Production via Double Neutron Capture - Since yields of radioisotopes produced by the double neutron capture process are proportional to the square of the neutron flux, the reactor neutron flux is an important factor for this common reaction pathway. Two radioisotope parents produced by this process which are of current interest for generator systems (Table 3) are tungsten-188 (parent of rhenium-188) and dysprosium-166 (parent of holmium-166). Holmium-166 can be produced directly from neutron irradiation of holmium-165 (monoisotopic in nature) but long-lived holmium-166*m* [half-life 1,200 years; 810 keV (57 %) and 712 keV (54 %) gammas, etc.] is also produced. As an alternative, dysprosium-166 produced from dysprosium-164 [10] provides carrier-free holmium-166 (containing no holmium-166*m*), which is separated by *HPLC* methods and is currently used for radiation synovectomy, etc. Rhenium-188 is readily separated from tungsten-188 on alumina (*vide infra*) and is of interest for a variety of therapeutic applications.

HFIR Production by the Inelastic (n,n') Route From Enriched Tin-117 - Tin-117*m* is produced with relatively low specific activity (5-6 mCi/mg) by neutron irradiation of enriched tin-116. Specific activity can be increased in the *HFIR* by a factor of about 3 by the tin-117(n, n')tin-117*m* inelastic route (20-22 mCi/mg) [11]. In contrast to the other radioisotopes of current interest for palliation, tin-117*m* decays by conversion electron emission. The low energy conversion electrons travel only a very limited distance in tissue, which may preclude potential bone marrow depression, which can be a limiting factor with high energy β^--emitting radioisotopes, is precluded. Potential advantages of tin-117*m* are the absence of high energy beta particles, the emission of a gamma photon of nearly optimal energy for imaging, and high metastatic uptake. Production of tin-117*m* in nuclear reactor involves radiative capture by the (n,γ) route by irradiation of enriched tin-116, or *via* the inelastic $(n,n'\gamma)$ route by irradiation of enriched tin-117. We have evaluated both these routes in detail using the *ORNL HFIR* [11], where specific activity values of 8-10 mCi/mg from enriched tin-117 after a long irradiation time (1 cycle = 24 days) are routinely obtained. The metallic powder target is shipped directly to customers for processing and preparation of the Sn-117*m*(IV)-*DTPA* complex.

Radionuclide Generators Requiring Reactor-Produced Parents

Radionuclide generators continue to play an important role in nuclear medicine [12-14]. Two radionuclide generators which are based on reactor-produced parent radioisotopes which are of current major interest (Table 3) provide dysprosium-166 (dysprosium-165/dysprosium-166) [10] and rhenium-188 (tungsten-188/rhenium-188) [15-19].