

Proteomics

- Proteomics is the study of protein structure and function.
- An organism's proteome is its entire set of proteins.
- Proteomics is much more complicated than genomics.

Proteomics Versus Genomics

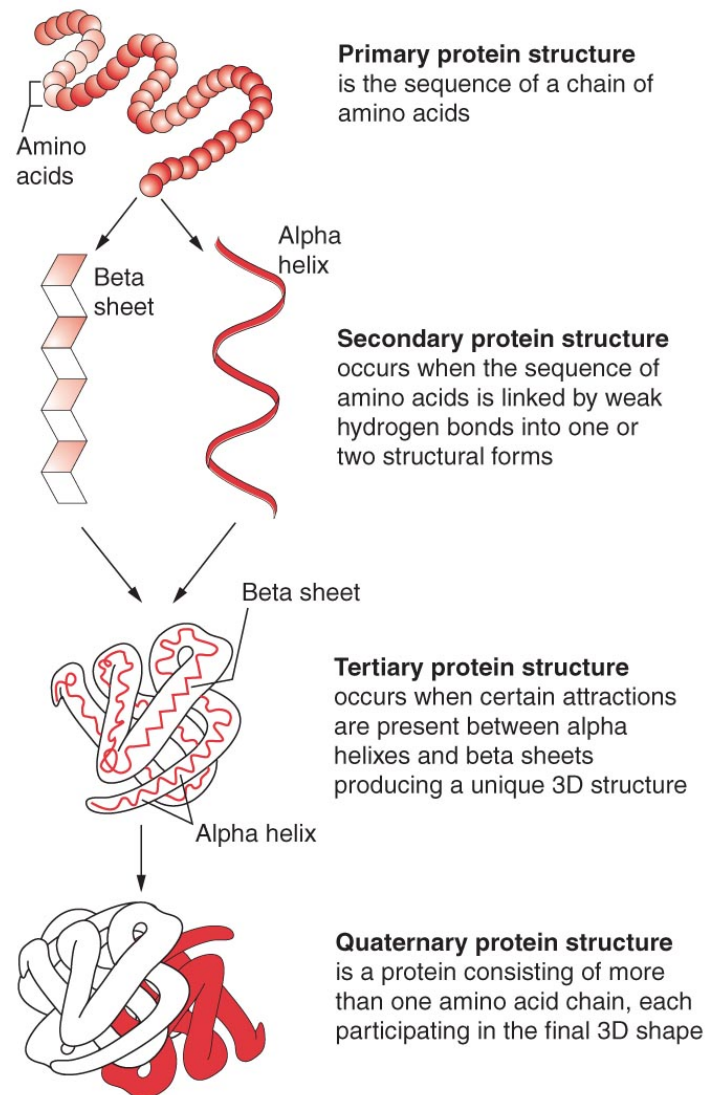
- Genomics tells us what kinds of proteins a given organism has the capacity for producing, but genomics tells us almost nothing about how those proteins function or when and in which cells those proteins are produced.
- Proteomics gives us a clearer picture of what roles the various proteins play in cells. Therefore, compared to genomics, proteomics allows us to better understand an organism.

Table 5.1 An Overview of Protein Functions

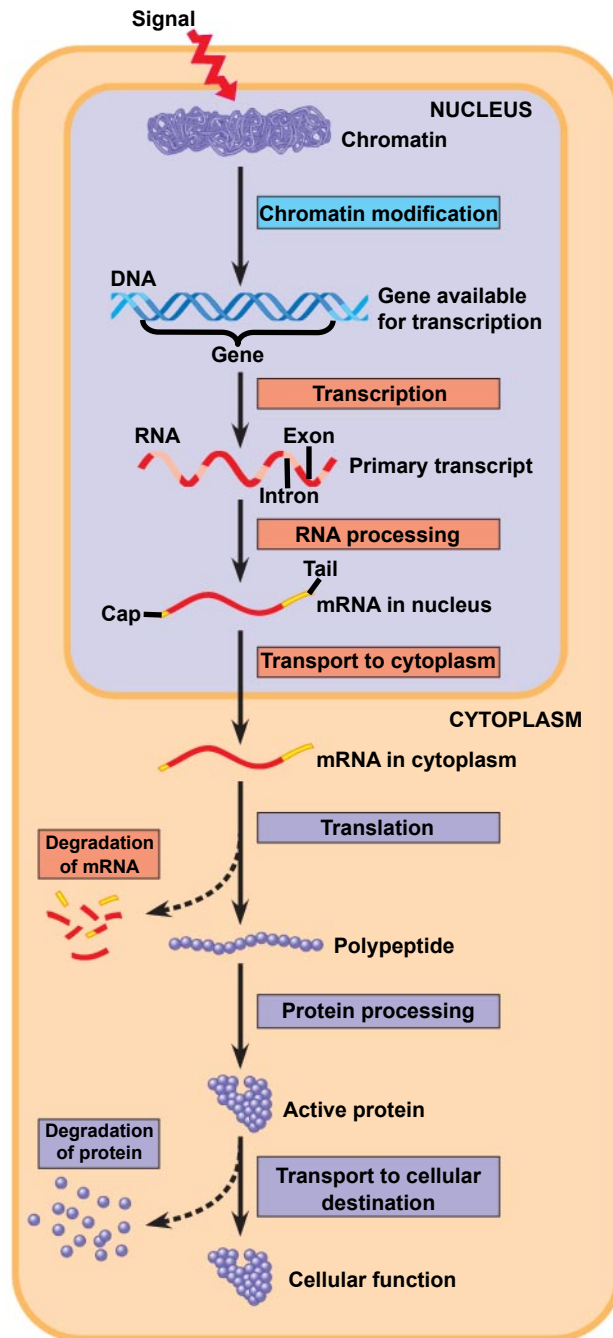
Type of Protein	Function	Examples
Enzymatic proteins	Selective acceleration of chemical reactions	Digestive enzymes
Structural proteins	Support	Silk fibers; collagen and elastin in animal connective tissues; keratin in hair, horns, feathers, and other skin appendages
Storage proteins	Storage of amino acids	Ovalbumin in egg white; casein, the protein of milk; storage proteins in plant seeds
Transport proteins	Transport of other substances	Hemoglobin, transport proteins
Hormonal proteins	Coordination of an organism's activities	Insulin, a hormone secreted by the pancreas
Receptor proteins	Response of cell to chemical stimuli	Receptors in nerve cell membranes
Contractile and motor proteins	Movement	Actin and myosin in muscles, proteins in cilia and flagella
Defensive proteins	Protection against disease	Antibodies combat bacteria and viruses.

Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.

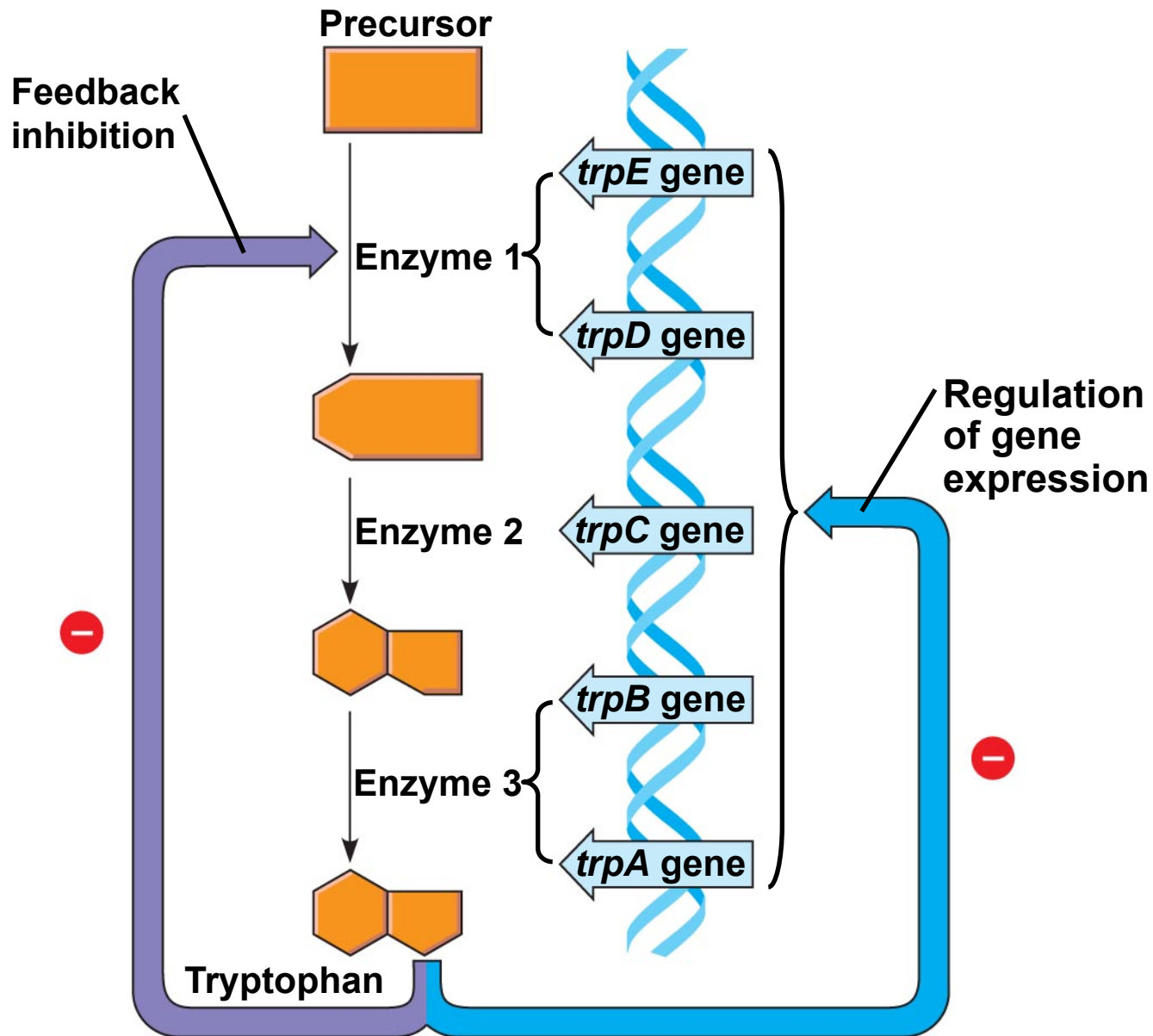
Four Levels of Protein Structure



Copyright © 2009 Pearson Education, Inc.

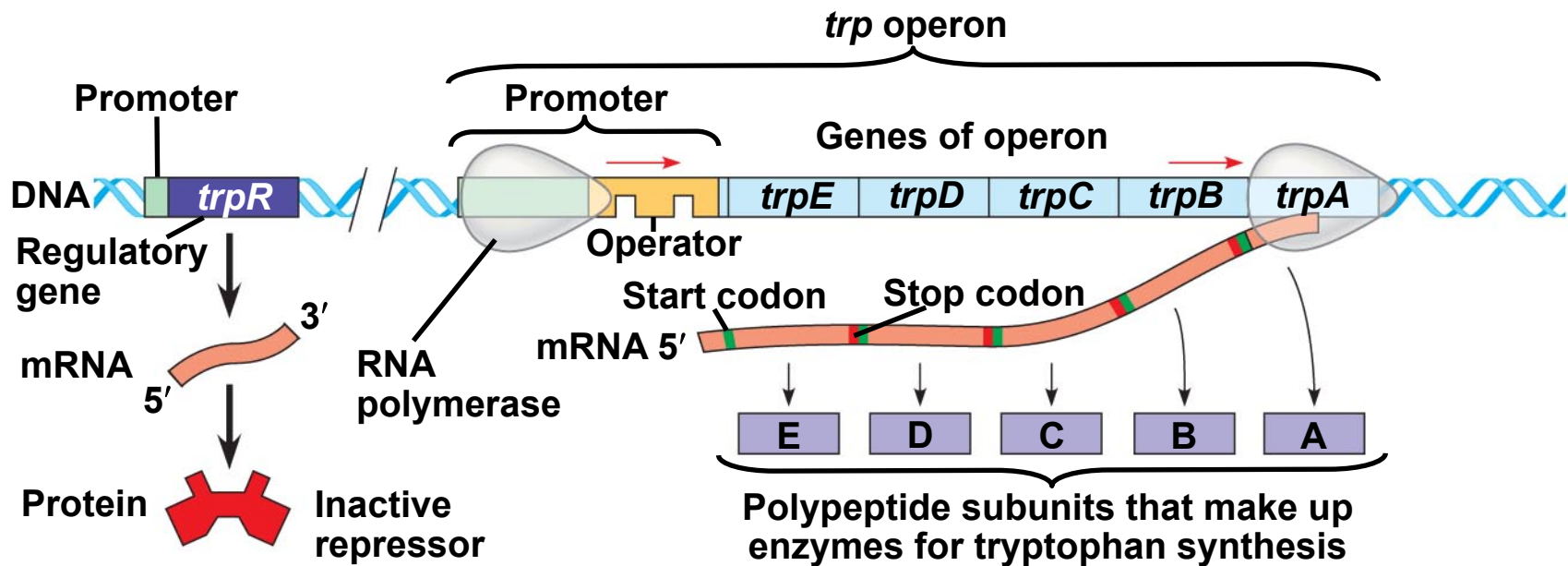


Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.

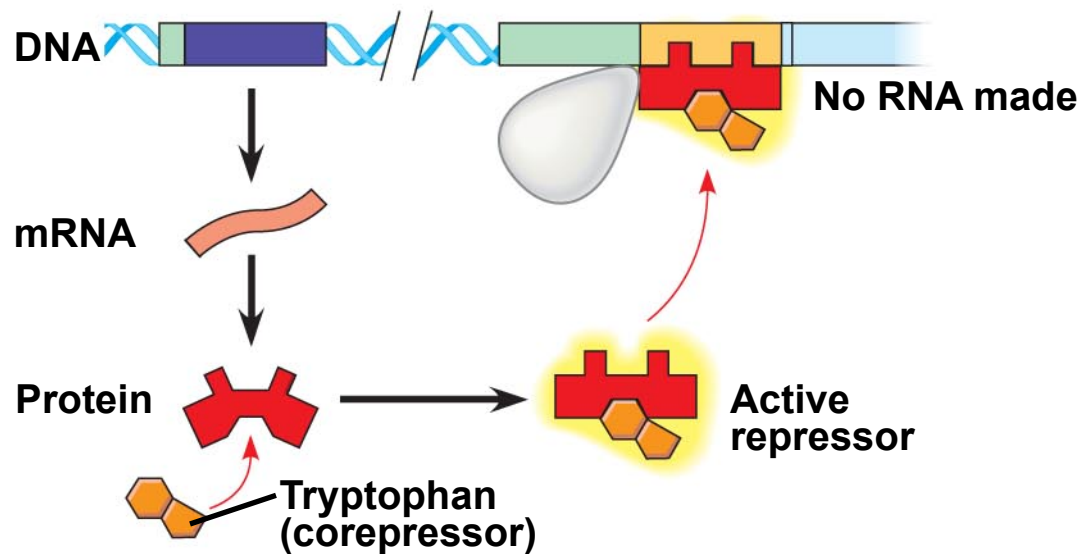


(a) Regulation of enzyme activity

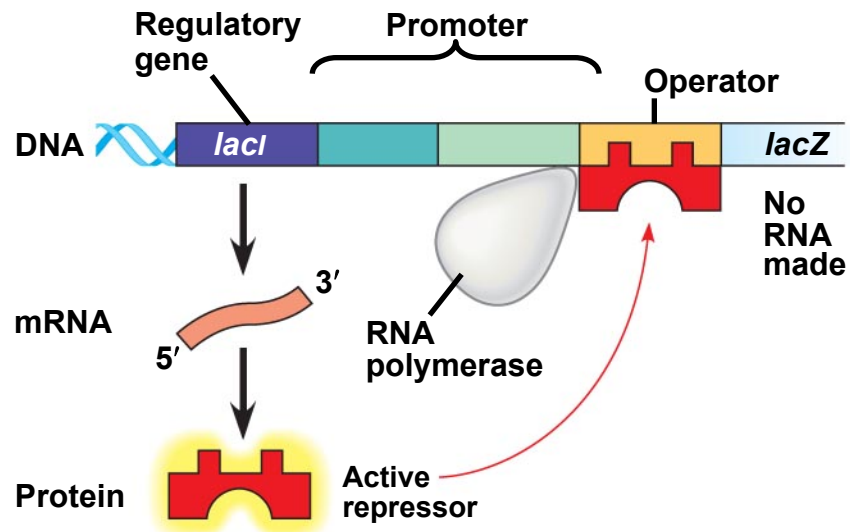
(b) Regulation of enzyme production



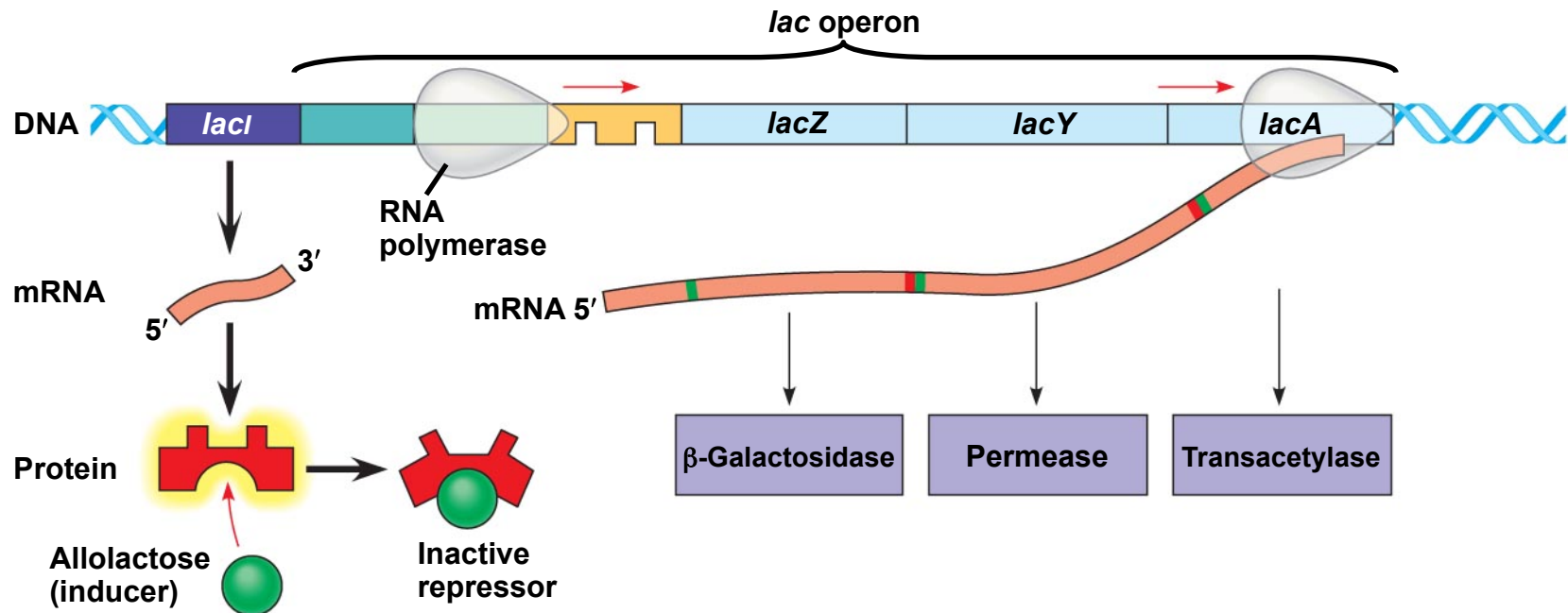
(a) Tryptophan absent, repressor inactive, operon on



(b) Tryptophan present, repressor active, operon off

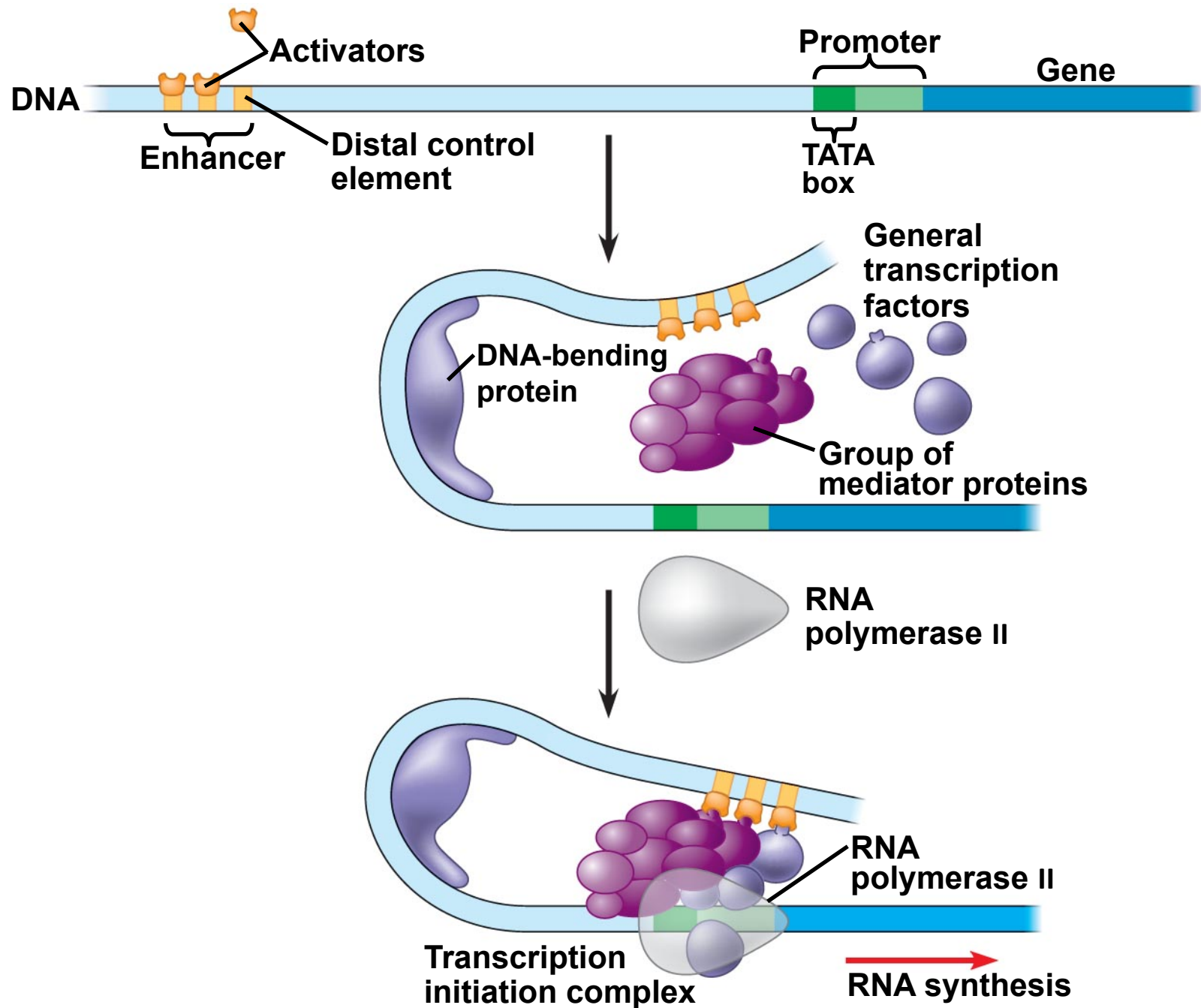


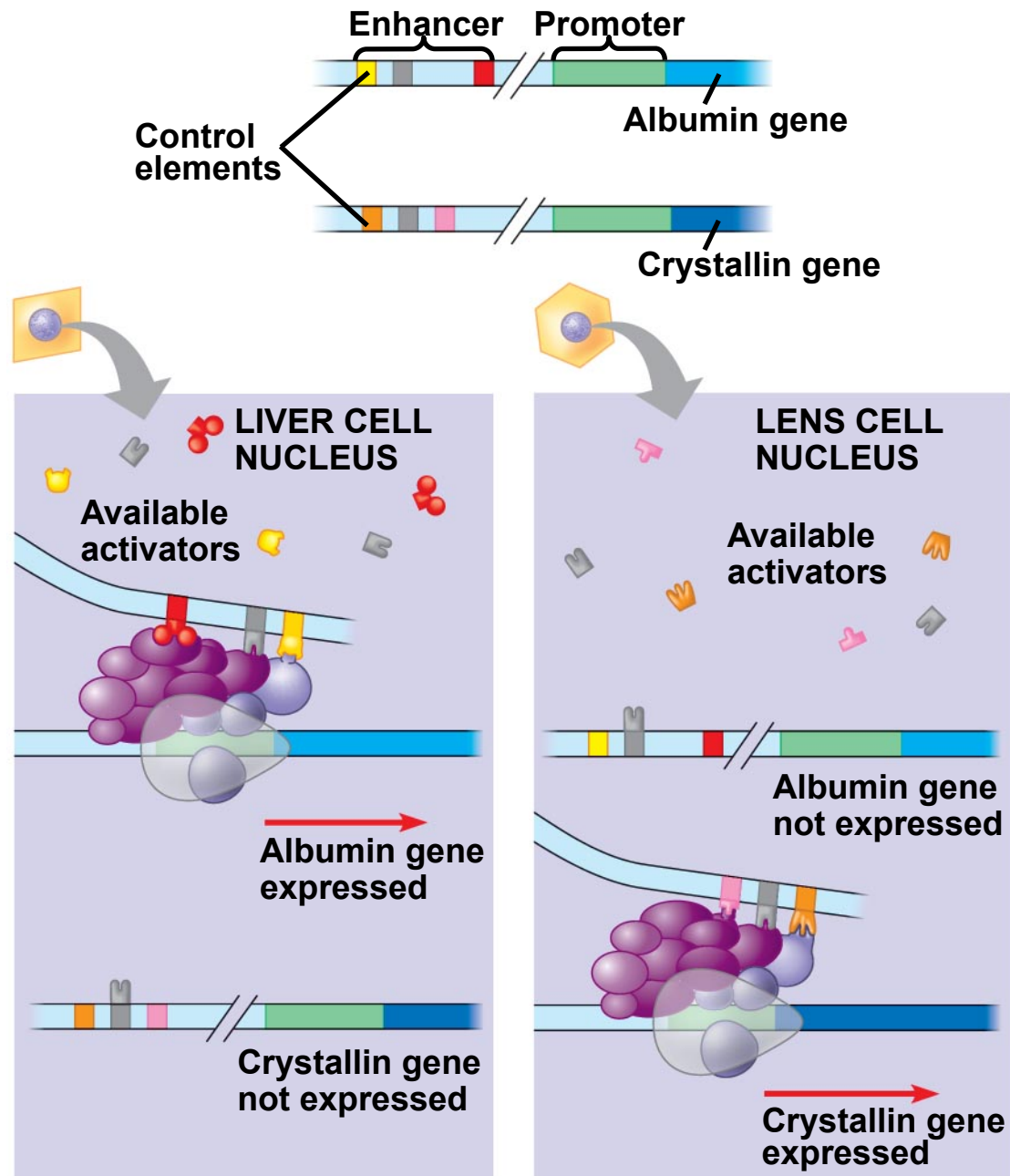
(a) Lactose absent, repressor active, operon off



(b) Lactose present, repressor inactive, operon on

Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.





(a) Liver cell

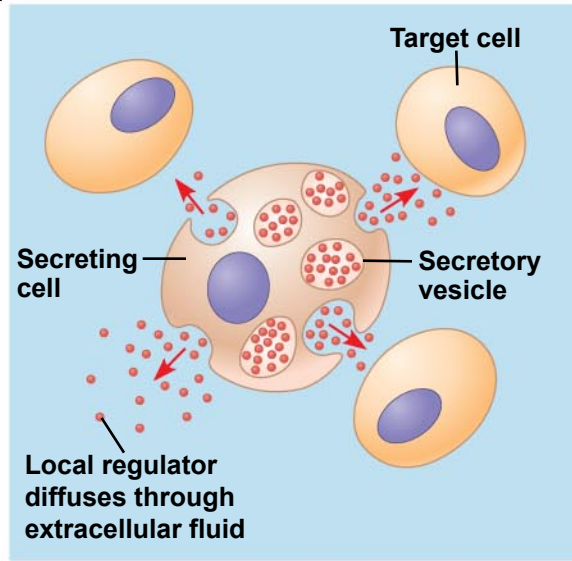
(b) Lens cell

Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.

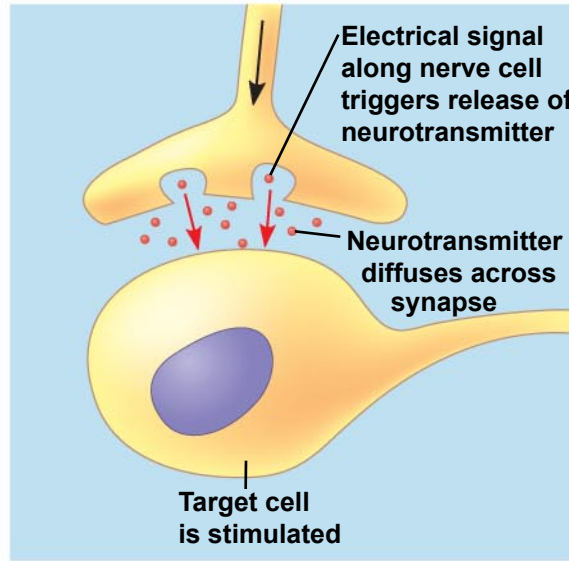
Post-translational Modifications

- Phosphorylation
- Ubiquitination
- Methylation
- Acetylation
- Glycosylation

Local signaling

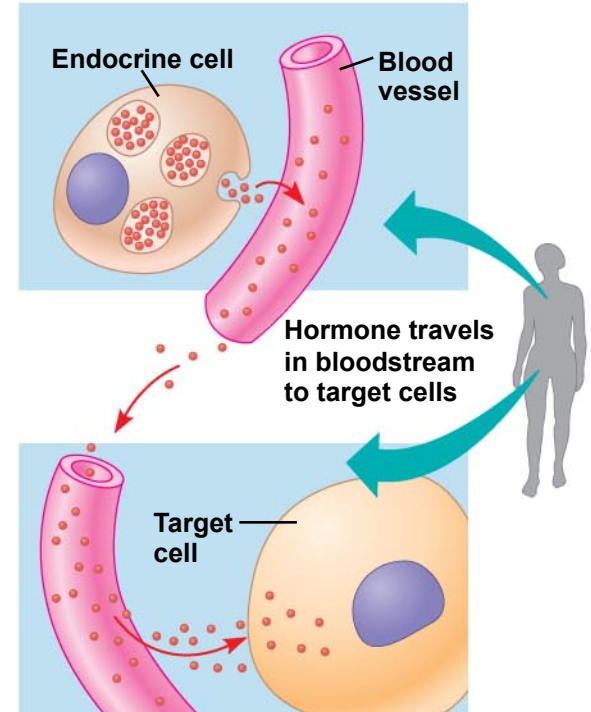


(a) Paracrine signaling

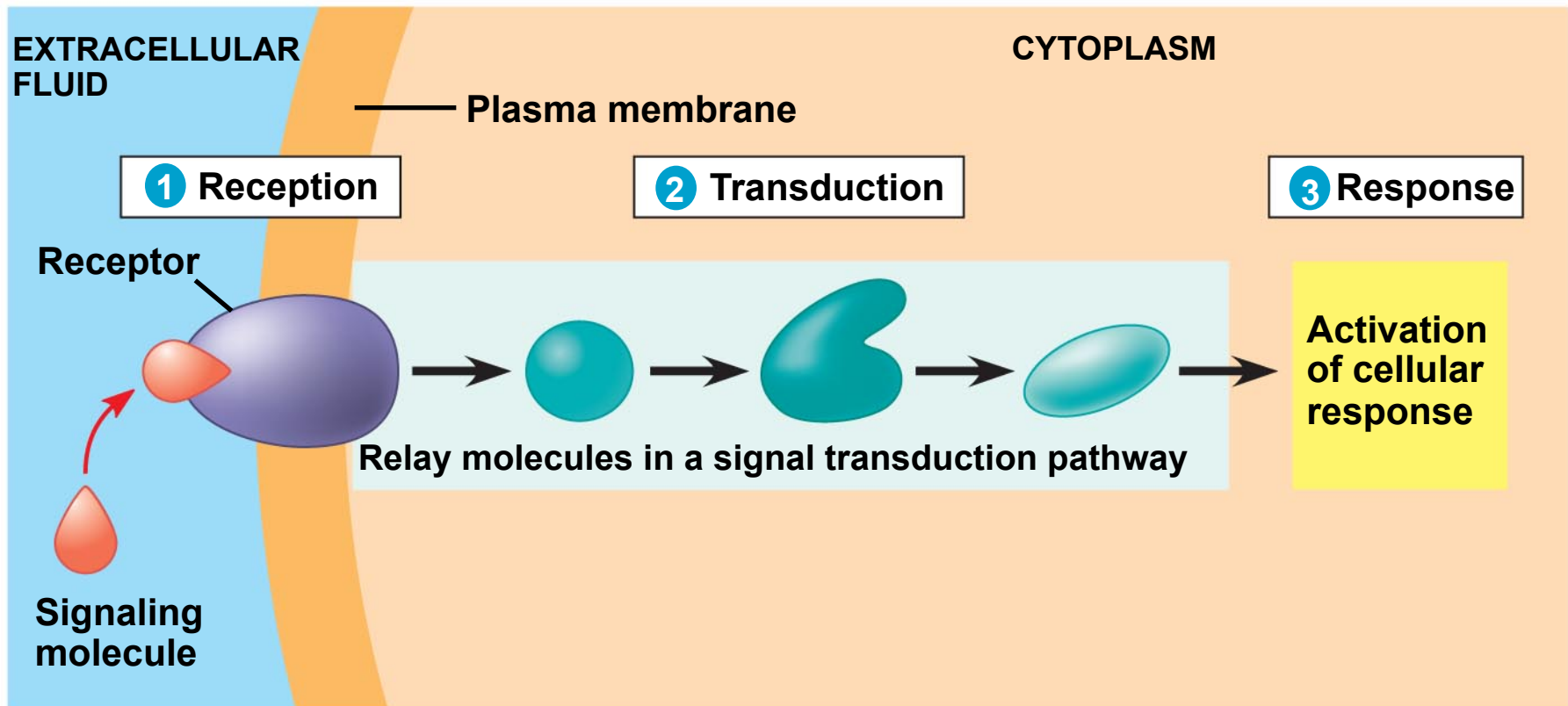


(b) Synaptic signaling

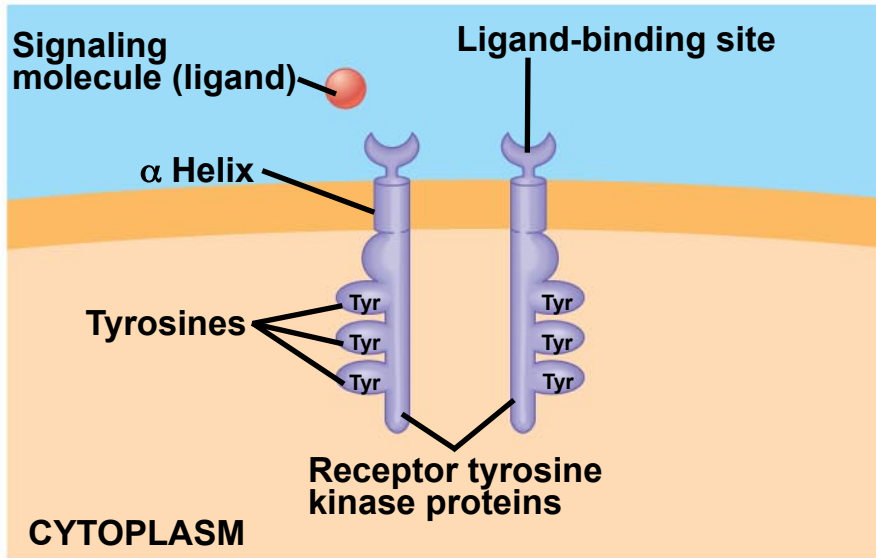
Long-distance signaling



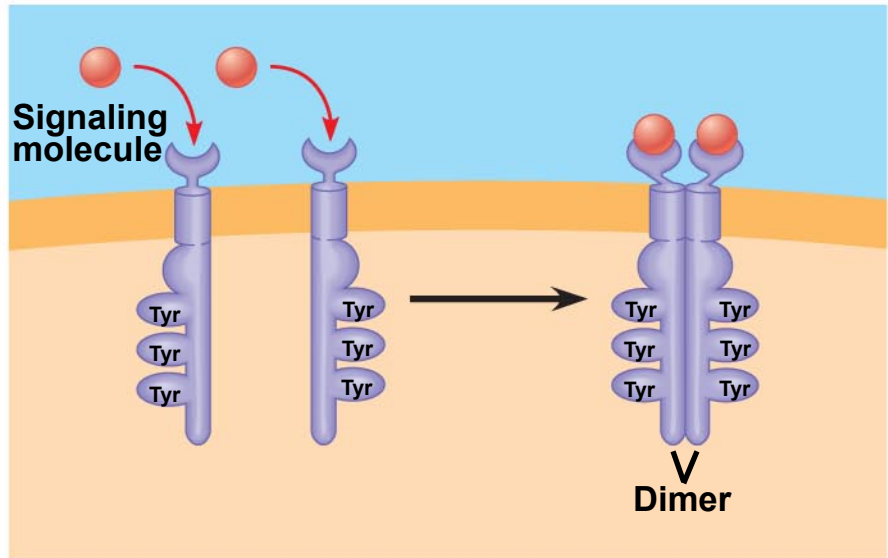
(c) Hormonal signaling



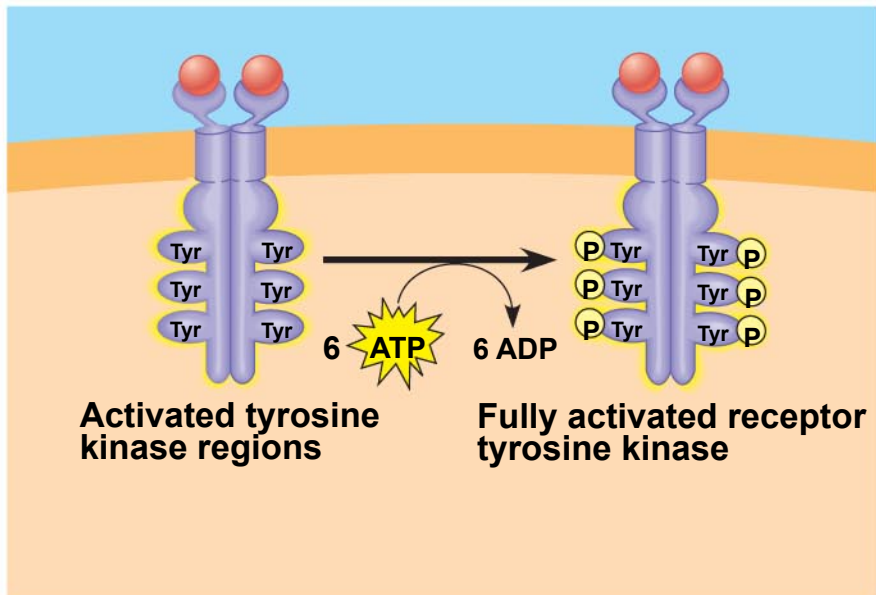
Copyright © 2008 Pearson Education, Inc., publishing as Pearson Benjamin Cummings.



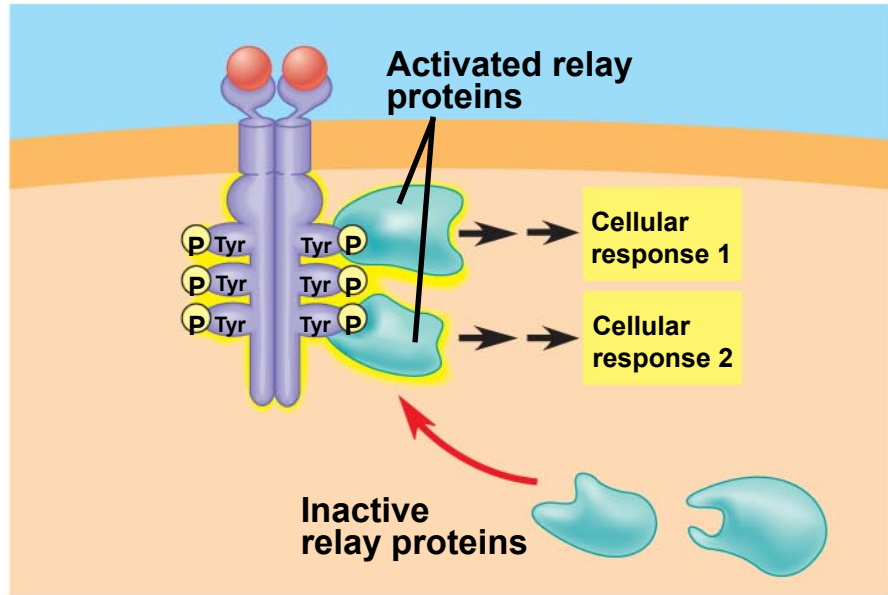
1



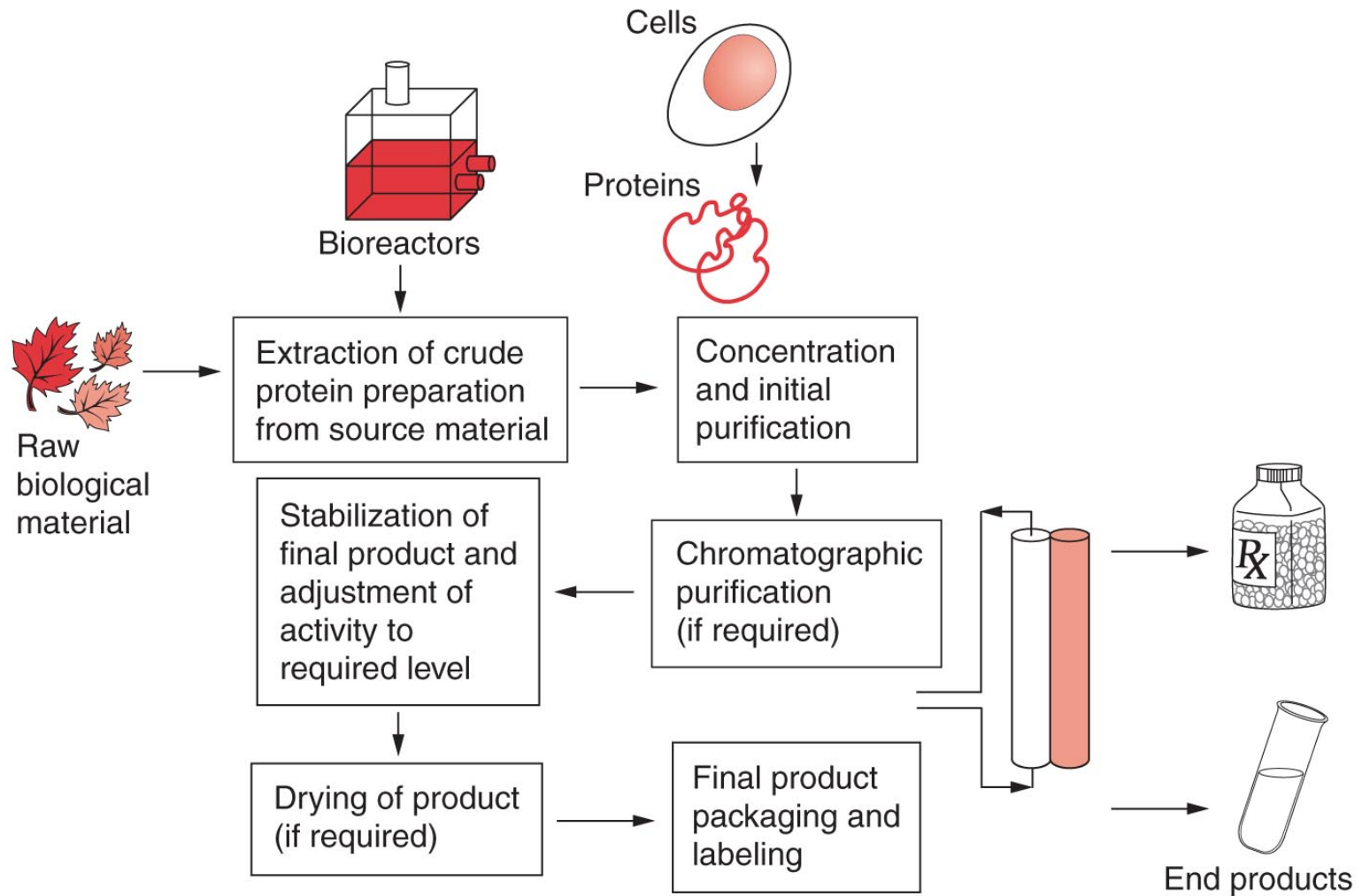
2



3



4



Copyright © 2009 Pearson Education, Inc.

Table 4.1 SOME PROTEIN-BASED PHARMACEUTICAL PRODUCTS (MOST PRODUCED AS RECOMBINANT PROTEINS)

Protein	Application
Erythropoietins	Treatment of anemia
Interleukins 1, 2, 3, 4	Treatment of cancer, AIDS; radiation- or drug-induced bone marrow suppression
Monoclonal antibodies	Treatment of cancer, rheumatoid arthritis; used for diagnostic purposes
Interferons (α , β , γ , including consensus)	Treatment of cancer, allergies, asthma, arthritis, and infectious disease
Colony-stimulating factors	Treatment of cancer, low blood cell count; adjuvant chemotherapy; AIDS therapy
Blood clotting factors	Treatment of hemophilia and related clotting disorders
Human growth factor	Treatment of growth deficiency in children
Epidermal growth factor	Treatment of wounds, skin ulcers, cancer
Insulin	Treatment of diabetes mellitus
Insulin-like growth factor	Treatment of type II diabetes mellitus
Tissue plasminogen factor	Treatment after heart attack, stroke
Tumor necrosis factor	Cancer treatment
Vaccines	Vaccinate against hepatitis B, malaria, herpes

Table 4.2 SOME ENZYMES AND THEIR INDUSTRIAL APPLICATIONS

Enzyme	Application
Amylases	Digest starch in fermentation and processing
Proteases	Digest proteins for detergents, meat/leather, cheese, brewing/baking, animal/human digestive aids
Lipases	Digest lipids (fats) in dairy and vegetable oil products
Pectinases	Digest enzymes in fruit juice/pulp
Lactases	Digest milk sugar
Glucose isomerase	Produce high-fructose syrups
Cellulases/ hemicellulases	Produce animal feeds, fruit juices, brewing converters
Penicillin acylase	Produce penicillin

Copyright © 2009 Pearson Education, Inc.