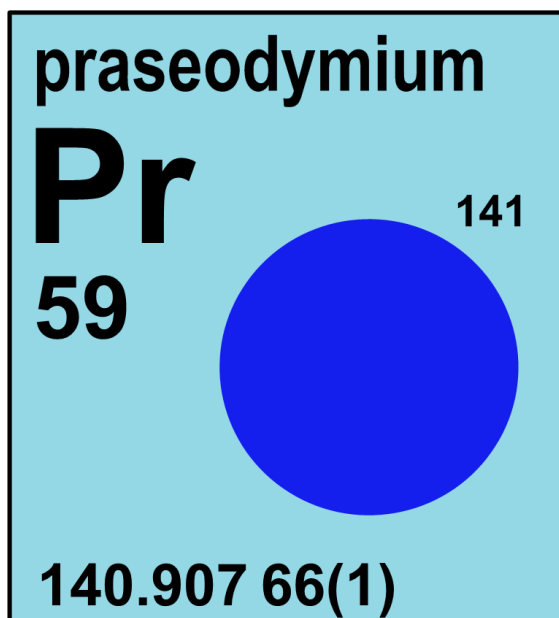




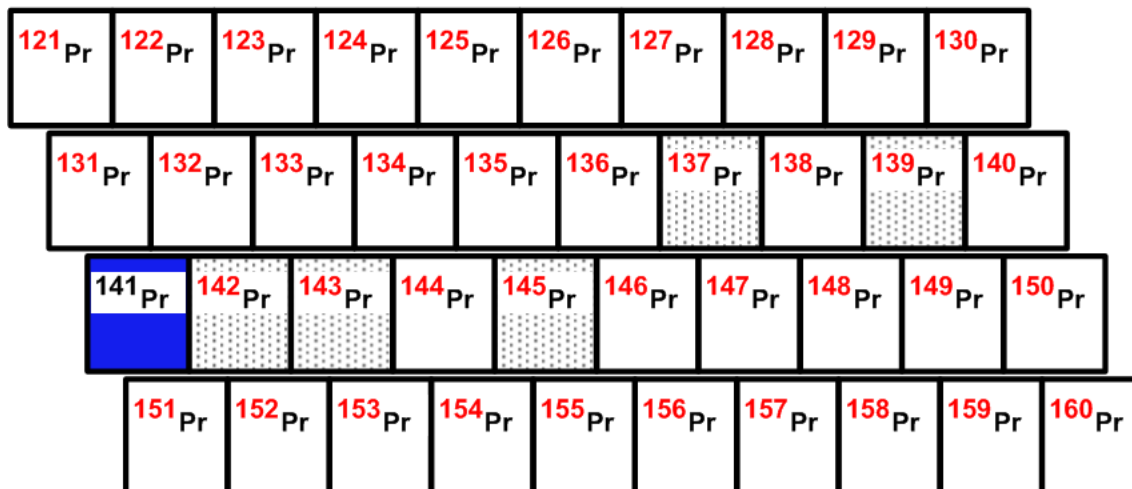
## 4.59 praseodymium



Stable isotope	Relative atomic mass	Mole fraction
$^{141}\text{Pr}$	140.907 66	1

## Half-life of radioactive isotope

Less than 1 hour   
Between 1 hour and 1 year 

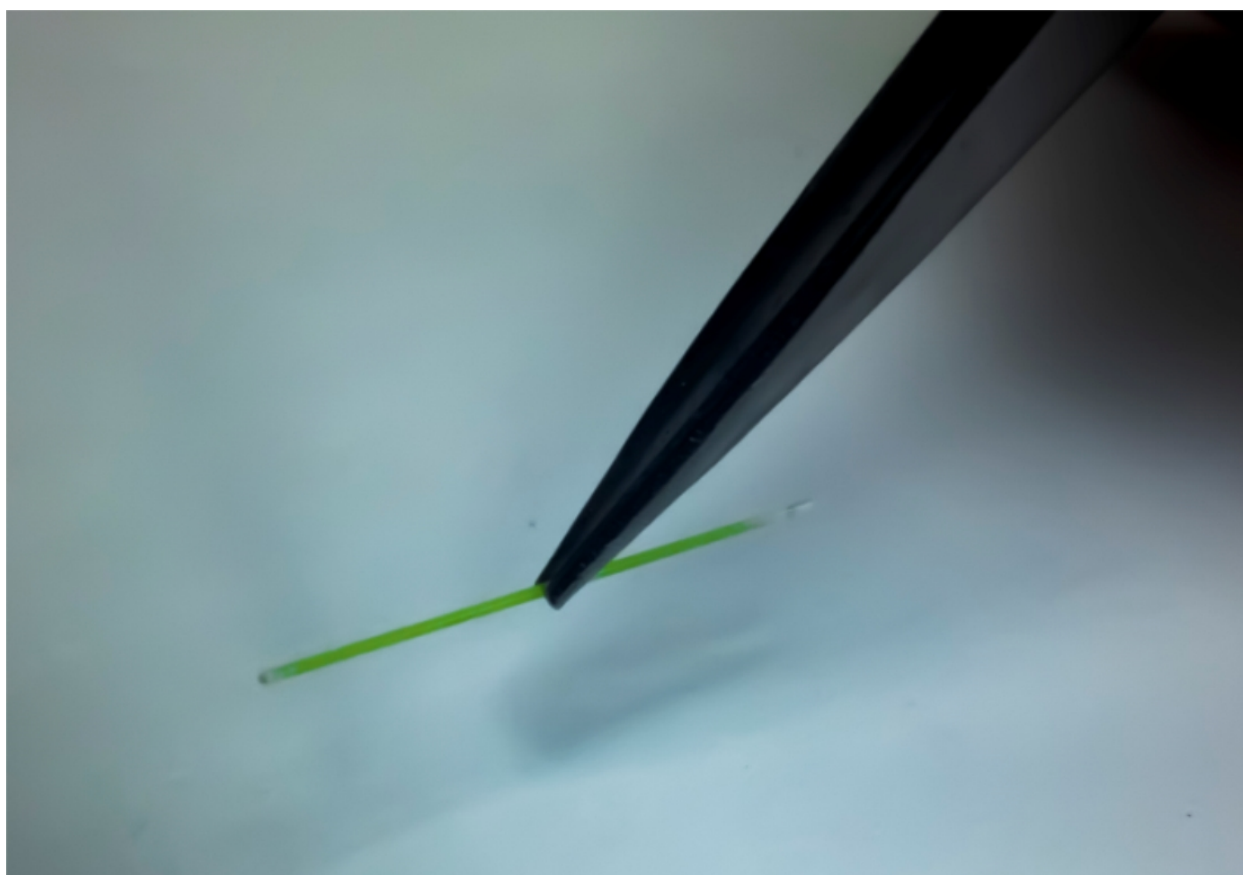


## 4.59.1 Praseodymium isotopes in medicine

Because of its relatively short **half-life** (19.12 hours) and decay primarily by **beta decay** (96.3 percent beta decay and 3.7 percent **alpha decay**),  $^{142}\text{Pr}$  has been proposed for two main innovative applications in medicine, namely in microsphere **brachytherapy** and in eye plaque brachytherapy [422].  $^{142}\text{Pr}$  is advantageous because penetration of the beta fraction of the radiation is limited to a few millimeters in tissue, therefore limiting the dose of radiation to the treated site.  $^{142}\text{Pr}$  may be produced either by fast **neutron** activation or **thermal neutron** activation of stable  $^{141}\text{Pr}$ .

## IUPAC

1 Research in metal-bearing **radiopharmaceuticals** is being conducted to determine the  
2 most efficient way to produce and process radioactive metals for *in vivo* tracing. This research  
3 has led to the development of a potential **radionuclide** generator that administers radioactive  
4 metal complexes to be observed during **positron emission tomography (PET)** imaging. A  
5  $n(^{140}\text{Nd})/n(^{140}\text{Pr})$  mole-ratio radionuclide generator has been designed to administer  $^{140}\text{Pr}$   
6 complexes, such as  $^{140}\text{Pr}$ -DTPA, to be used as a **tracer** during a PET scan [423]. The half-life of  
7  $^{140}\text{Pr}$  is 3.4 minutes. The  $n(^{140}\text{Nd})/n(^{140}\text{Pr})$  ratio radionuclide generators can also be used for  
8 administering  $^{140}\text{Pr}$ -phosphonate complexes to identify the development of skeletal **metastases**.  
9 Once the skeletal metastases are found,  $^{153}\text{Sm}$ -EDTMP can be administered as a  
10 radiotherapeutic agent to treat bone cancer (Figure 4.59.1) [423]. The half-life of  $^{153}\text{Sm}$  is  
11 1.9 days.  
12  
13



14  
15  
16 **Fig. 4.59.1:** Glass microcapillary for use in **brachytherapy** investigations [422], composed of a  
17 mixture of silica, aluminium, oxygen, and praseodymium-141 and praseodymium-142. The glass  
18 was irradiated in a nuclear reactor to produce radioactive  $^{142}\text{Pr}$  from stable  $^{141}\text{Pr}$ . Image kindly  
19 provided by Dr. Clara Ferreira (University of Oklahoma, Oklahoma City, Oklahoma, USA).