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**CHAPTER 6** Endocrinology is the study of hormones, which are combinations of a radioactive tracer and a pharmaceutical agent. A tracer is a radioactive molecule or drug that acts as a marker to determine localization and biodistribution. Endocrinologists themselves confer the desired properties. Both naturally occurring and synthetic hormones can easily be radiolabeled.

**CHAPTER 7** Radiopharmaceutical mechanisms of localization important in clinical practice are listed in Table 1-1. Understanding the mechanism and rationale for the use of each agent is critical to understanding the normal and pathological findings demonstrated scintigraphically. All radiopharmaceuticals must be approved by the U.S. Food and Drug Administration (FDA) before they can be commercially produced and used for human clinical or research purposes.

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The pharmaceutical component should be free of toxicity or physiological effects. The radiopharmaceutical should not disassociate *in vitro* or *in vivo* and should be readily available or easily compounded. The radiopharmaceutical should rapidly and specifically localize according to the intended application. Background clearance should be rapid, leading to good target-to-background ratios.

## ■ PRODUCTION OF RADIONUCLIDES

Naturally occurring radionuclides (e.g., uranium-235, thorium, radium, and radon) are heavy elements with very long half-lives (>1000 years). These play a small role in diagnostic nuclear medicine. Radionuclides commonly used clinically are artificially produced by nuclear fission or through the bombardment of stable materials by neutrons or alpha particles.

Neutron bombardment of stable nuclides produces fission products having greater mass than the atomic chart (Fig. 1-1). Some nuclides have unique半衰期 (radioactive half-life) in a nuclear reactor. These are called "reactor nuclides." Neutron capture nuclides include iodine-131, xenon-133,