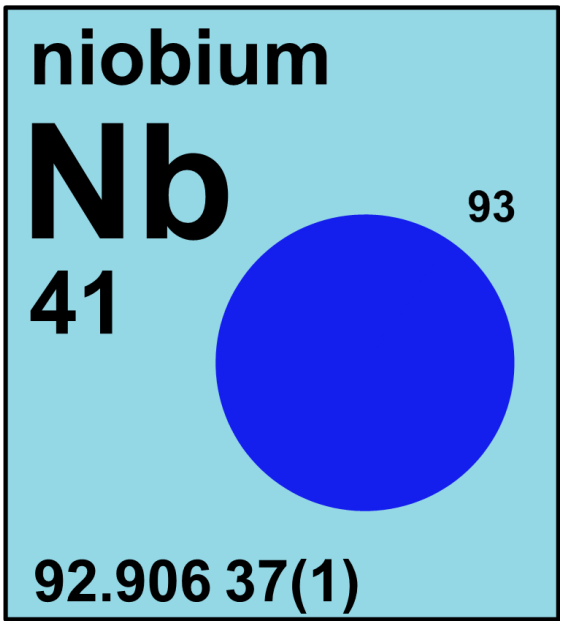
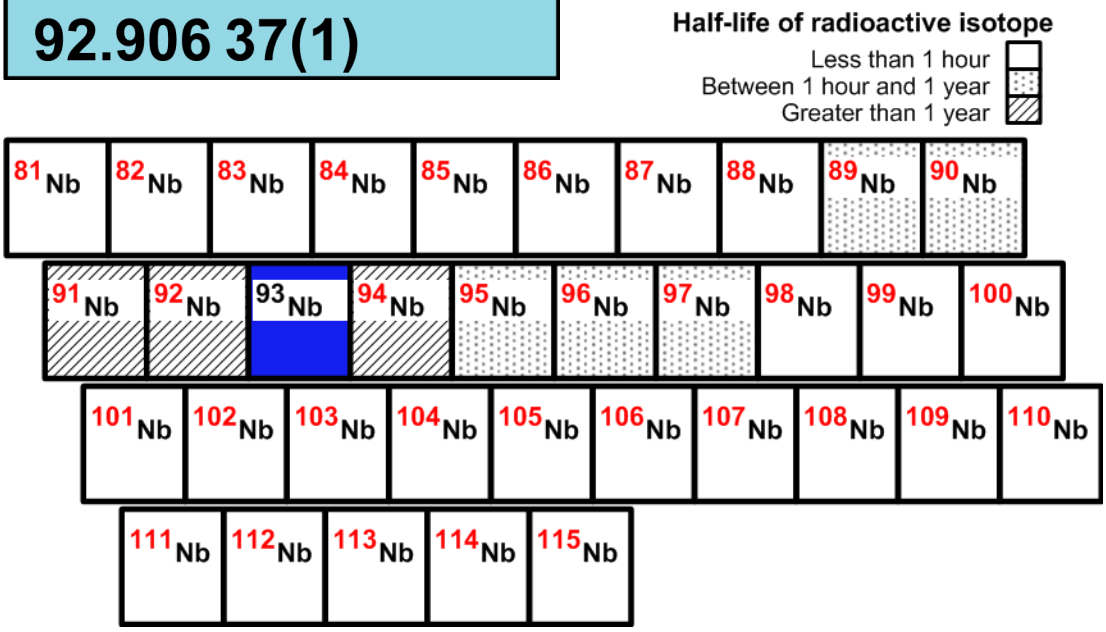
4.41 niobium



Stable isotope	Relative atomic mass	Mole fraction
^{93}Nb	92.906 37	1



4.41.1 Niobium isotopes in biology

^{95}Nb (with a **half-life** of 35 days) and ^{95}Nb-oxalates have been used to study the absorption, retention and distribution of niobium in the body [306, 307].

4.41.2 Niobium isotopes in Earth/planetary science

Nuclear physicists are trying to study the generation of new **isotopes** and their **elements** in stars (astrophysical **nucleosynthesis**) via the rapid **neutron** capture process (**r-process**). Physicists at the Radioactive Isotope Beam Facility (RIBF) of the RIKEN Nishina Center for Accelerator-Based Science in Wako, Japan, have begun creating and studying highly neutron-rich isotopes that are thought to only be produced by the r-process. The data for many neutron-rich isotopes is incomplete, and the RIKEN team is filling in key missing information that is needed to simulate the r-process (including information on the half-lives of the neutron-rich isotopes). So far, the half-lives of 38 neutron-rich isotopes have been measured from krypton to technetium, including ^{111}Nb and ^{112}Nb. When the missing information has been obtained, physicists will have a better understanding of the r-process and how elements are created [308, 309].

4.41.3 Niobium isotopes in medicine

^{95}Nb and ^{95m}Nb (with a half-life of 3.6 days) have been used in tumor research and tumor imaging studies (Figure 4.41.1) [310-312]. The m in the superscript of ^{95m}Nb indicates a **metastable isotope**.

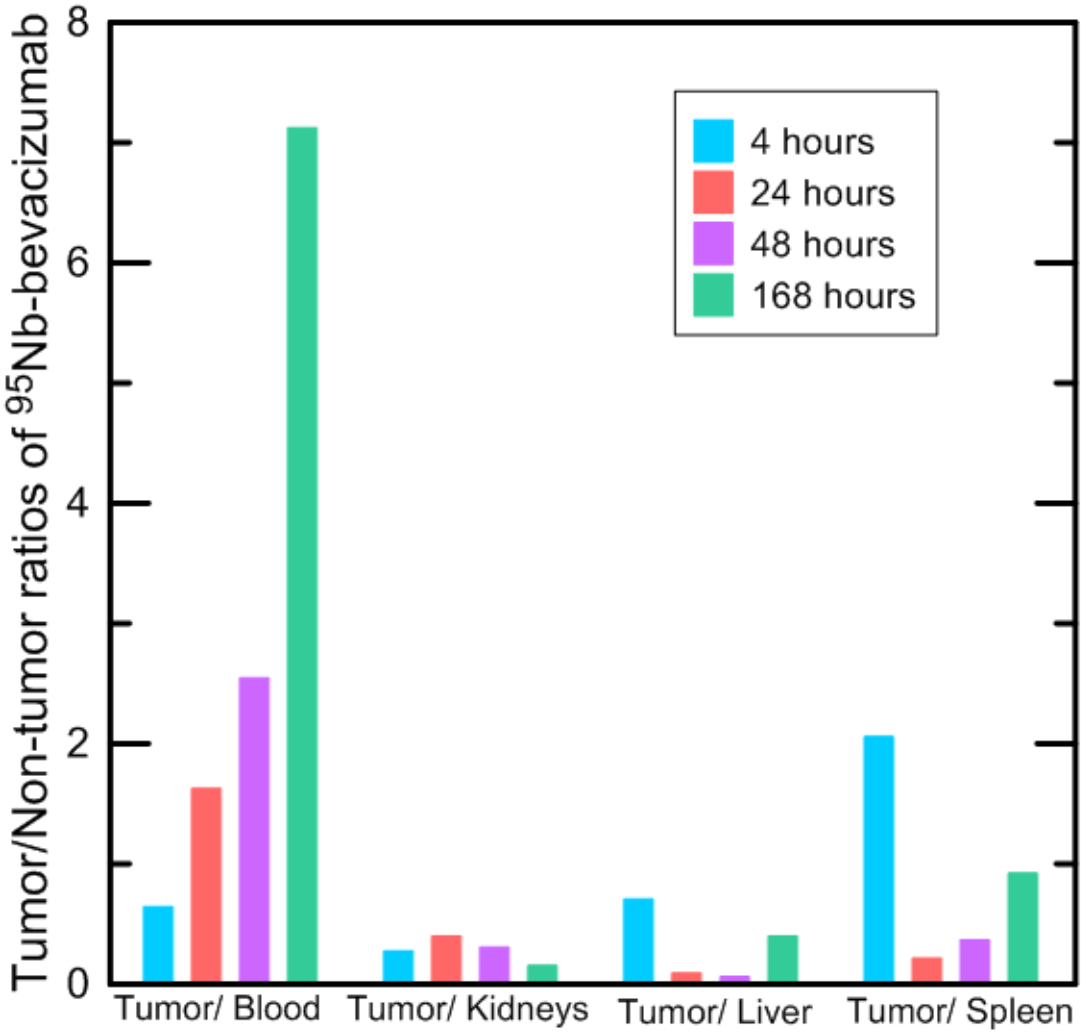


Fig. 4.41.1: Tumor/Non-tumor ratios of ^{95}Nb-bevacizumab at 4, 24, 48 and 168 hours post injection (modified from [312]). Bevacizumab, sold under the trade name Avastin, is a drug that slows the growth of new blood vessels and was approved by the U.S. Food and Drug Administration for selected metastatic cancers, including colon cancer. This ***in vivo*** biodistribution study (a distribution of compounds within a biological system or organism) shows increased tumor uptake of ^{95}Nb-bevacizumab and a satisfactory tumor/blood ratio.