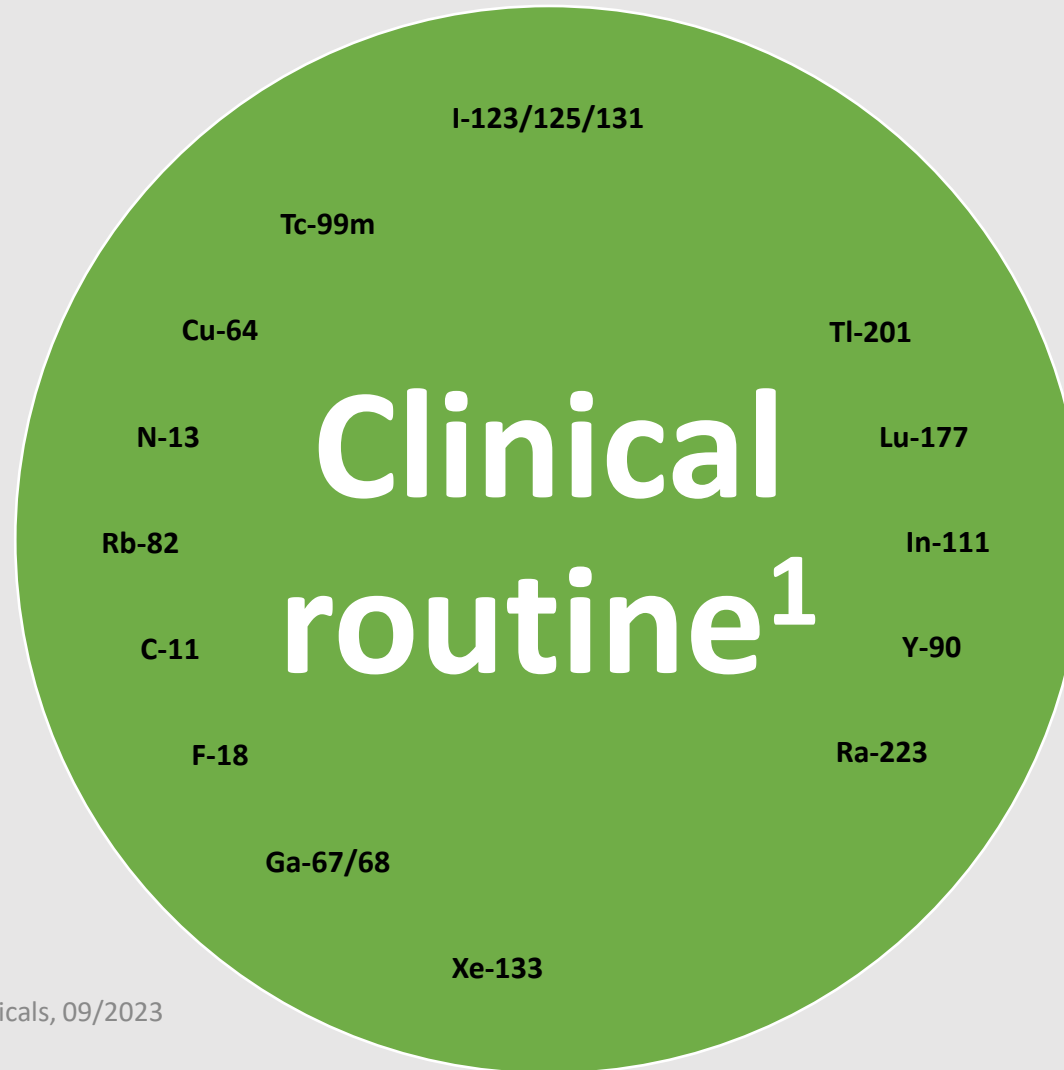
Adapted from: Eur. Comm. (2019) doi:10.2833/120792.; p 39

Radioisotopes in clinical routine



IMAGING

γ -camera
SPECT
PET



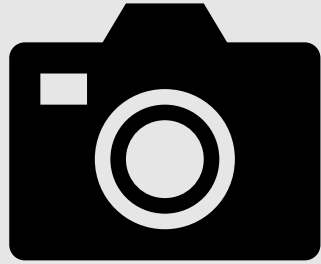
THERAPY

α -emitter
 β^- -emitter

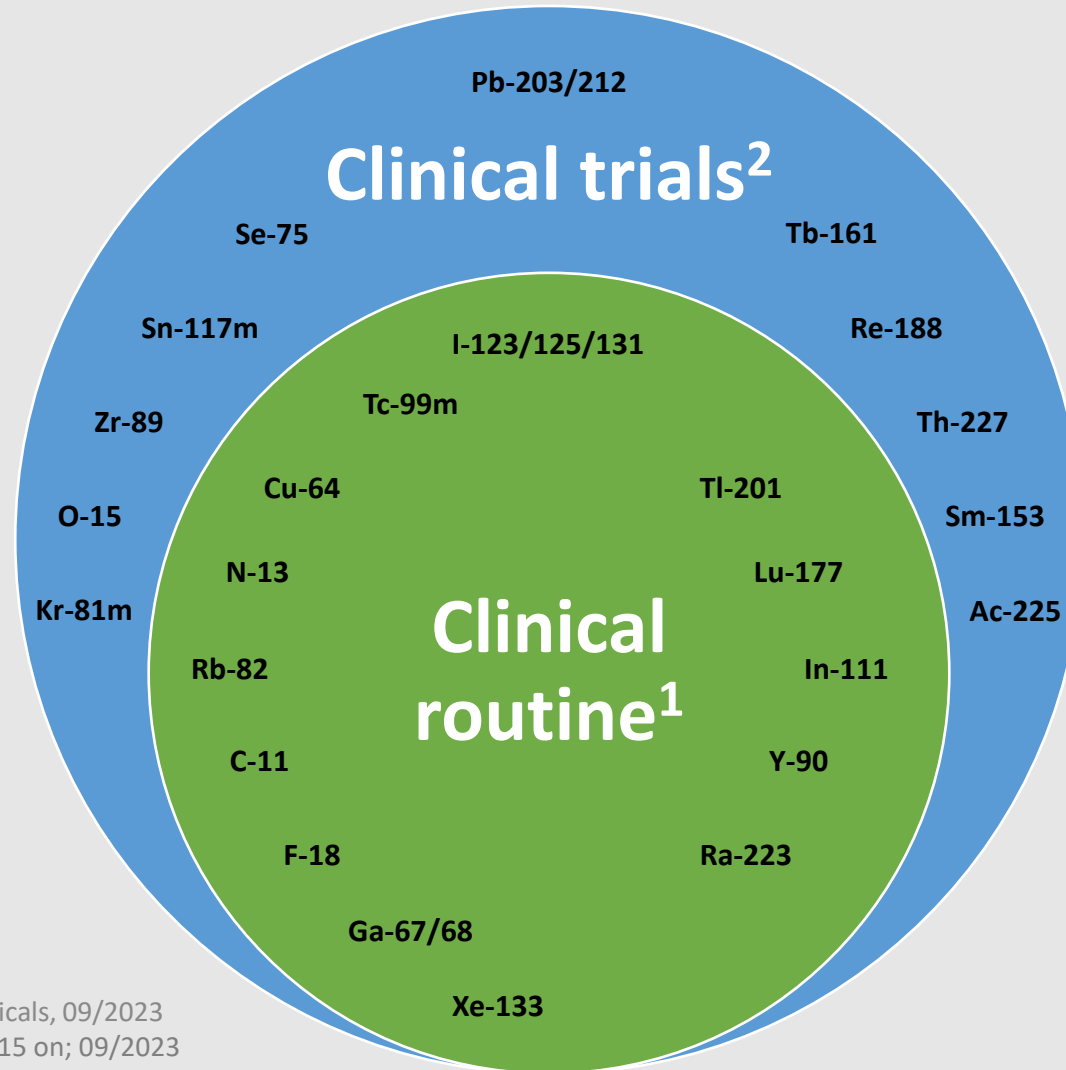
¹ Radioisotopes of FDA approved radiopharmaceuticals, 09/2023

Isotopes for brachytherapy are not included

Radioisotopes in clinical routine & research



IMAGING
 γ -camera
SPECT
PET



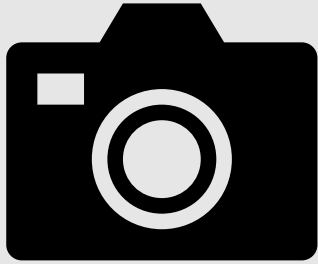
THERAPY
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¹ Radioisotopes of FDA approved radiopharmaceuticals, 09/2023

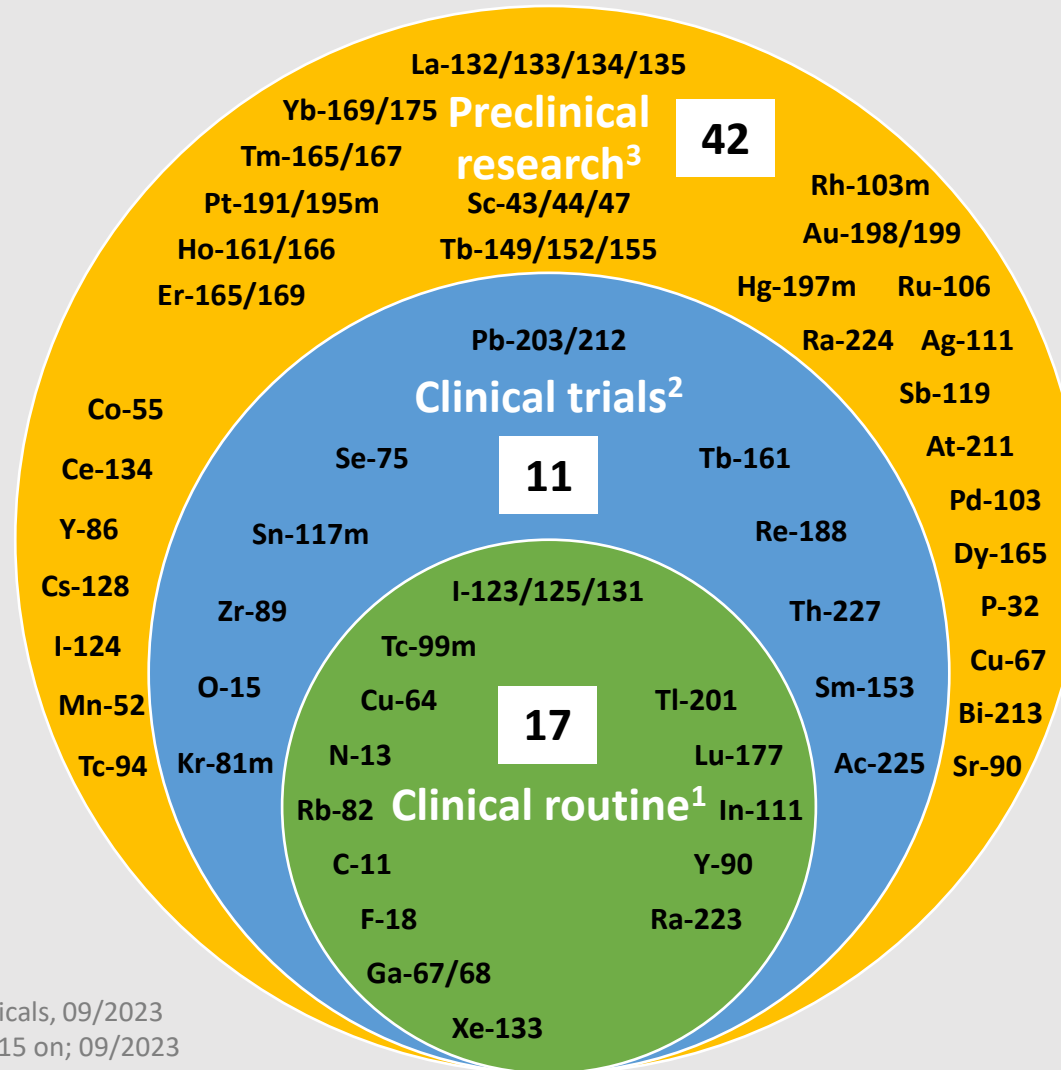
² clinicaltrials.gov; studies included from 01/2015 on; 09/2023

Isotopes for brachytherapy are not included

Radioisotopes in clinical routine & research



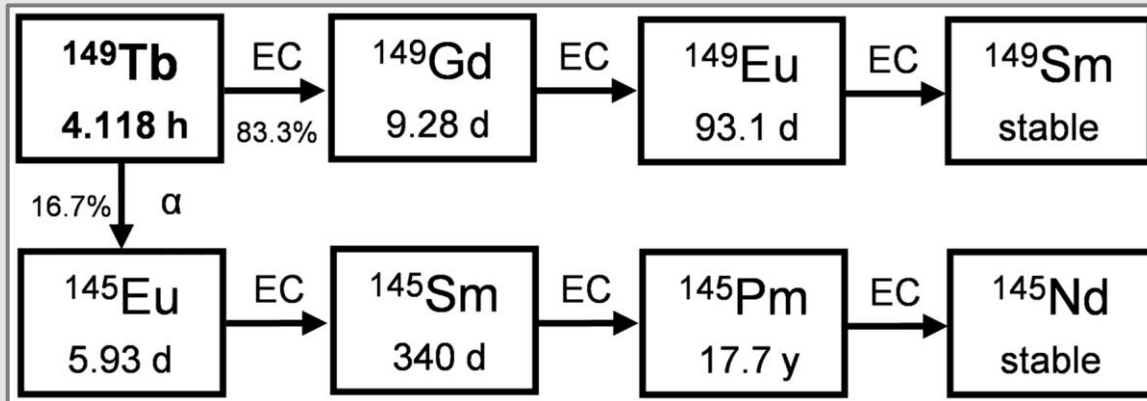
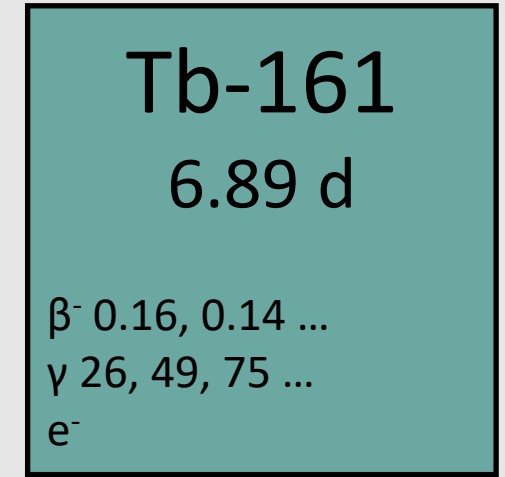
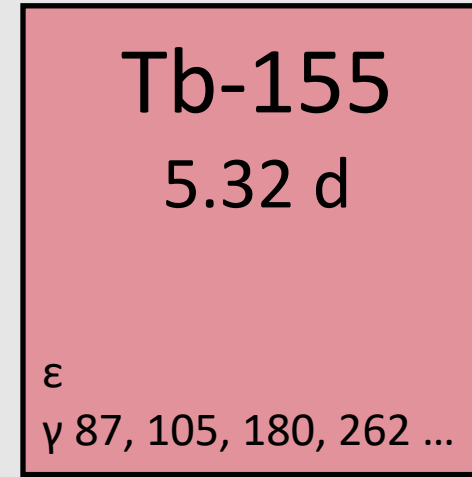
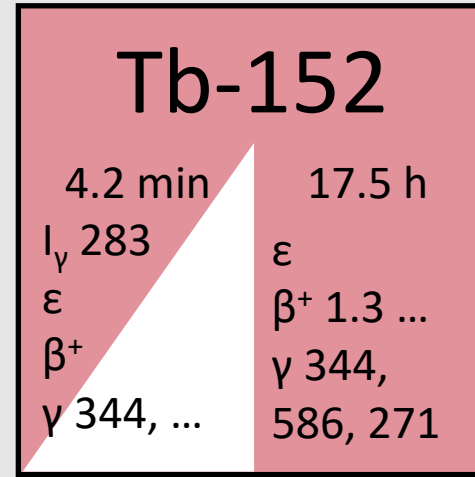
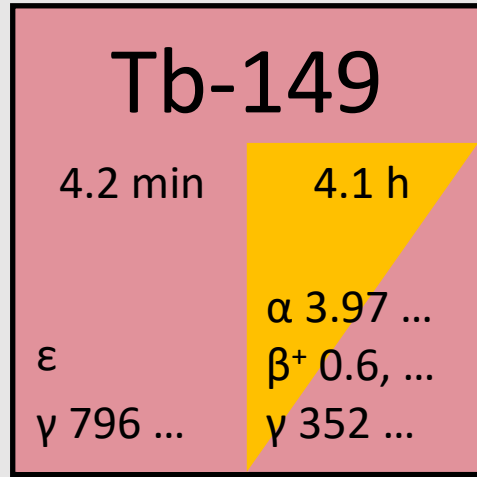
IMAGING
 γ -camera
 SPECT
 PET



THERAPY
 α -emitter
 β^- -emitter
 Auger-Meitner e^-

¹ Radioisotopes of FDA approved radiopharmaceuticals, 09/2023
² clinicaltrials.gov; studies included from 01/2015 on; 09/2023
³ radioisotopes identified for potential application in nuclear medicine
 Isotopes for brachytherapy are not included

The terbium radioisotopes



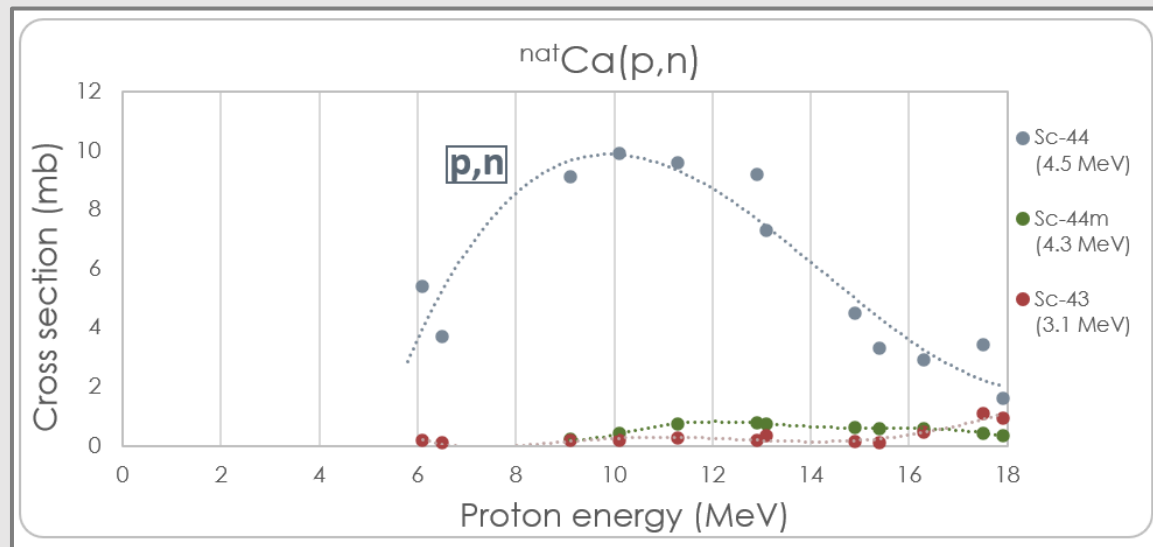
- True theranostics with α -emitter
- Complicated decay scheme
 - QC & calibration factors
 - Long-lived daughters
- Tb-161 production

Adapted from: JNM Nov 2021, 62 (11) 1495-1503; DOI: 10.2967/jnumed.120.261016

The scandium radioisotopes

<p>Sc-43 3.89 h</p> <p>β^+ 0.5, 0.3 ... γ 373 ... ϵ</p>	<p>Sc-44</p> <p>58.61 h 3.97 h</p> <p>I_γ 271 ϵ β^+ 0.6 ... γ (1002...) γ 1157</p>	<p>Sc-47 3.35 d</p> <p>β^- 0.16 ... γ 159</p>
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- Sc-44: $E_\gamma = 1157$ keV (99%)
 - Increased dose-rate
 - Different shielding requirements



cross-section for $^{44}\text{Ca}(p,n)$ reaction;
with permission from Dr Karin Nielsen

- High purity Sc-43/44
 - Enriched materials
 - Impurities: Sc-44m

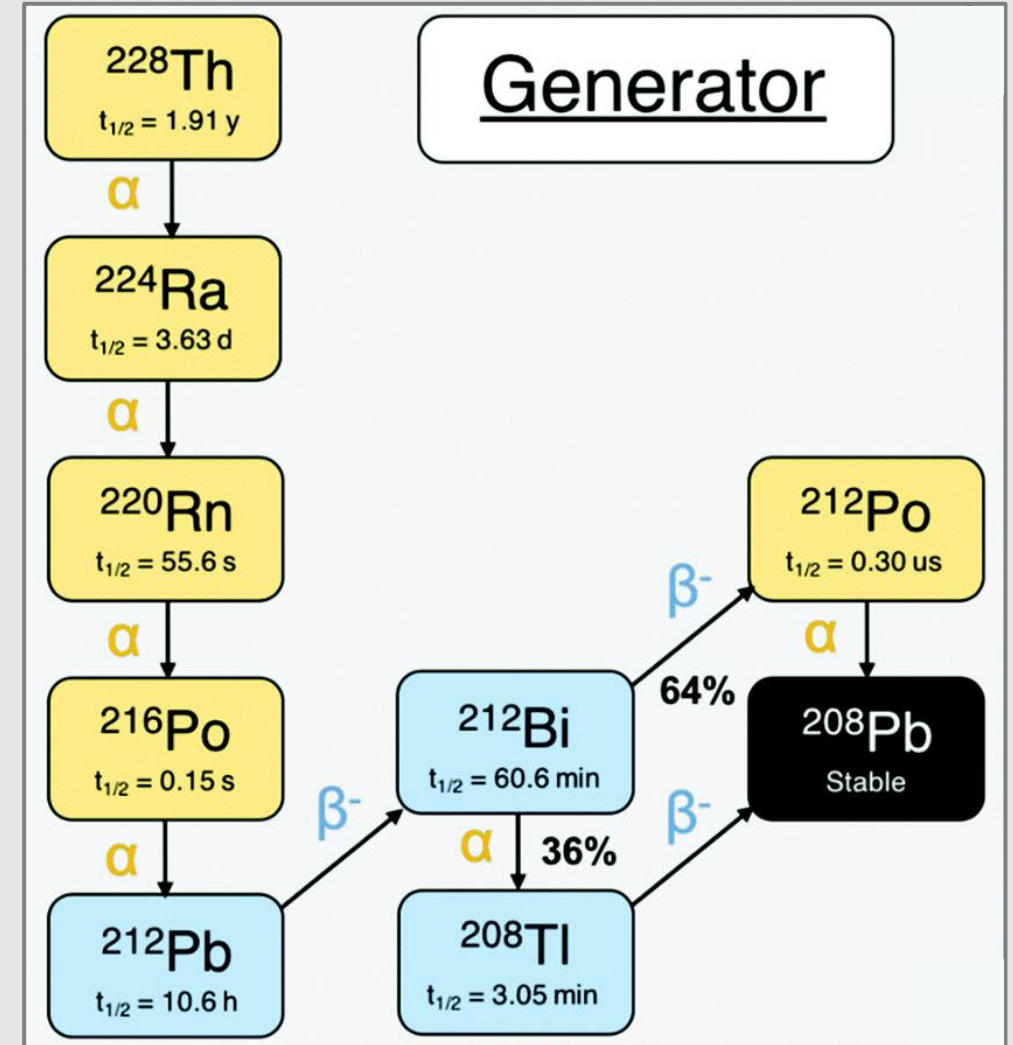
The lead radioisotopes

Pb-203	
6.2 s	51.9 h
I_{γ} 825, 820 ...	ϵ γ 279, 401 ...

Pb-212
10.62 h
β^- 0.1, 0.2 ... γ 239, 300 ...

- Complicated decay scheme
 - QC & calibration factors
- Rn-220 \uparrow
- Po-216: $E_{\alpha} = 6.7$ MeV

Adapted from: Dalton Trans., 2021,50, 11579-11595



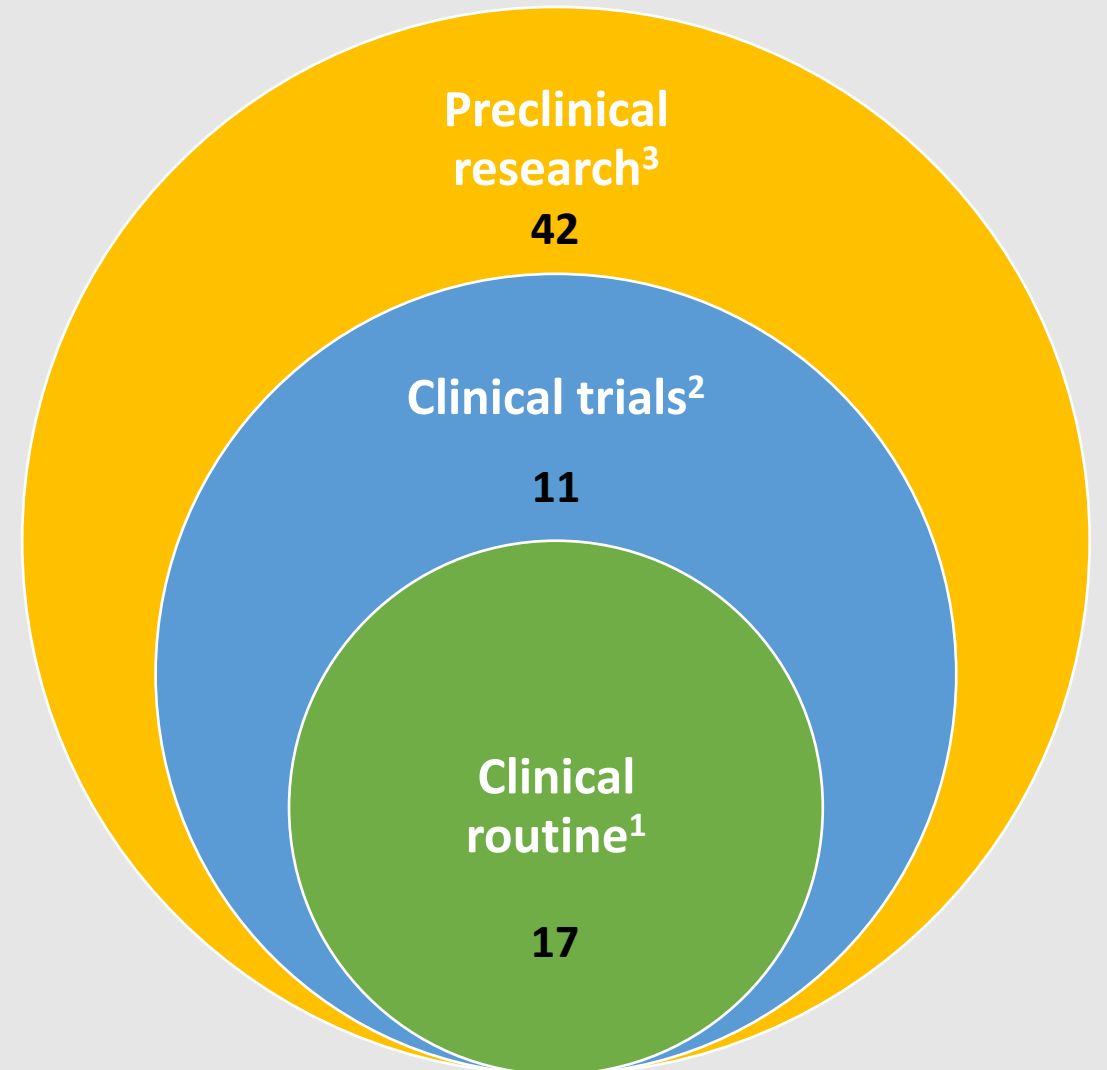
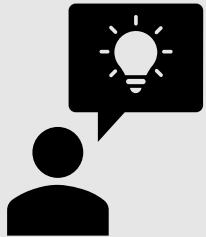
Challenges and questions

- Isotopes
 - Sufficient quantity & quality
 - Stable & reliable supply
- Practical considerations
 - Waste & stock storage
 - Licencing & space
- Quality control
 - Calibration factors
 - QC methods
- Staff training
- Patient care



Conclusion & Outlook

- Therapeutic isotopes
- True theranostic pairs
- Auger-Meitner e⁻-emitters



Thank you

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