TABLE 10.1 Positron-Emitting Radioisotopes

Isotopes	t½ (min)	Imaging time
^{18}F	110	~8 h
^{11}C	20	1.5 h
^{13}N	10	40 min
^{15}O	2	10 min

of detection due to radioactive decay. Once the positron emitting isotopes have been generated (using either a cyclotron or linear particle accelerator) they must be incorporated into a radioligand using the appropriate synthetic chemistry, purified, formulated, dosed in the subject, and all measurements must be taken before the signal fades due to radioactive decay. Needless to say, time is an important consideration in running PET experiments.

Single-photon emission computed tomography (SPECT) is similar to PET imaging in that it also requires a radioligand. In addition, as with PET imaging, a series of two-dimensional images are obtained and mathematically assembled to produce a three-dimensional rendering of the subject. There are, however, some important differences that should be considered. First and foremost, SPECT imaging systems are designed to detect gamma ray emissions. As a result, different radioisotopes are required for SPECT imaging techniques (Table 10.2)[30] and

TABLE 10.2 SPECT Radioisotopes

Isotope	t½	Isotope	t½
^{123}I	13.22 h	^{99m}Tc	6 h
^{131}I	8 days	^{111}In	2.8 days
^{177}Lu	6.6 days	^{67}Ga	3.2 days
^{186}Re	3.7 days	^{67}Cu	2.6 days

the radiochemical properties of these radioisotopes is the genesis of another significant difference between PET and SPECT. In general, the radioactive decay (expressed as t½) is slower in the radioisotopes necessary for SPECT imaging. This creates a larger time window of opportunity for imaging experiments, and substantially decreases the overall costs. As with PET imaging, radioligands with specific and tight binding to targeted biomolecules enables the visualization of specific regions