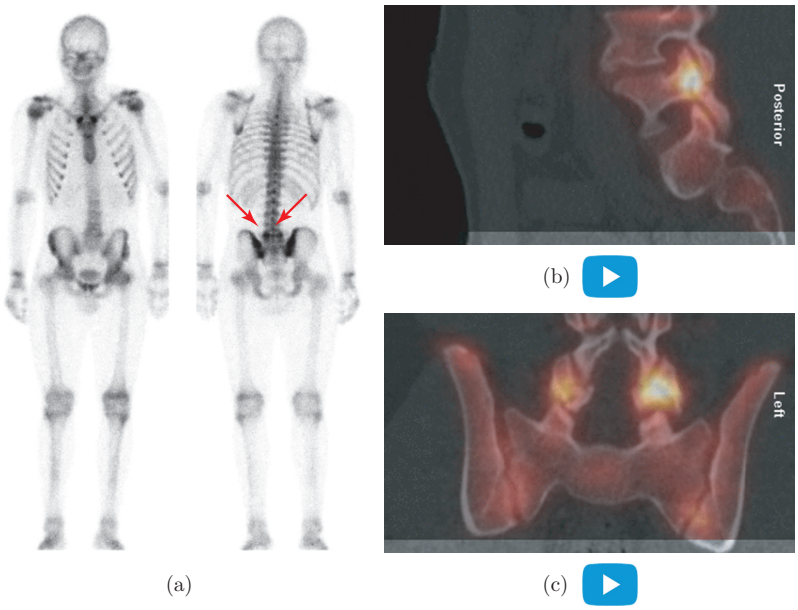

Figure 5.24 Scintigraphy, after injection of 780 MBq ^{99m}Tc-labeled methylene diphosponate, of an 18-year-old patient suffering from lower backpain. **(a)** Whole-body planar image with increased uptake in the lower lumbar region (arrows). **(b)** Sagittal and **(c)** coronal-fused SPECT-CT images show that this increased uptake is located in the base of both inferior articular processes of L5 corresponding with active spondylolysis. The radioactive uptake (color) and anatomical data (gray values) are integrated into a single image. (Courtesy of Professor L. Mortelmans and Dr. H. Hudyana, Department of Nuclear Medicine.)

- ***Lung embolism*** In order to detect lung embolism, ^{99m}Tc-labeled human serum albumin is injected intravenously. This tracer with a mean diameter of 10–40 μm sticks in the first capillaries it meets (i.e., in the lungs). Areas of decreased or absent tracer deposits correspond to a pathological perfusion, which is compatible with a lung embolism. The specificity of the perfusion scan can be increased by means of a ventilation scan (Figure 5.26). Under normal conditions a gas or an aerosol with ^{99m}Tc-labeled particles is spread homogeneously in the lungs by inhalation. Lung embolism is typically characterized by a mismatch (i.e., a perfusion defect with a normal ventilation). A perfusion CT scan of the lungs has become the first choice technique for diagnosis of lung embolism.
- ***Tumors*** A very successful tracer for measuring metabolic activity is ^{18}FDG (fluoro-deoxy-glucose). This molecule traces glucose metabolism. The uptake of this tracer is similar to that of glucose. However, unlike glucose, FDG is only partially metabolized and is trapped in the cell. Consequently, FDG accumulates proportionally to glucose consumption. A tumor is shown as an active area or "hot spot" (Figure 5.27), as in most tumors glucose metabolism is considerably higher than in the surrounding tissue. Whole-body FDG has become a standard technique for the staging of oncologic patients and also for the therapeutic evaluation of chemotherapy and/or radiotherapy.

  Specific tracers have recently emerged for different types of tissue characterization. An example is ^{68}Ga labeled PSMA (prostate-specific membrane antigen), which is a biomarker for prostate cancer (Figure 5.28).
- ***Thyroid function*** Uptake of ^{99m}Tc pertechnetate or ^{123}I iodide shows the tracer distribution within the thyroid (Figure 5.29), which is a measure of the metabolic function, and is used to differentiate between diverse causes of hyperthyroidism (thyroid hyperfunction), such as Graves' disease and toxic adenoma. ^{131}I iodide with a half-life of 8 days is mainly used for treatment of hyperthyroidism or thyroid cancer.
- ***Neurological disorders*** Brain disorders can be diagnosed using SPECT perfusion scans and PET FDG scans measuring brain metabolism. FDG PET brain scans play an important role in the early and differential diagnosis of Alzheimer's disease (Figure 5.30). New tracers are used for the evaluation of neuroreceptors, transporters, enzymes, etc., allowing more specific diagnosis of several brain disorders. A typical example is the presynaptic dopamine transporter (DAT), possibly in combination with the postsynaptic dopamine receptor (D2) (Figure 5.31). It measures the amount of dopamine-producing cells in the substantia nigra