



Figure 9–29 Dual control of the *lac* operon. Glucose and lactose levels control the initiation of transcription of the *lac* operon through their effects on the *lac* repressor protein and CAP. Lactose addition increases the concentration of allolactose, which binds to the repressor protein and removes it from the DNA. Glucose addition decreases the concentration of cyclic AMP; because cyclic AMP no longer binds to CAP, this gene activator protein dissociates from the DNA, turning off the operon. As shown in Figure 9–8, CAP is known to induce a bend in the DNA when it binds; for simplicity, the bend is not shown here. *LacZ*, the first gene of the *lac* operon, encodes the enzyme β -galactosidase, which breaks down lactose to galactose and glucose.