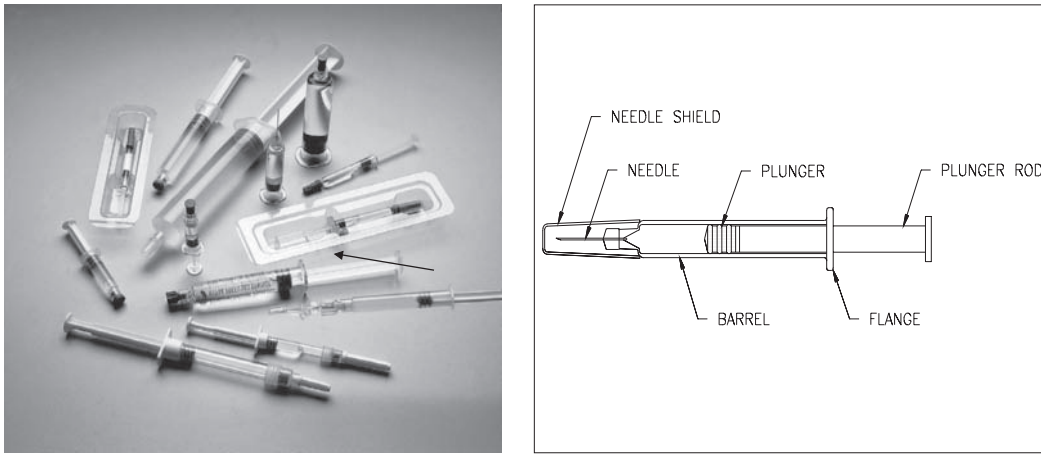

Figure 4-4 Syringe examples. *Source*: Courtesy of Baxter Healthcare Corporation.

Primary reasons for syringe popularity include the following:

- The emergence of biotechnology and the need to eliminate overfill (reduced waste) of expensive biomolecules compared with vials and other containers. Vaccines, antithrombotics, and various home health care products such as growth hormone and treatments for rheumatoid arthritis and multiple sclerosis are much more conveniently used and administered using prefilled syringes

Table 4-1 Prefilled Syringe Options

Sterilization	Presterilized by empty syringe manufacturer and ready-to-fill Supplied nonsterile, washed and sterilized by product manufacturer
Barrel size	0.5–100 mL; typically 0.5–10 mL
Needle format	Luer tip, use needle of choice Staked needle affixed to syringe Hub, not used often
Needle gauge	21–32
Needle length	$^{1}/_{2}$ to $^{5}/_{8}$ in.
Needle shield	Natural or synthetic rubber
Silicone application	Silicone oil or silicone emulsion Applied at syringe manufacturer Applied at finished product manufacturer
Silicone level	Varies, 0.6–1.0 mg per 1 mL syringe
Type of rubber plunger	Synthetic rubber (halobutyl)
Type of rubber septum (tip)	Natural or synthetic rubber Plastic covers
Coating of rubber	Absent or use of fluoropolymer
Filling machine	Rotary piston Peristaltic Time pressure Rolling diaphragm Single head up to 10 heads Up to 600 syringes filled per minute
Rubber plunger insertion	Insertion tube system Vacuum