

A Brief History of Radiopharmaceutical Therapy

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Program
August 13, 2025



WISCONSIN DEPARTMENT
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Agenda

- History
- Projected growth
- New radioisotopes
- Challenges



History of Approvals

1951: I-131
sodium
iodide

1957: P-32
sodium
phosphate

1974: P-32
chromic
phosphate

1993: Sr-
89
Metastron

1997:
Sm-153
Quadramet

2002: Y-
90 Zevalin

2003: I-131
Bexxar

2013:
Ra-223
Xofigo

2018:
Lu-177
Lutathera

2018: I-131
Azedra

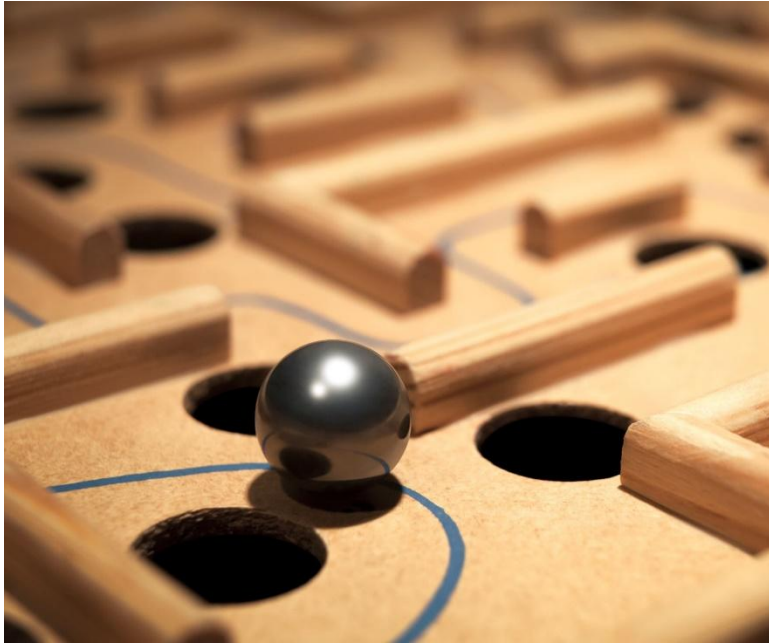
2022:
Lu-177
Pluvicto




$$11 - 6 = 5$$



Pitfalls of Early Drugs

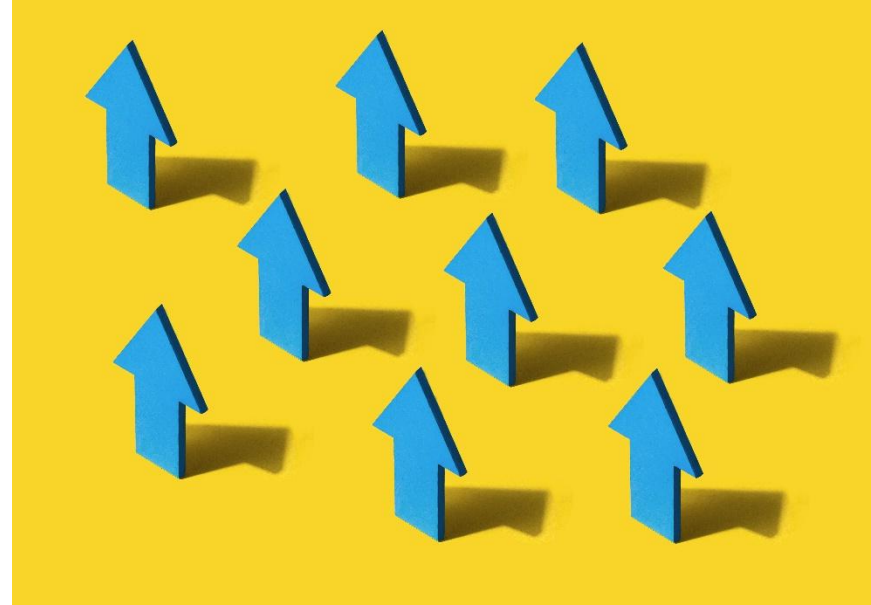


- Single fraction
- Non-radioactive options
- Drug cost
- Irradiation of normal tissue




Projected Growth


- 38 companies
- 45 clinical stage programs
- More than 275 therapy clinical trials



New Radioisotopes


Actinium-225

 10 day half-life


 4 alphas, 2 betas
to stable Bi-209

Astatine-211

 7.2 h half-life


 1 alpha, 1 EC to
stable Pb-207


Lead-212

 10.6 hour half-life

 2 betas, 1 alpha
to stable Pb-208

Thorium-227

 18.6 day half-life

 5 alphas, 2 betas
to stable Pb-207




New Radioisotopes

Scandium-47

 3.3 day half-life

 Beta decay to
to stable Ti-47

Copper-67

 61.8 hour half-life


 Beta decay to
stable Zn-67

Rhenium-186

 3.7 day half-life

 Beta decay to
stable Os-186

Terbium-161

 ~7 day half-life

 Beta decay to
stable Dy-161



Licensing Challenges (1 of 2)

- Actinium-227 impurities
 - 10 microcurie limit for financial assurance
 - Annual limit on intake of 0.4 nanocuries
 - Reportable spill threshold of 2 nanocuries
- Guidance: <https://www-pub.iaea.org/MTCD/publications/PDF/TE-2057web.pdf>



Licensing Challenges (2 of 2)

- High purity targets are needed to limit co-production of impurities with longer half-lives.
- Lower energy gammas may introduce geometric dependency on activity measurements (Tb-161).
- How will generators be licensed?



Considerations for Future

- More targeted therapeutics
- Wider variety of isotopes
- How to license impurities

<https://isotopes.gov/program-highlights>





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