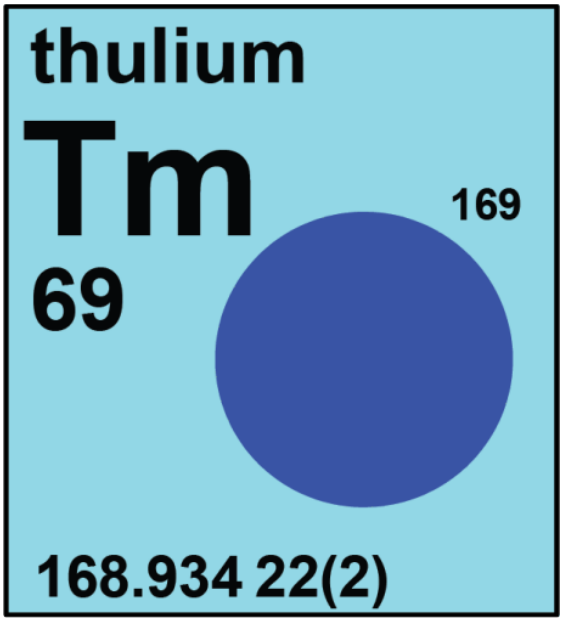
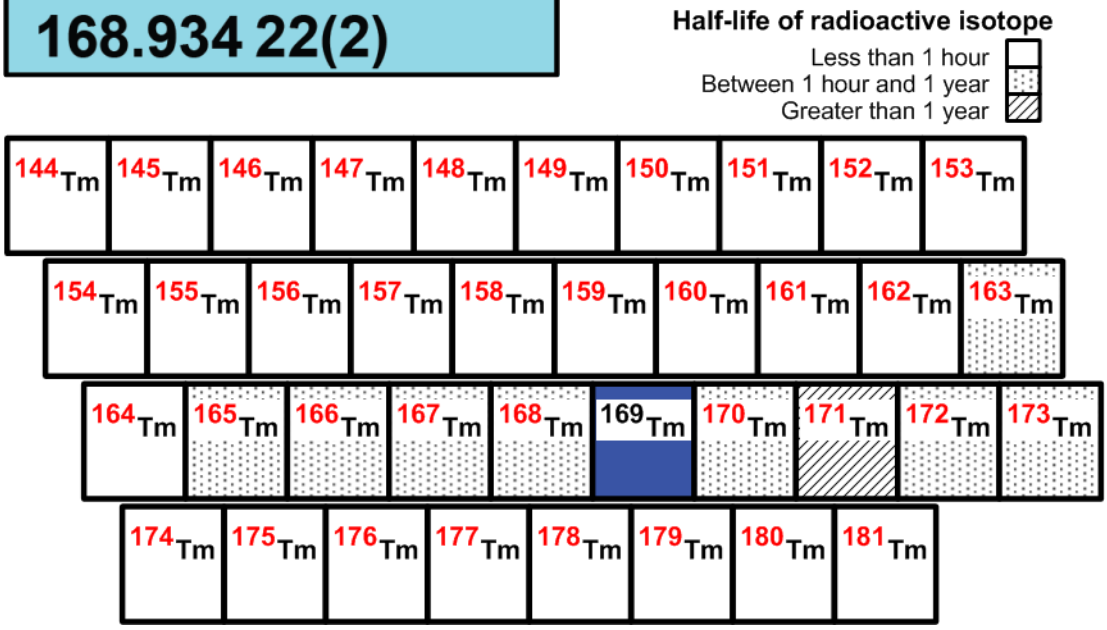


Stable isotope	Relative atomic mass	Mole fraction
^{169}Tm	168.934 22	1



Thulium isotopes in industry

^{170}Tm is used in the **petrochemical** industry for industrial **radiography** to test welds in pipes and tanks [222].

Thulium isotopes in medicine

^{167}Tm is useful for tumor and bone studies [491, 492]. Stable ^{169}Tm can be bombarded in a nuclear reactor to create ^{170}Tm, via the ^{169}Tm (n, γ) ^{170}Tm reaction, which emits **X-rays** and can be used in portable X-ray equipment as a radiation source [491, 493]. ^{170}Tm has been studied for use in high-dose-rate (HDR) **brachytherapy** [491, 493, 494] and for use in radiation synovectomy of medium sized joints (Figure 1) [495].

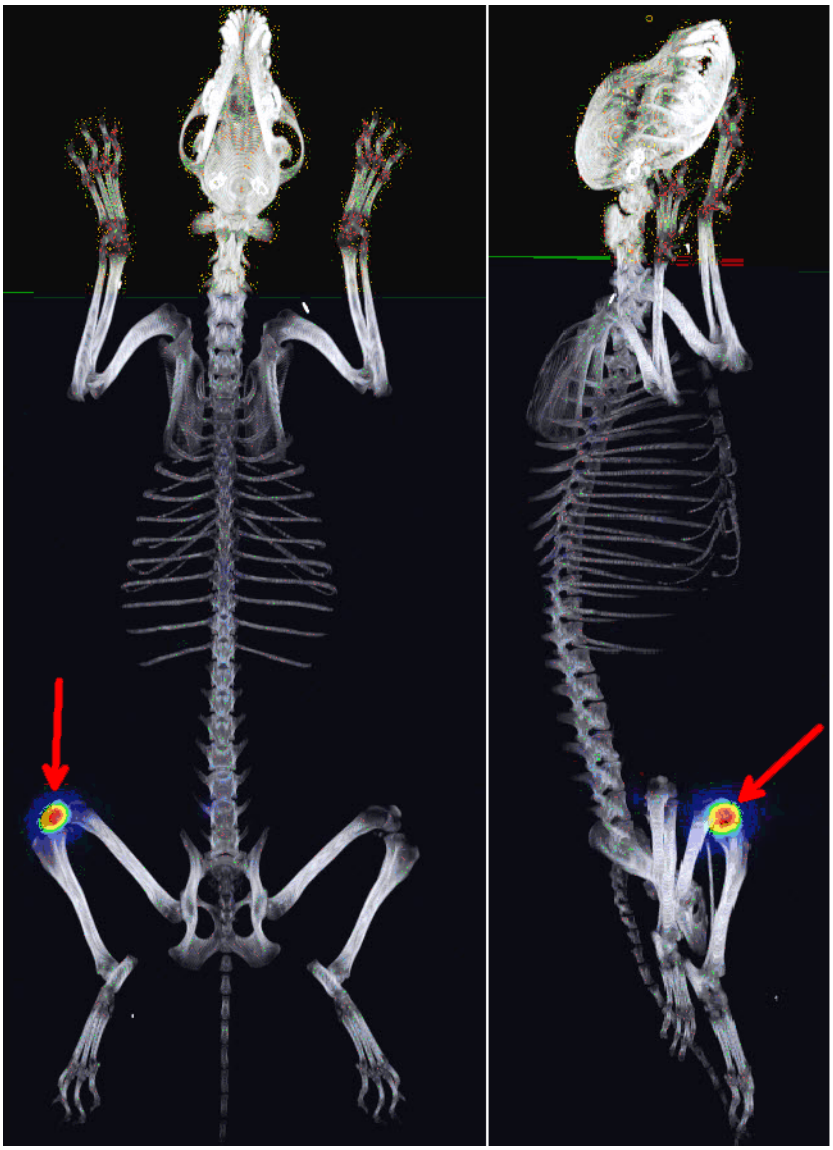


Fig. 1: Wholebody **single-photon emission computed spectroscopy** (colored layer in image) and CT scan of Beagle dog recorded after 4 hours of administration of ^{170}Tm-labeled microparticles [495]. Radioactive-colloid accumulation is displayed in the right knee joint. The Beagle did not suffer any health impairment. Image kindly provided by Dr. Andras Polyak (Dept. of Nuclear Medicine, Hannover Medical School, Germany).

Glossary

atomic number (*Z*) – The number of protons in the nucleus of an atom.

brachytherapy – the treatment of cancer, especially prostate cancer, by the insertion of radioactive implants directly into the tissue near the tumor. [return]

electron – elementary particle of matter with a negative electric charge and a rest mass of about 9.109×10^{-31} kg.

element (**chemical element**) – a species of atoms; all atoms with the same number of **protons** in the atomic nucleus. A pure chemical substance composed of atoms with the same number of protons in the atomic nucleus [703].

gamma rays (gamma radiation) – a stream of high-energy electromagnetic radiation given off by an atomic nucleus undergoing **radioactive decay**. The energies of gamma rays are higher than those of **X-rays**; thus, gamma rays have greater penetrating power.

half-life (radioactive) – the time interval that it takes for the total number of atoms of any **radioactive isotope** to decay and leave only one-half of the original number of atoms.

isotope – one of two or more species of atoms of a given **element** (having the same number of **protons** in the nucleus) with different atomic masses (different number of **neutrons** in the nucleus). The atom can either be a **stable isotope** or a **radioactive isotope**.

neutron – an elementary particle with no net charge and a rest mass of about 1.675×10^{-27} kg, slightly more than that of the **proton**. All atoms contain neutrons in their nucleus except for protium (^{1}H).

petrochemical – relating to or denoting substances obtained by the processing of oil and natural gas. [return]

proton – an elementary particle having a rest mass of about 1.673×10^{-27} kg, slightly less than that of a **neutron**, and a positive electric charge equal and opposite to that of the **electron**. The number of protons in the nucleus of an atom is the **atomic number**.

radioactive decay – the process by which unstable (or radioactive) **isotopes** lose energy by emitting alpha particles (helium nuclei), beta particles (positive or negative **electrons**), **gamma radiation**, **neutrons** or **protons** to reach a final stable energy state.

radioactive isotope (radioisotope) – an atom for which **radioactive decay** has been experimentally measured (also see **half-life**).

radiography – an imaging technique that uses electromagnetic radiation other than visible light, especially **X-rays** and **gamma rays**, to view the internal structure of non-uniform objects, such as metal parts, welded pipes, and the human body. [return]

single-photon emission computed spectroscopy (SPECT) – a nuclear medicine imaging technique that is able to provide true three-dimensional information using gamma rays from a radiopharmaceutical. [return]

stable isotope – an atom for which no radioactive decay has ever been experimentally measured.

X-rays – electromagnetic radiation with a wavelength ranging from 0.01 to 10 nanometers—shorter than those of UV rays and typically longer than those of gamma rays. [return]

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