The use of positron emitting radioisotopes for the localization of brain tumours was first proposed by Wrenn et al. in Science in 1951. Since the construction of the “hair dryer” in the 60s in Brookhaven and the development of X-ray CT in the 70s, detector development and signal treatment have achieved continuous progress to improve the quality and accuracy of medical images. Basics of emission and transmission tomography will be presented, from the detection of annihilation photon pairs in coincidence to building the 3D X-Ray Transform of a volume down to its inversion while processing 3D PET reconstruction. Trends and current challenges in detector development and signal treatment will be addressed in the field to positron emission tomography (PET), X-ray CT, and the combination of different modalities to image simultaneously anatomy and metabolic function of living tissues.