

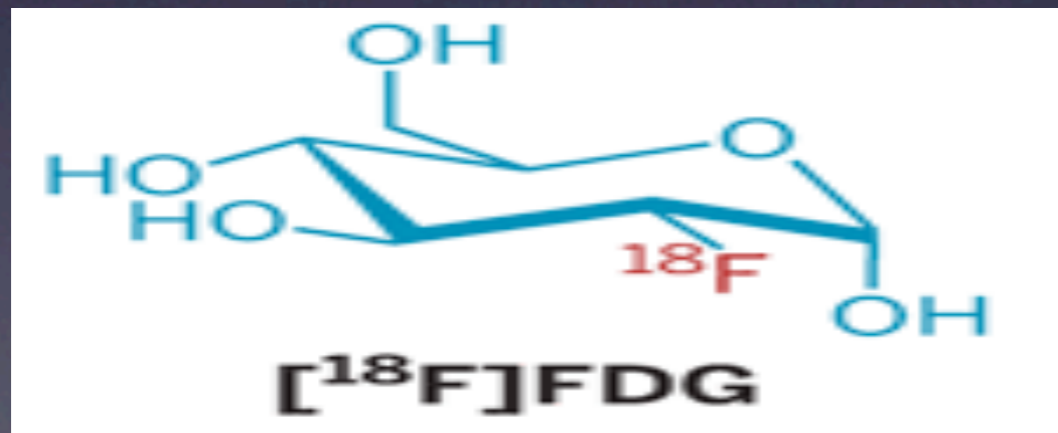
Making a radiotracer: bombarding with neutrons or protons



Ask Mish



Copyright © 2007 Theodore W. Gray

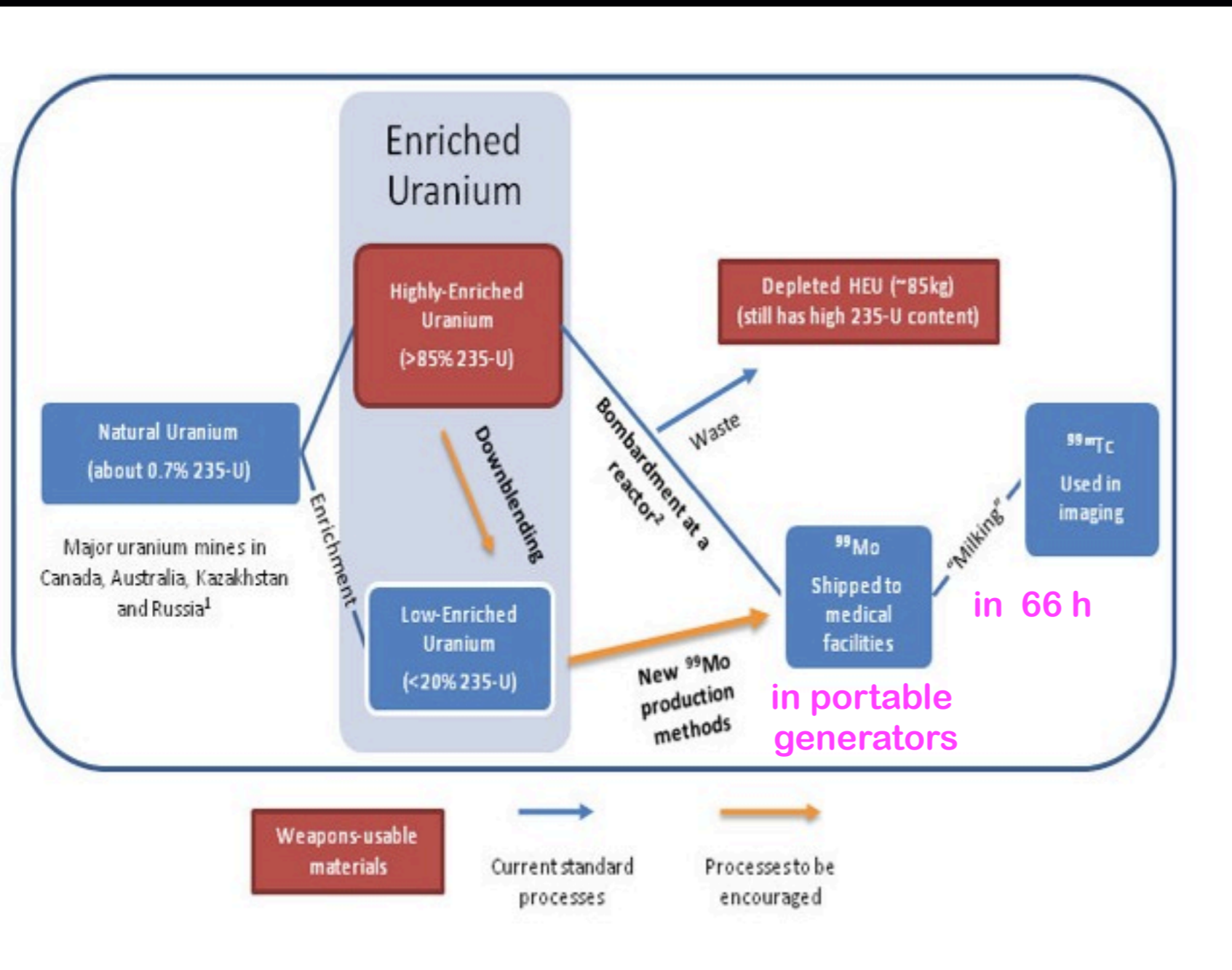


- by artificially unbalance Z/N ratio:
- one way is **bombarding w/ neutrons** in nuclear **reactors** making long live isotopes into shorter live; sometimes these shorter live isotopes are put into a portable generator since they decay further into very short live isotopes. E.g. **Tc99m** which is attached to another molecule carrier (ligand) and used as a radiotracer.
- another is **bombarding w/ protons** in **cyclotrons** (charged particle accelerators, a linear accelerator rolled up into a spiral) E.g. **F18**. FDG (fluorodeoxyglucose) is produced by placing F18 in position 2 on glucose ring, replacing -OH.

Tc 99 m production in reactor and generator



Ask Mish

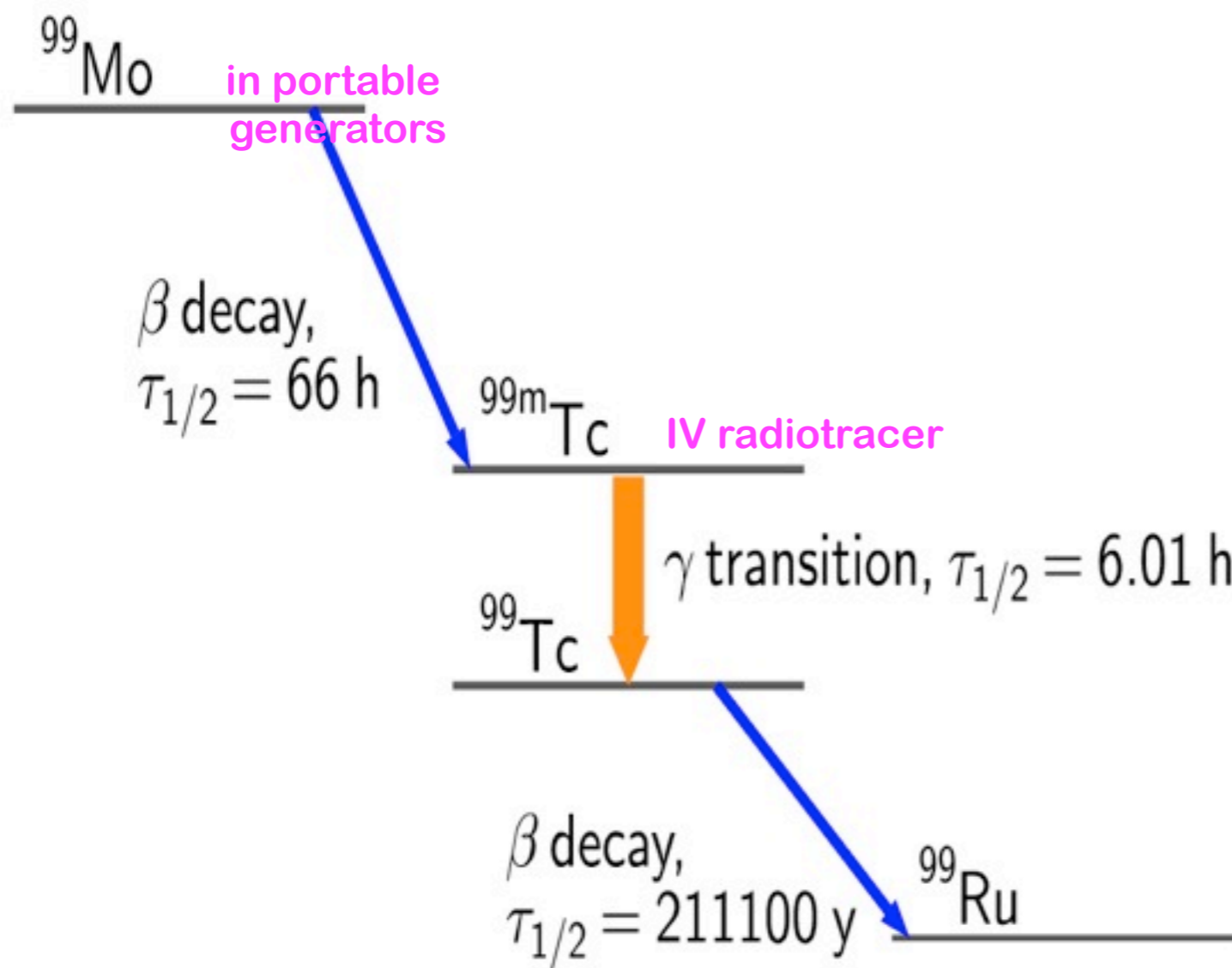


- **metastable** refers to **longer** $T_{1/2}$ of 6 hrs in comparison w/ 10to-16 for natural isotopes
- **Tc 99m production: in reactor:**
U 235 +neutron \rightarrow U 236 unstable \rightarrow nuclear fission
-
>Mo 99 +other products
- **in portable generator: Mo 99 \rightarrow decays in 66hrs to Tc 99m**



Ask Mish

Tc 99 m production in generator and use as an IV radiotracer

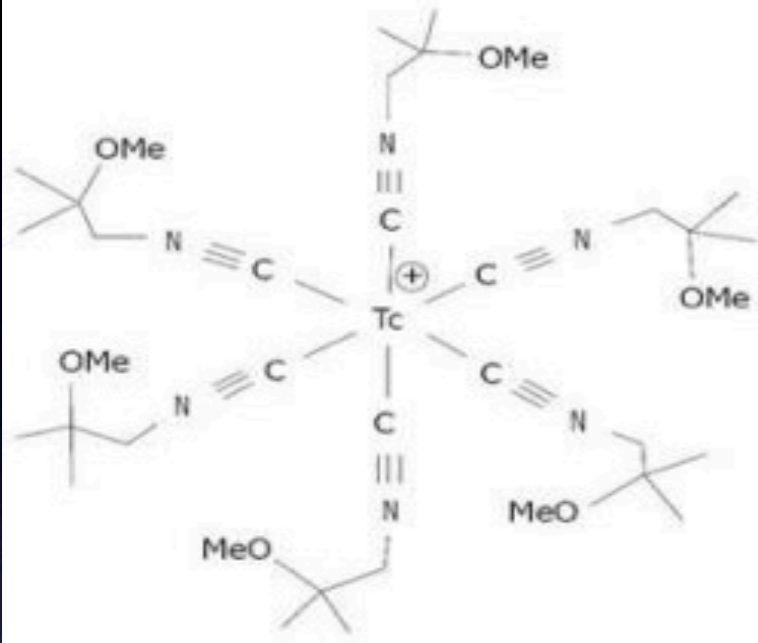


- Other way of producing Tc99m is Mo98 in cyclotron \rightarrow Mo99, this is first way to obtain Tc99m in 1938
- Tc99m \rightarrow Tc99 in 2 ways:
- 88% IT : long excited state with decay in 6 hrs (Tc99m) \rightarrow short excited Tc99 through gamma emission
- 12% energy released ejected electron (K/L/M) producing ionization IC : internal conversion
- Tc99m vs Tc99, difference: SPIN
- T1/2 physical : 6hrs for Tc 99m = decay in 6 hrs
- T1/2 biological: 24 hrs for leaving the body

Tc 99m LIGANDS

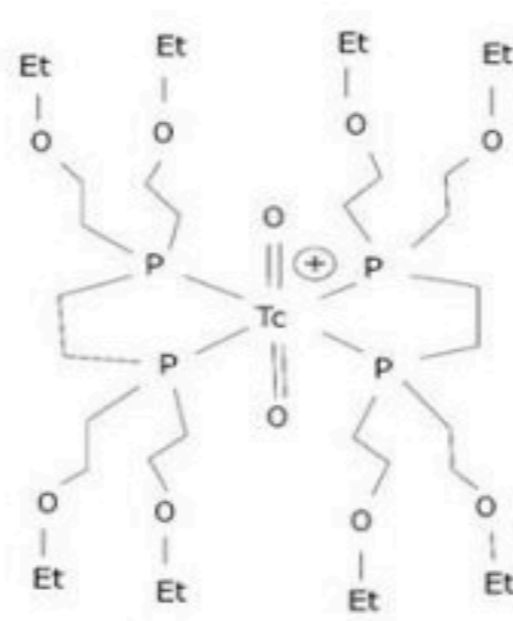


Ask Mish



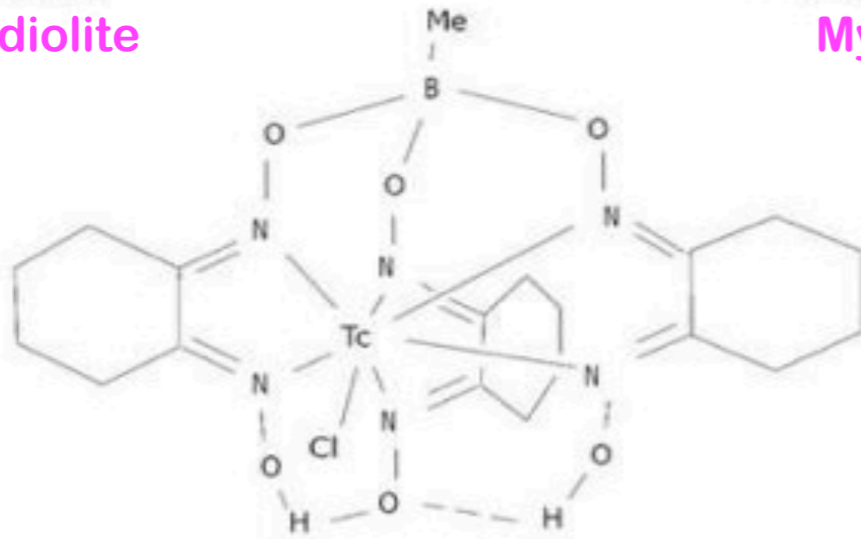
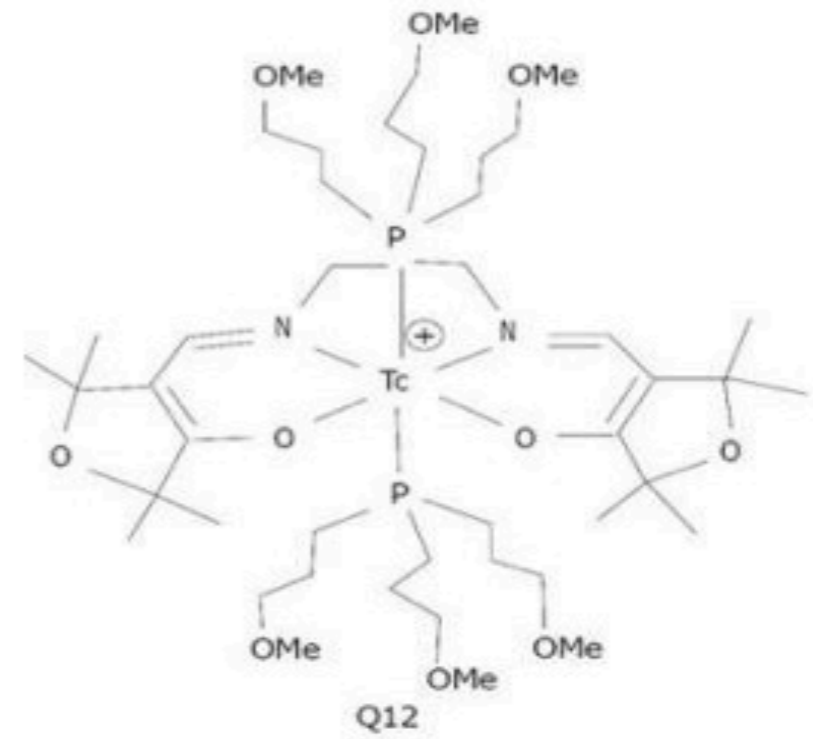
^{99m}Tc-sestamibi

Cardiolite

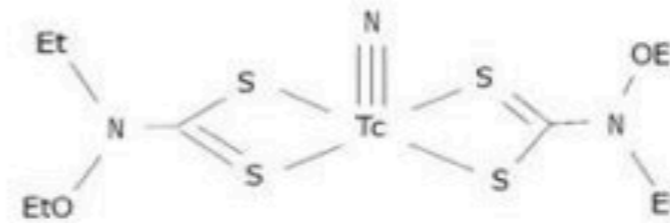


^{99m}Tc-tetrofosmin

Myoview



^{99m}Tc-teboroxime



^{99m}TcN-NOET

How to obtain unstable isotopes to make a radiotracer



Ask Mish

Place	Reaction	Final product	Next
Nuclear reactor	neutron bombard-> nuke fission	unstable isotopes	separation & move to generators
Generator	unstable isotope from fission decays	unstable isotopes	IT: isomeric transition EC: e capture
Cyclotron	proton bombard	unstable isotopes	B+: beta + decay