Microbial Genetics (Ch 8)

Chromosome

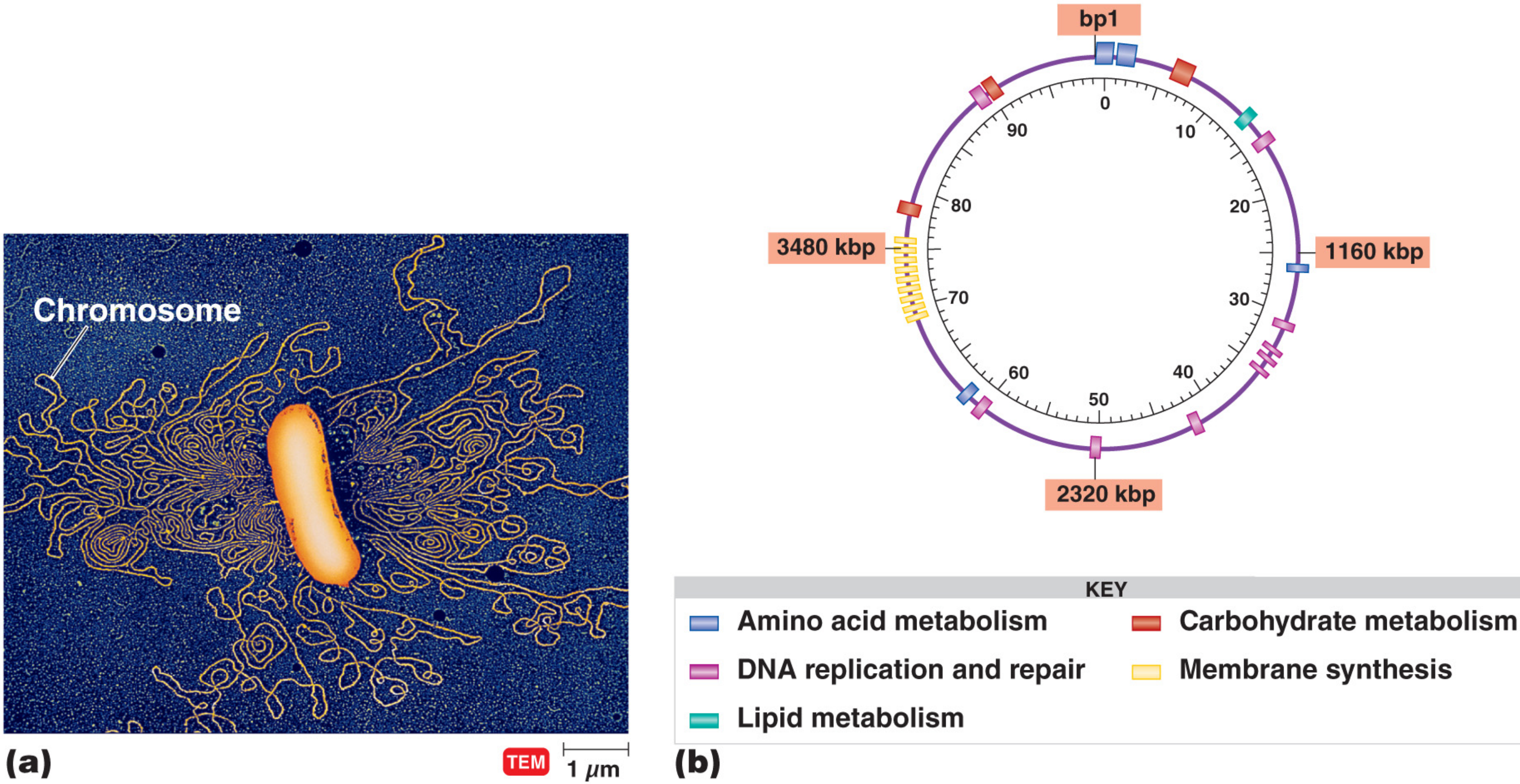


Fig 8.1

Major genetic pathways

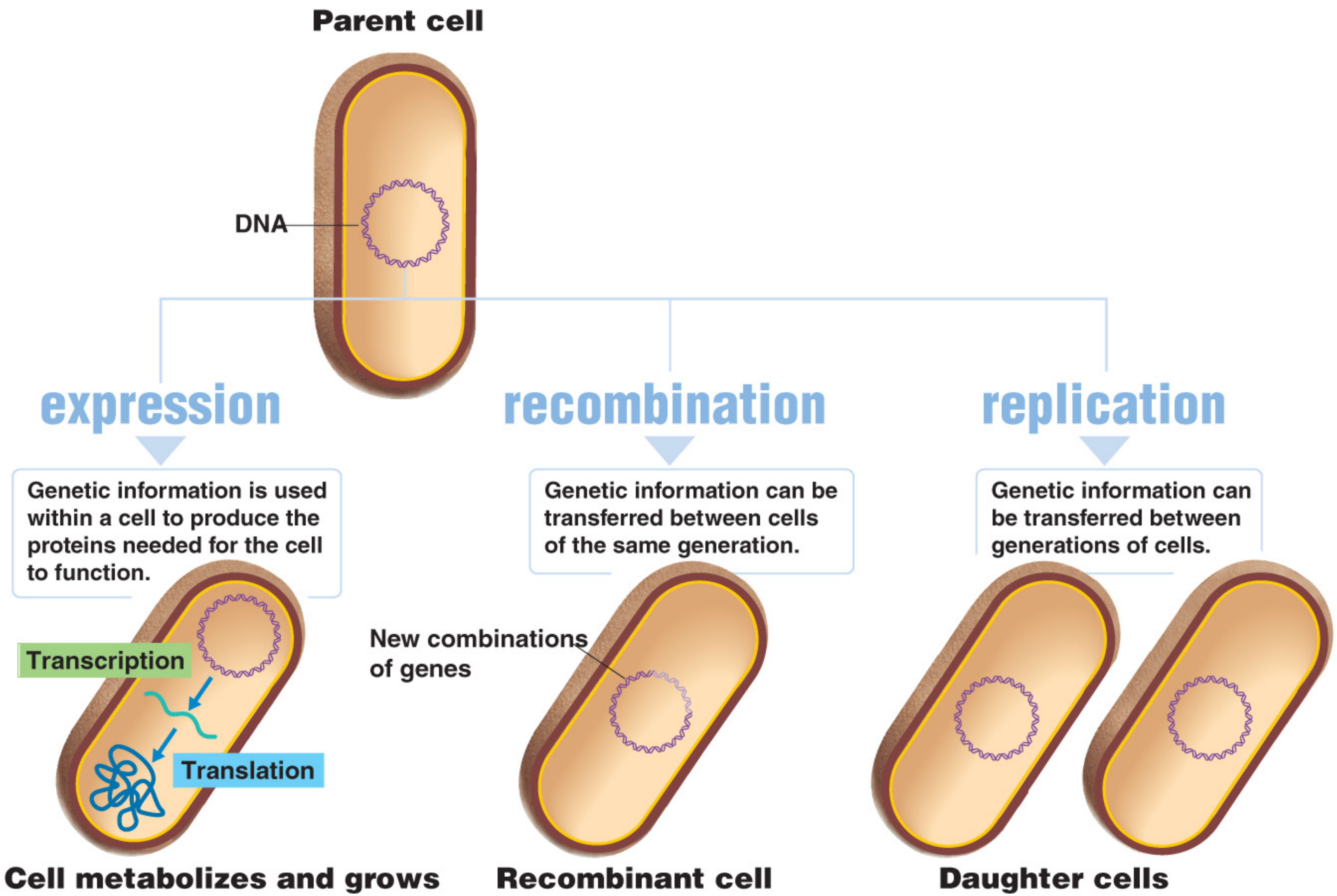
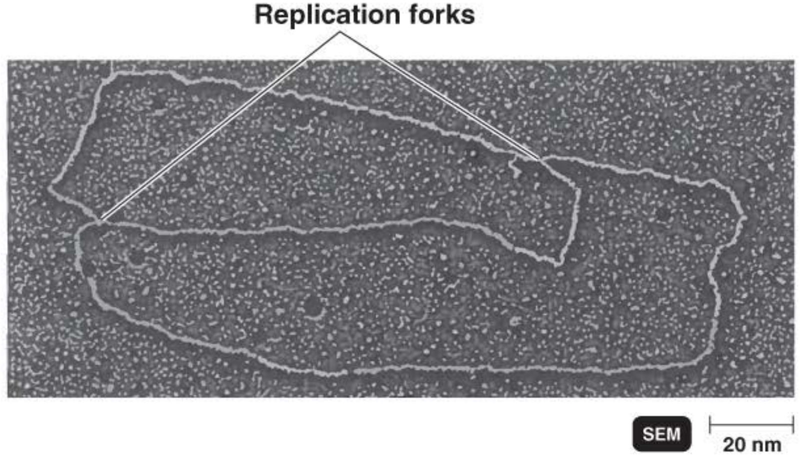
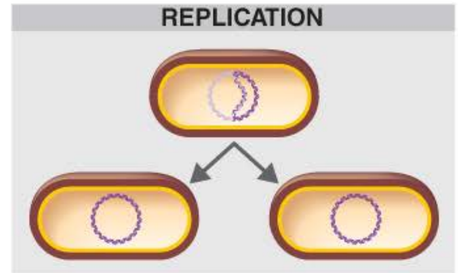


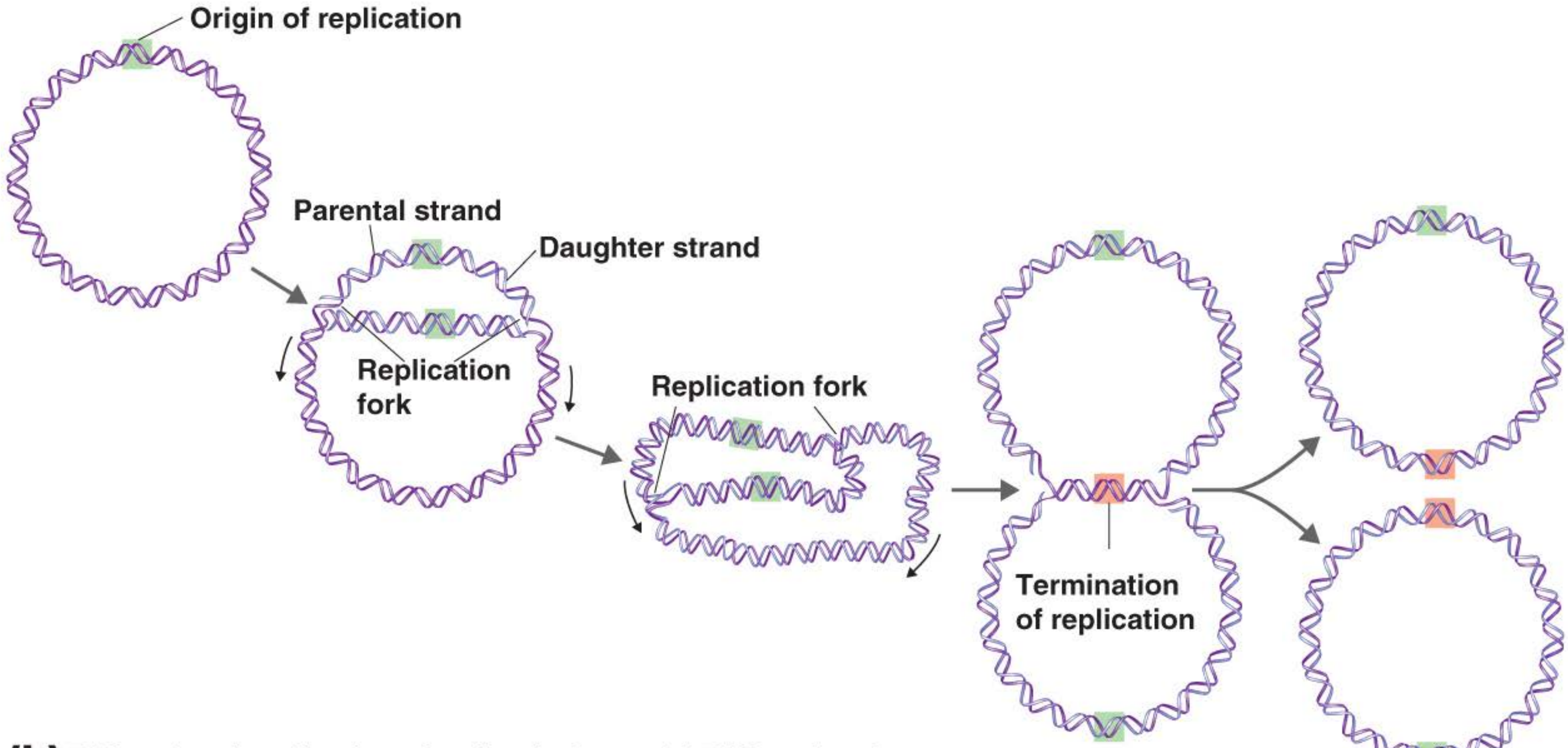
Fig 8.2

Bidirectional replication





(a) An *E. coli* chromosome in the process of replicating



(b) Bidirectional replication of a circular bacterial DNA molecule

Fig 8.6

Expression, intro

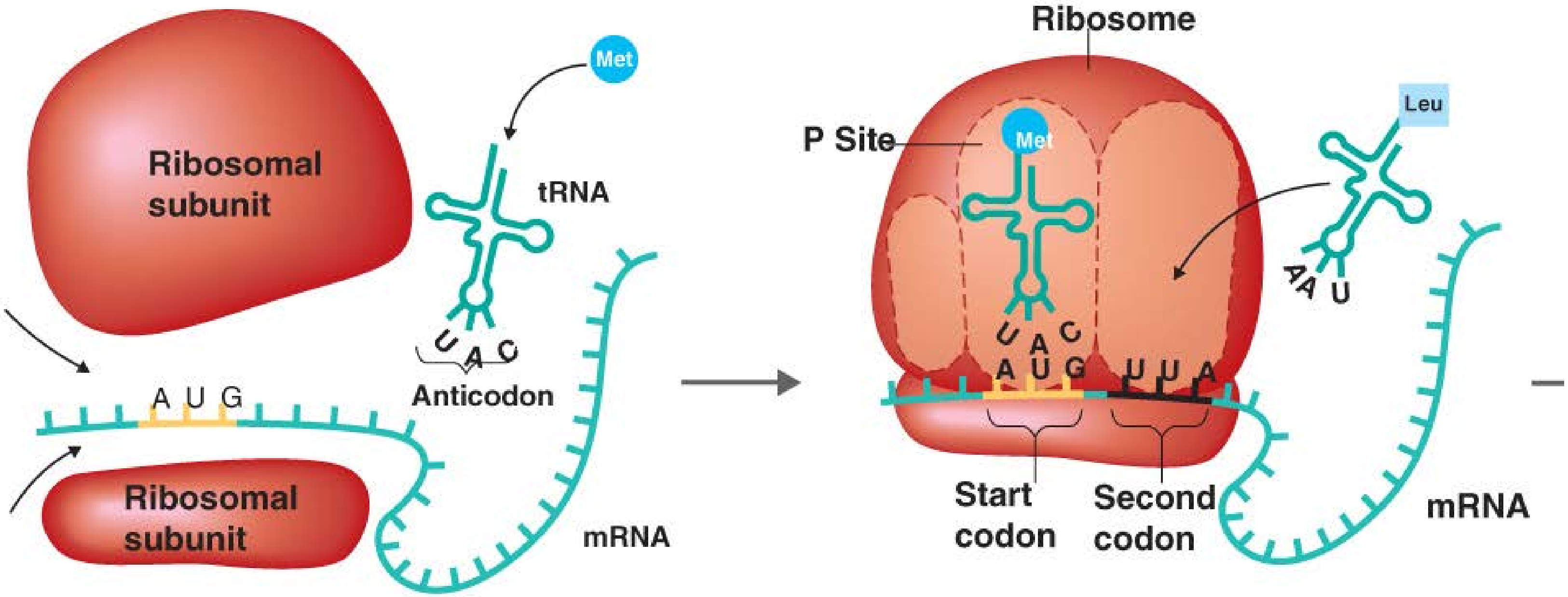


Fig 8.9

Simultaneous transcription + translation

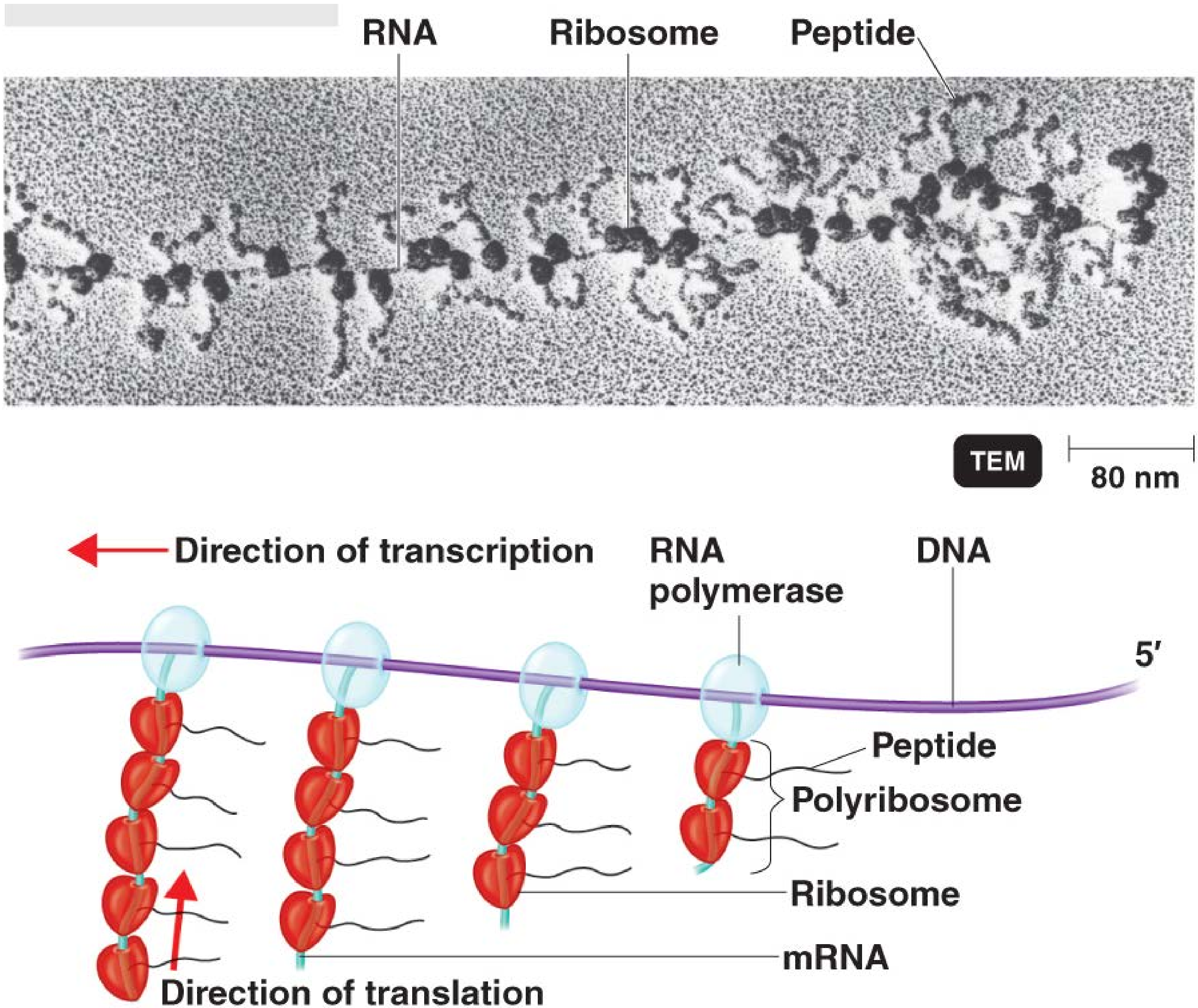


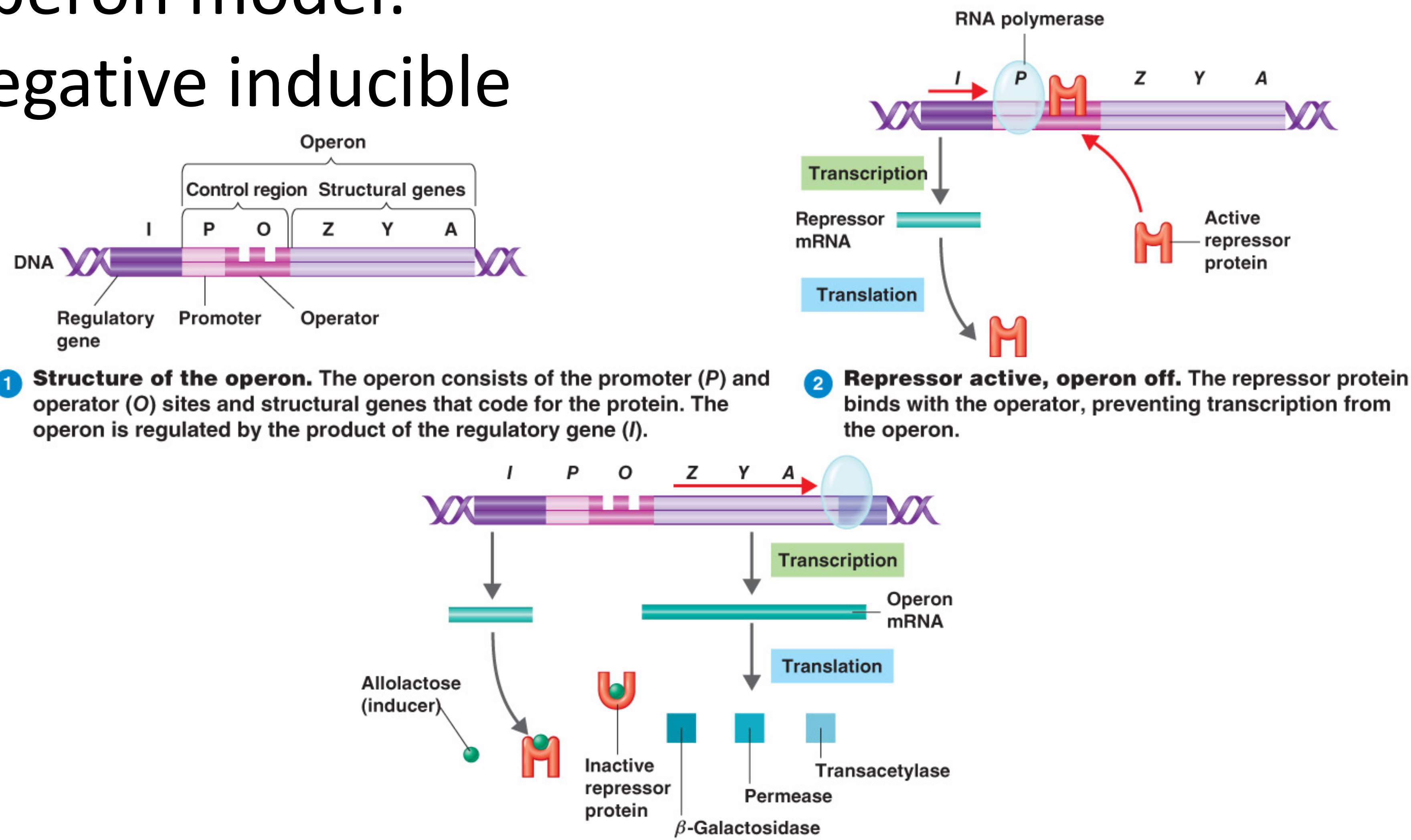
Fig 8.10

Operons

Intro to *lac* operon: https://www.youtube.com/watch?v=oBwtxdI1zvk

Operon lecture video: https://www.youtube.com/watch?v=10YWgqmAEsQ

Operon model: Negative inducible



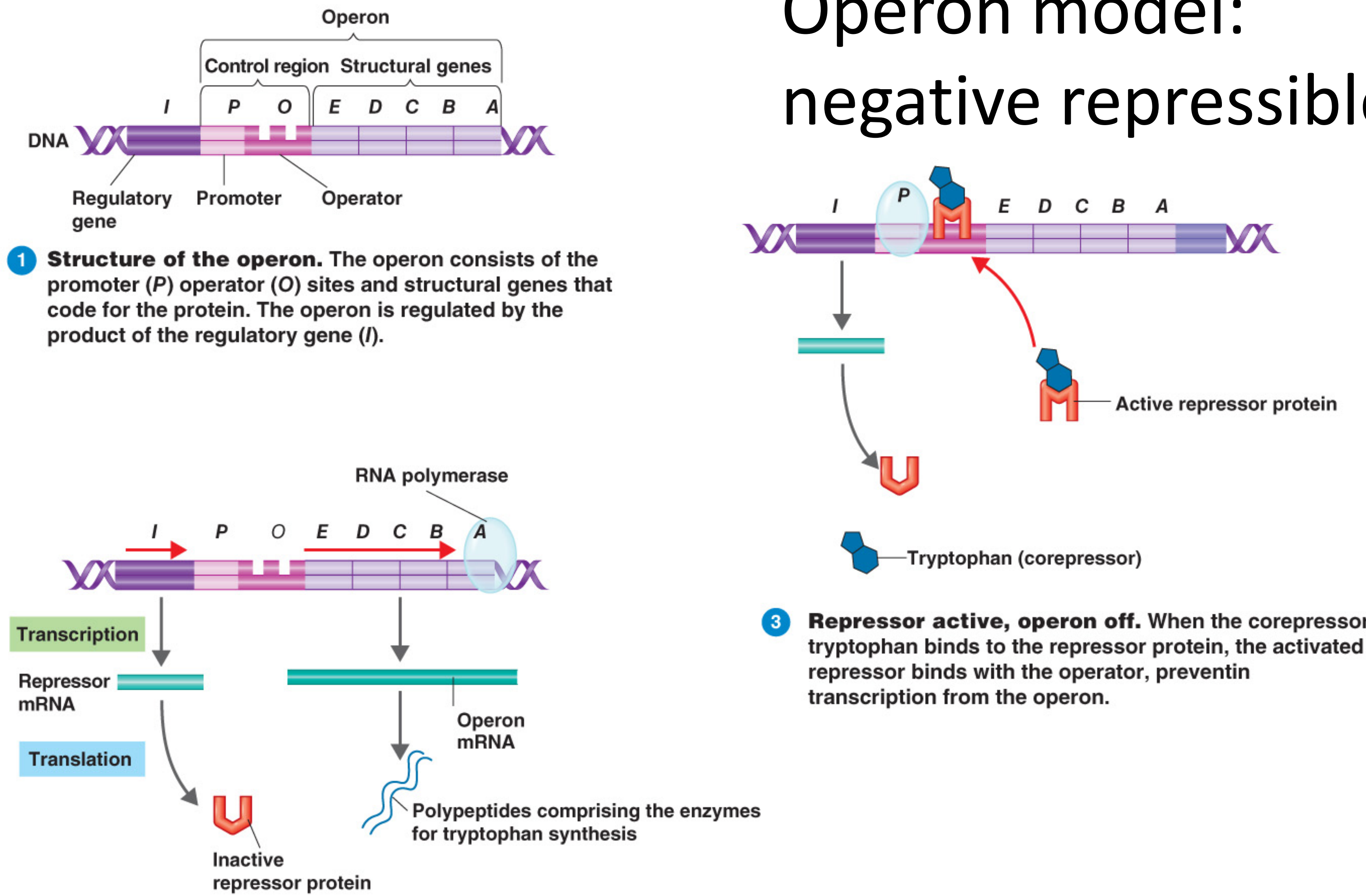
1 **Structure of the operon.** The operon consists of the promoter (*P*) and operator (*O*) sites and structural genes that code for the protein. The operon is regulated by the product of the regulatory gene (*I*).

2 **Repressor active, operon off.** The repressor protein binds with the operator, preventing transcription from the operon.

3 **Repressor inactive, operon on.** When the inducer allolactose binds to the repressor protein, the inactivated repressor can no longer block transcription. The structural genes are transcribed, ultimately resulting in the production of the enzymes needed for lactose catabolism.

Fig. 8.12

Operon model: negative repressible



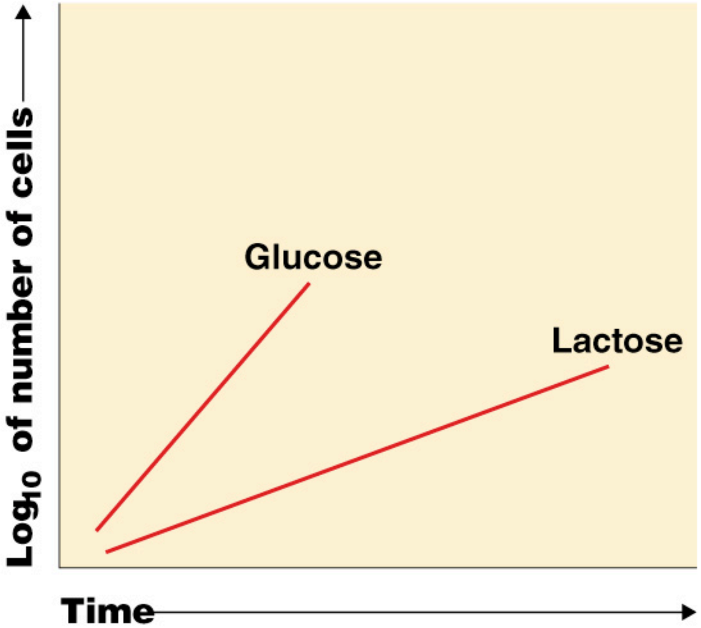
1 **Structure of the operon.** The operon consists of the promoter (*P*) operator (*O*) sites and structural genes that code for the protein. The operon is regulated by the product of the regulatory gene (*I*).

2 **Repressor inactive, operon on.** The repressor is inactive, and transcription and translation proceed, leading to the synthesis of tryptophan.

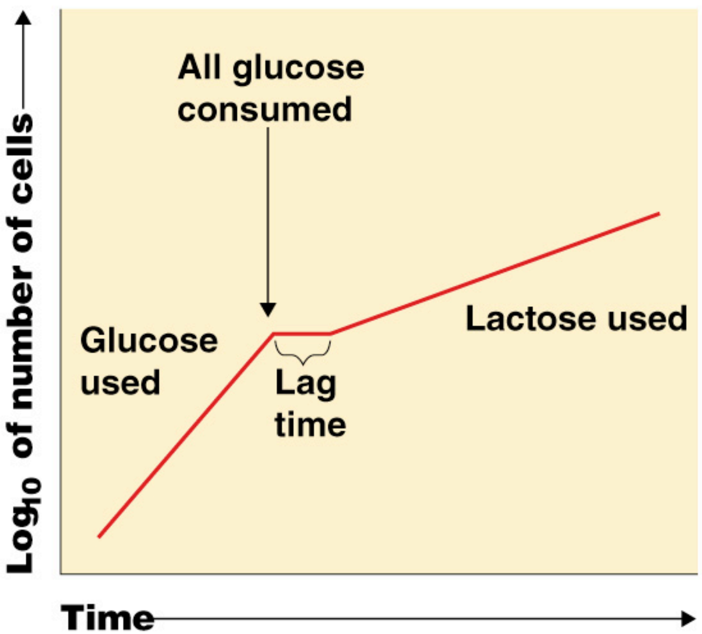
3 **Repressor active, operon off.** When the corepressor tryptophan binds to the repressor protein, the activated repressor binds with the operator, preventin transcription from the operon.

Fig. 8.13

Operon model



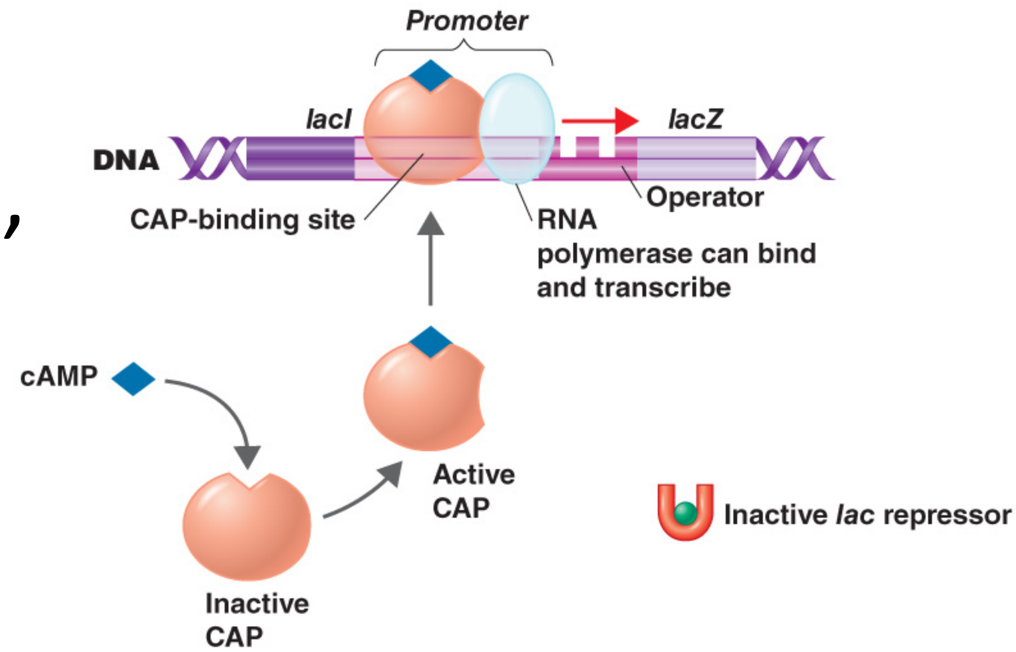
(a) Bacteria growing on glucose as the sole carbon source grow faster than on lactose.



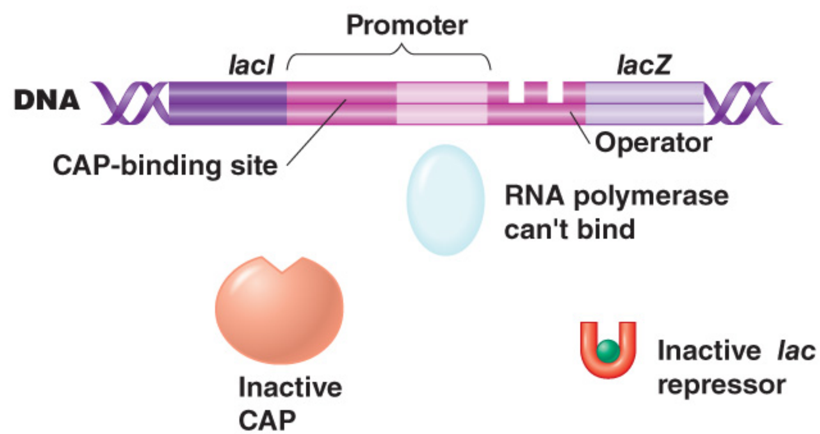
(b) Bacteria growing in a and lactose first consume the glucose and then, after a short lag time, the lactose. During the lag time, intracellular cAMP increases, the operon is transcribed, more lactose is transported into the cell, and β-galactosidase is synthesized to break down lactose.

Fig. 8.14

Operon model: Positive inducible, complex



(a) Lactose present, glucose scarce (cAMP level high). If glucose is scarce, the high level of cAMP activates CAP, and the lac operon produces large amounts of mRNA for lactose digestion.



(b) Lactose present, glucose present (cAMP level low). When glucose is present, cAMP is scarce, and CAP is unable to stimulate transcription.

Fig. 8.15

Paper on other regulated genes:
Toledo-Arana *et al.* 2009

Mutations

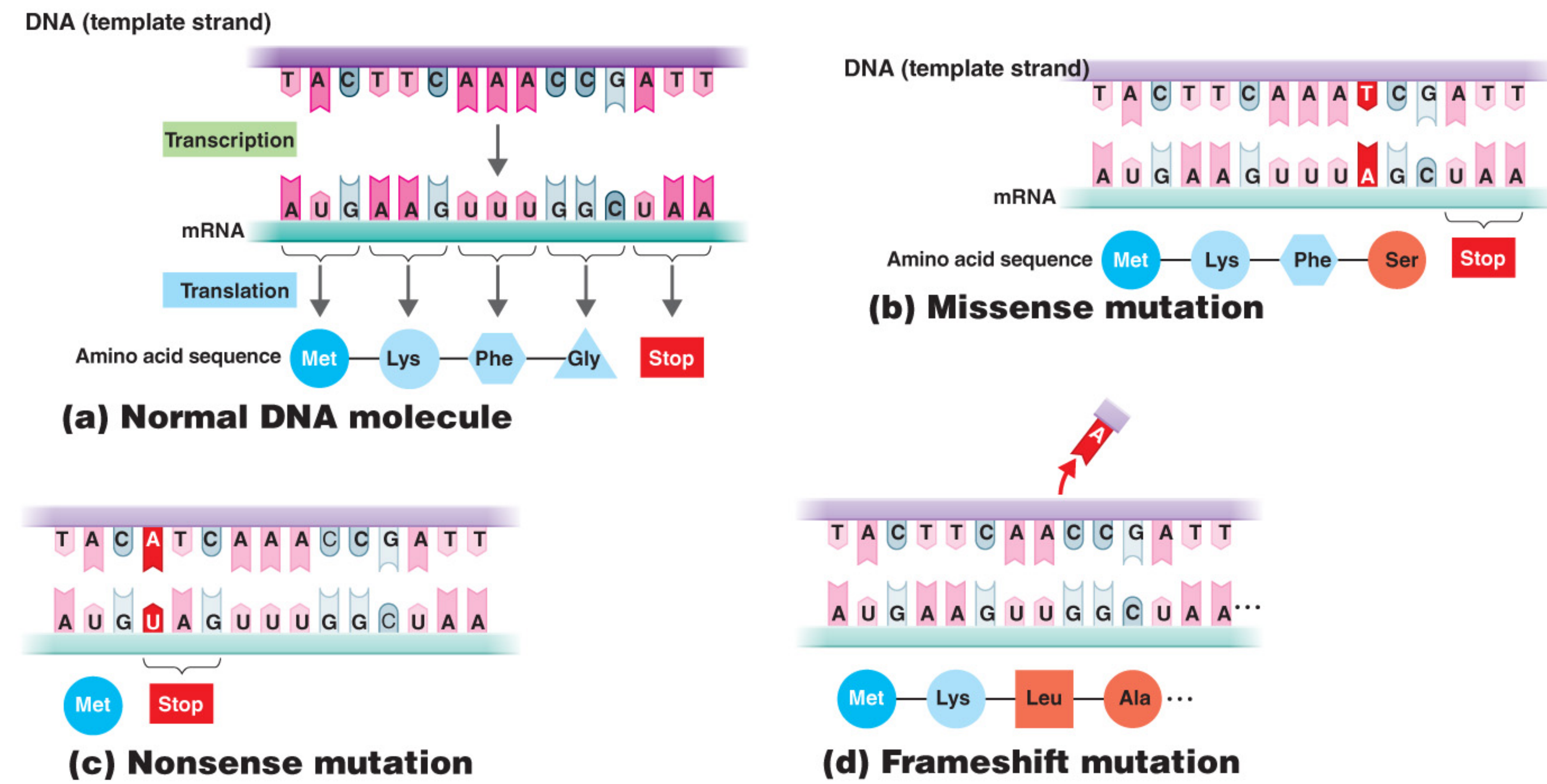
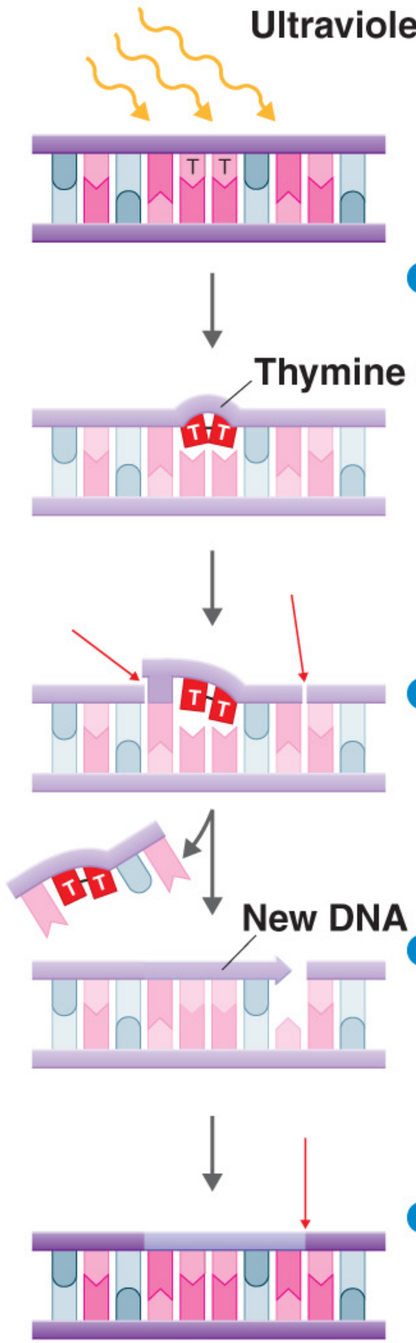


Fig. 8.18

Mutations



1. Exposure to ultraviolet light causes adjacent thymines to become cross-linked, forming a thymine dimer and disrupting their normal base pairing.
2. An endonuclease cuts the DNA, and an exonuclease removes the damaged DNA.
3. DNA polymerase fills the gap by synthesizing new DNA, using the intact strand as a template.
4. DNA ligase seals the remaining gap by joining the old and new DNA.

Fig. 8.21

Ames test for mutagens

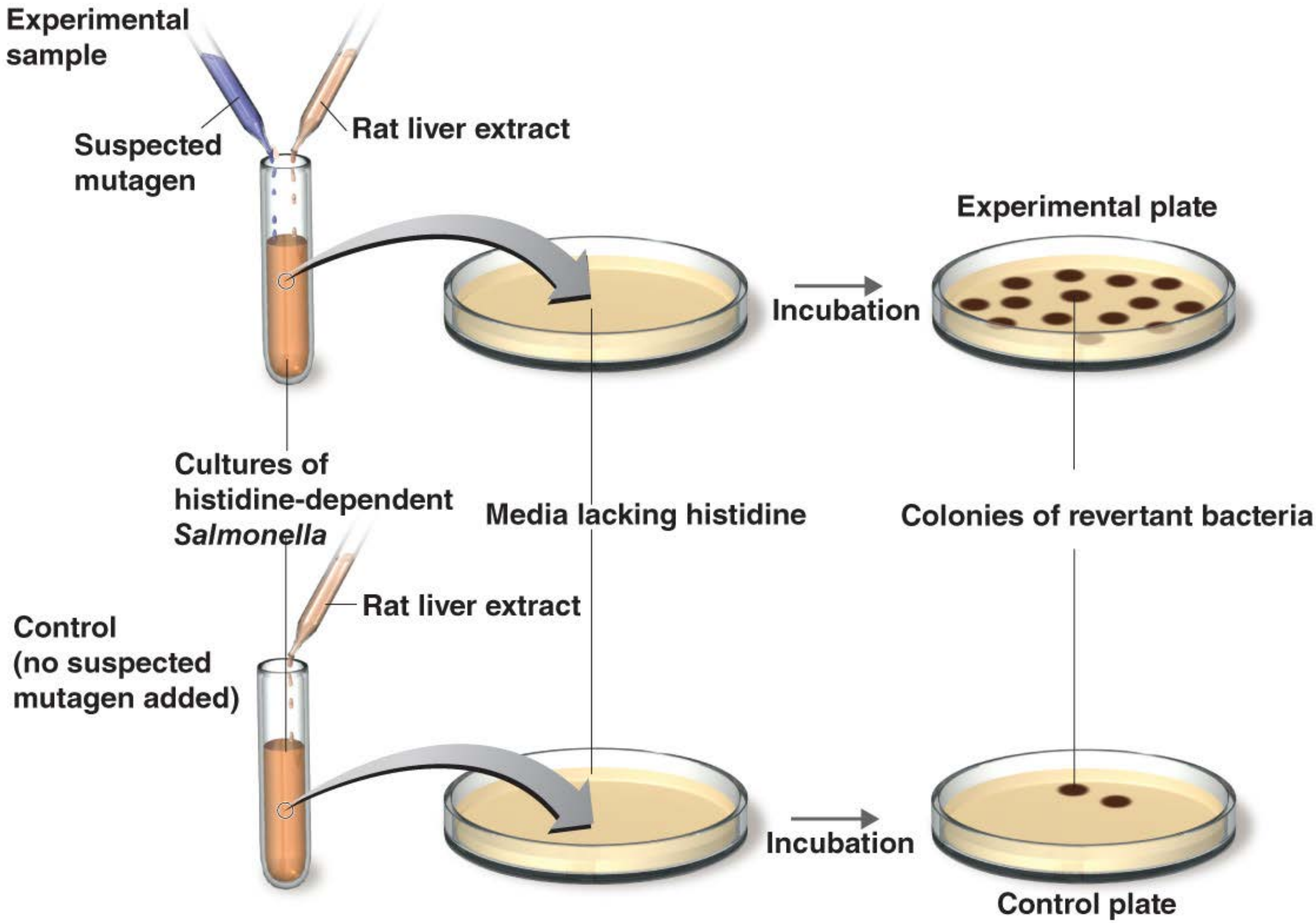


Fig. 8.23

Cyclophosphamide: a nitrogen mustard alkylating agent

en.wikipedia.org

Griffith's experiment: a sign of recombination

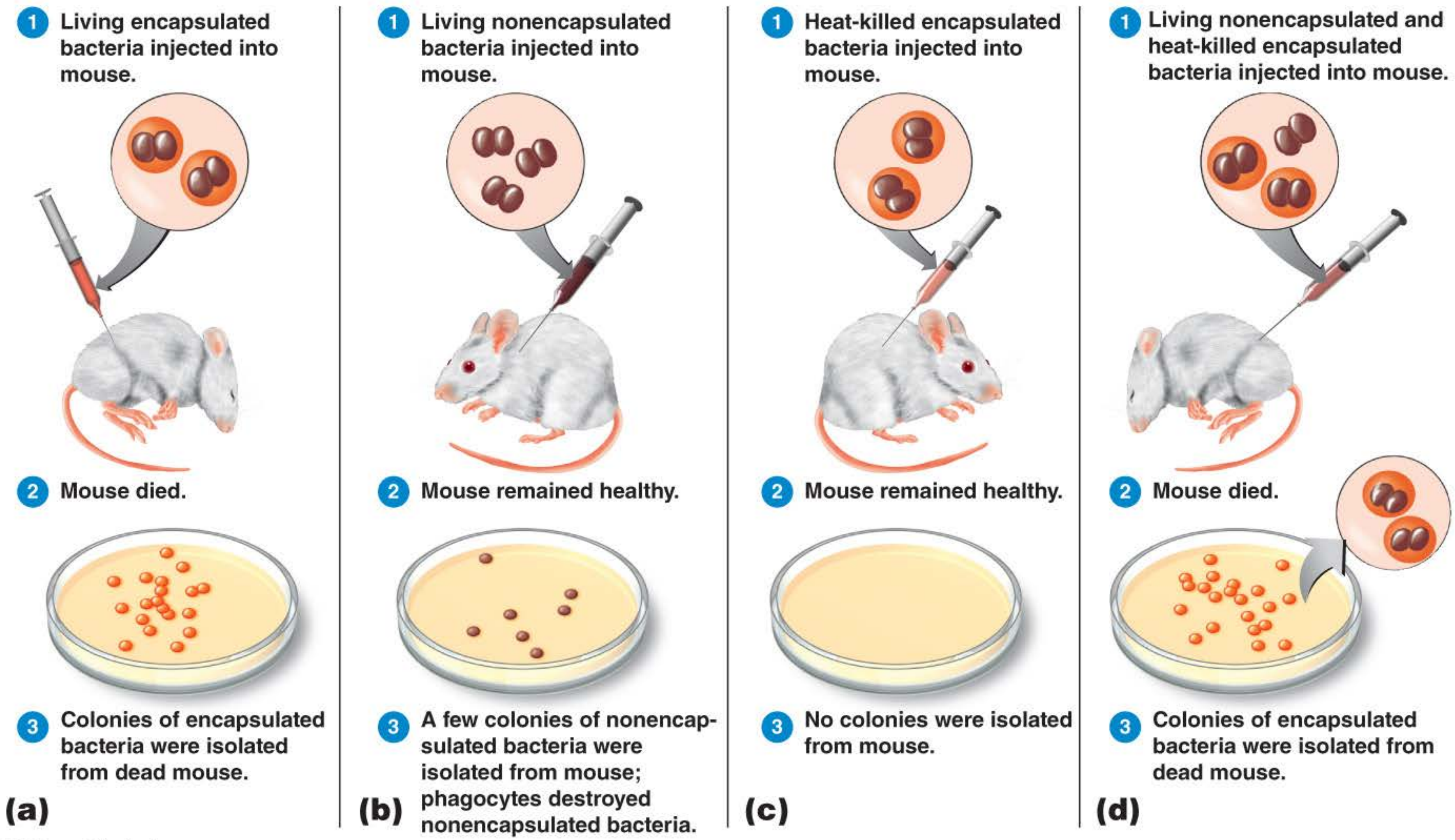


Fig. 8.25

Transformation

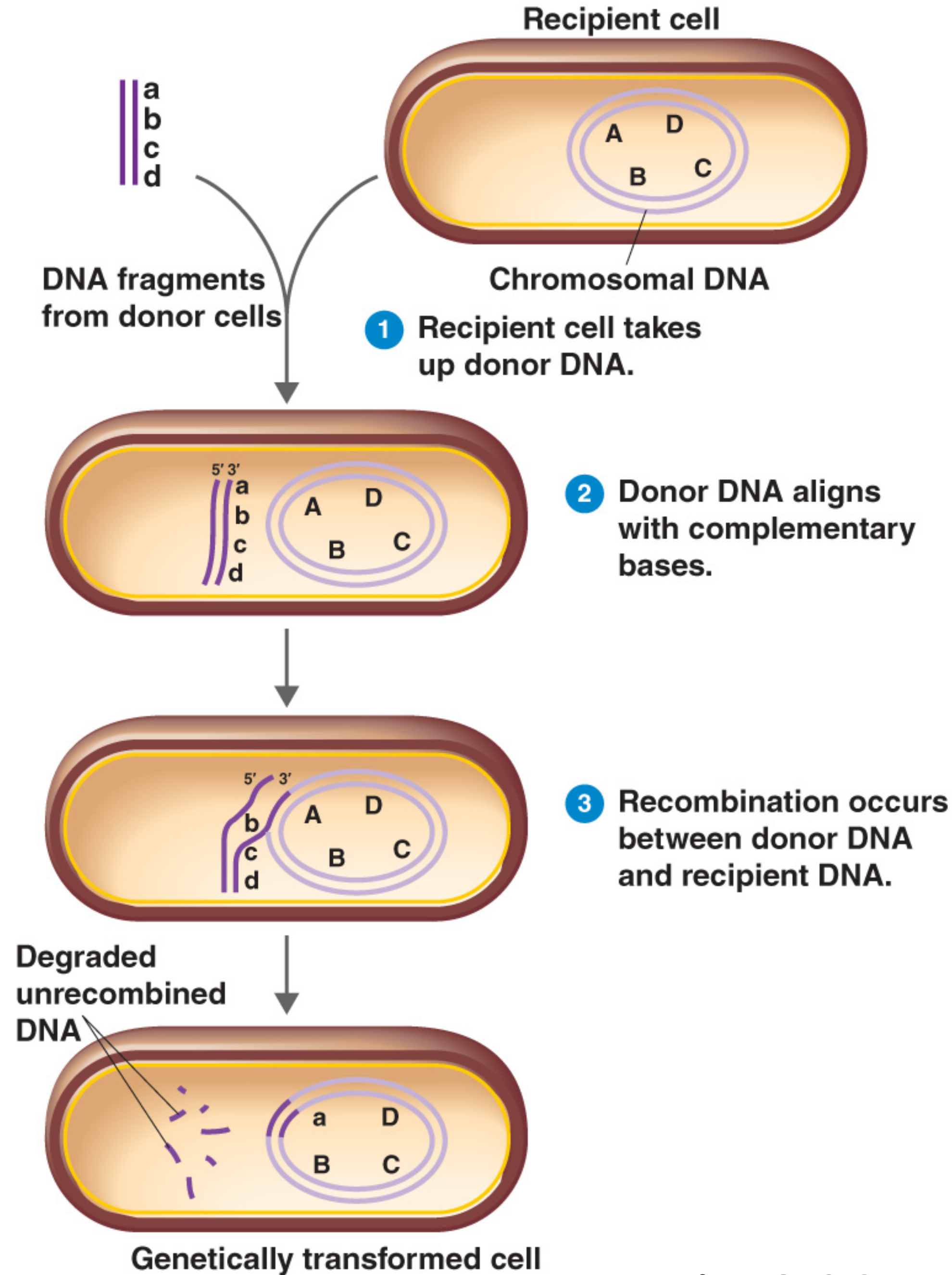
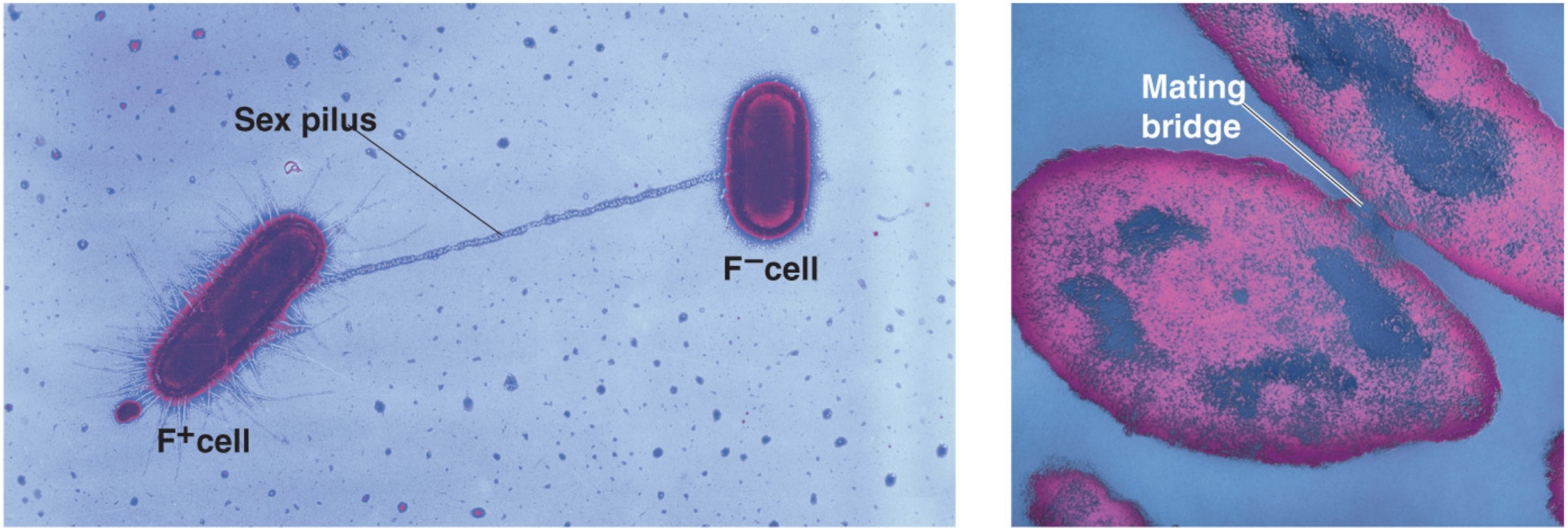


Fig. 8.26

Conjugation



(a) Sex pilus

(b) Mating bridge

Fig. 8.27

Recombination: Transduction

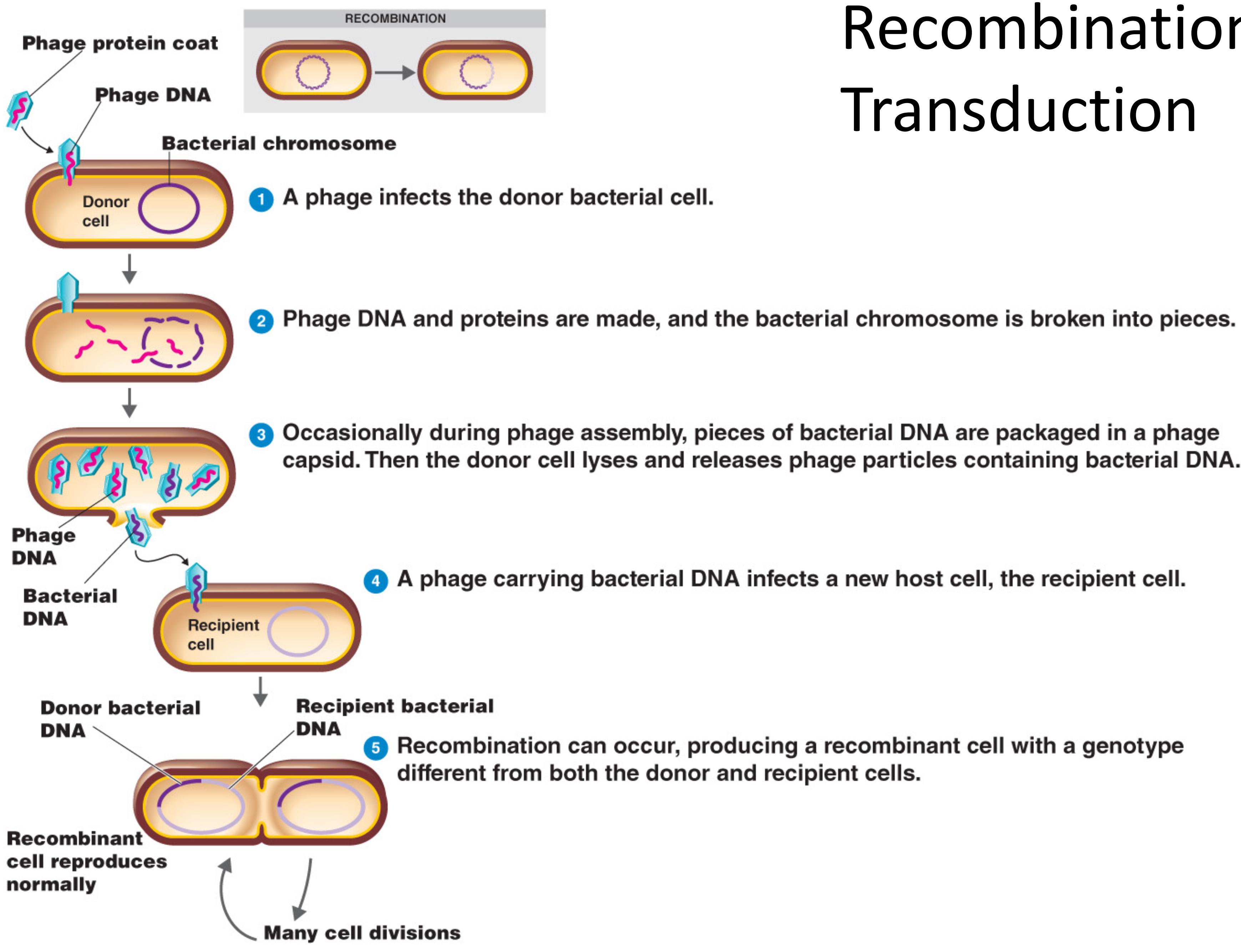


Fig. 8.29

Plasmids

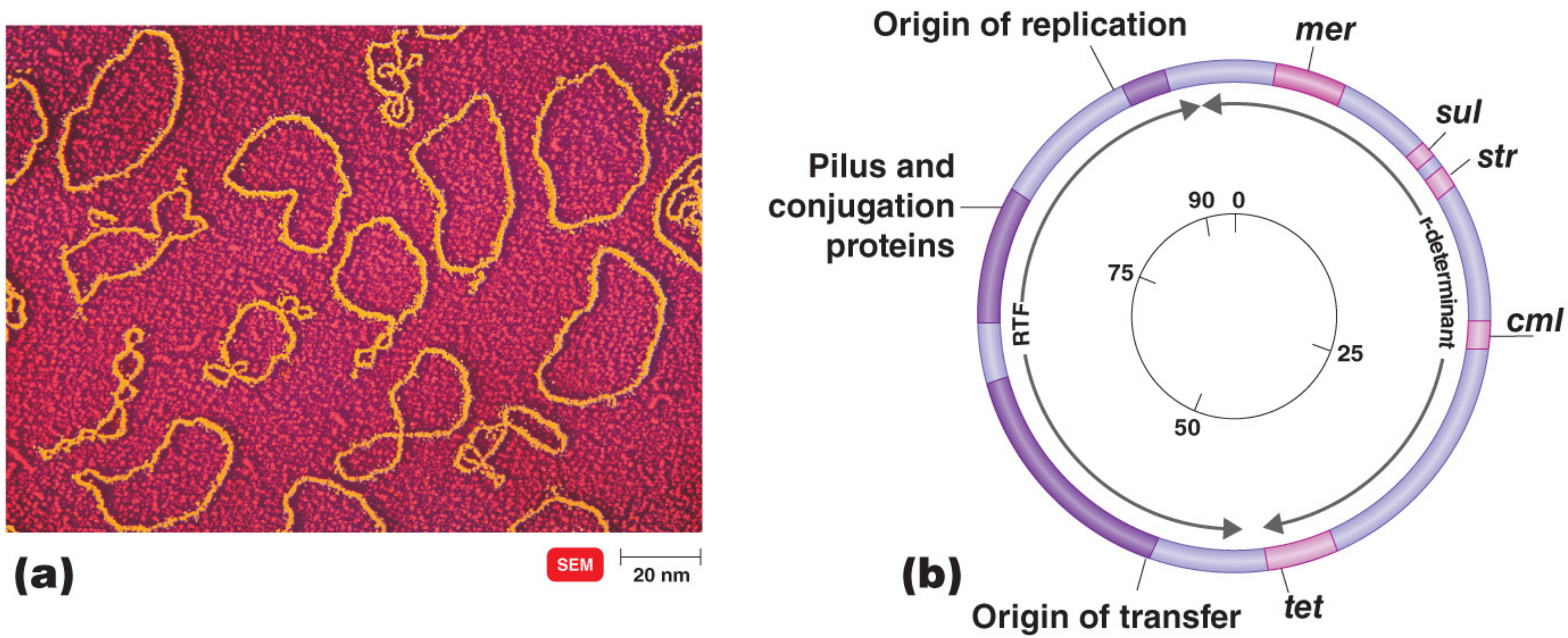


Fig. 8.30

Operon model

Fig. 8.13