Lecture for Friday

Dr. Prince

BIOL 1408

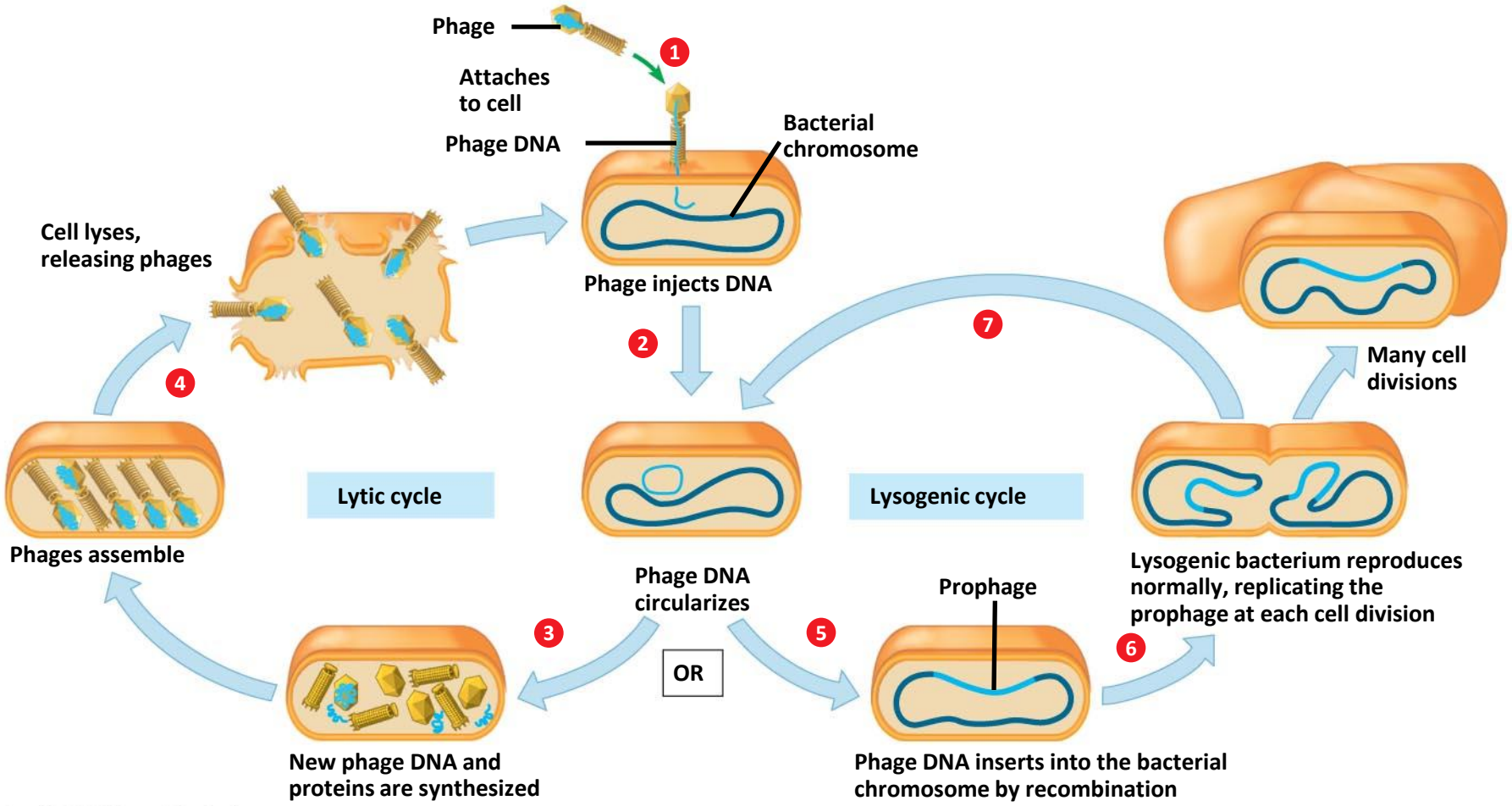
MICROBIAL GENETICS

Viral DNA may become part of the host chromosome

- Viruses have two types of reproductive cycles
  - **Lytic cycle**
    - Viral particles are produced using host cell components
    - The host cell lyses, and viruses are released

Viral DNA may become part of the host chromosome

- Viruses have two types of reproductive cycles
  - **Lysogenic cycle**
    - Viral DNA is inserted into the host chromosome by recombination
    - Viral DNA is duplicated along with the host chromosome during each cell division
    - The inserted phage DNA is called a **prophage**
    - Most prophage genes are inactive
    - Environmental signals can cause a switch to the lytic cycle

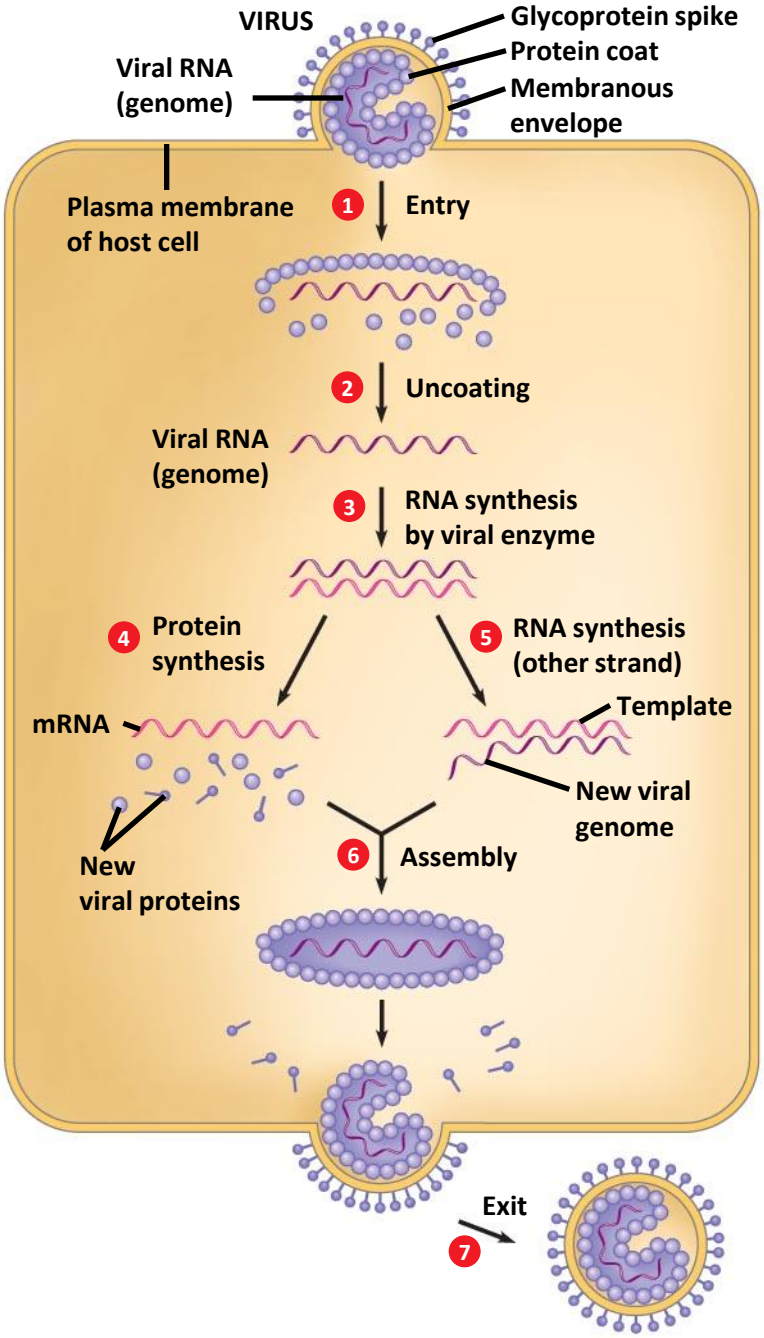


Many viruses cause disease in animals and plants

- Both DNA viruses and RNA viruses cause disease in animals
- Reproductive cycle of an RNA virus
  - Entry
    - Glycoprotein spikes contact host cell receptors
    - Viral envelope fuses with host plasma membrane
  - Uncoating of viral particle to release the RNA genome
  - mRNA synthesis using a viral enzyme
  - Protein synthesis
  - RNA synthesis of new viral genome
  - Assembly of viral particles

Many viruses cause disease in animals and plants

- Some animal viruses reproduce in the cell nucleus
- Most plant viruses are RNA viruses
  - They breach the outer protective layer of the plant
  - They spread from cell to cell through plasmodesmata
  - Infection can spread to other plants by animals, humans, or farming practices



EVOLUTION: Emerging viruses threaten human health

- How do **emerging viruses** cause human diseases?
  - Mutation
    - RNA viruses mutate rapidly
  - Contact between species
    - Viruses from other animals spread to humans
  - Spread from isolated populations

EVOLUTION: Emerging viruses threaten human health

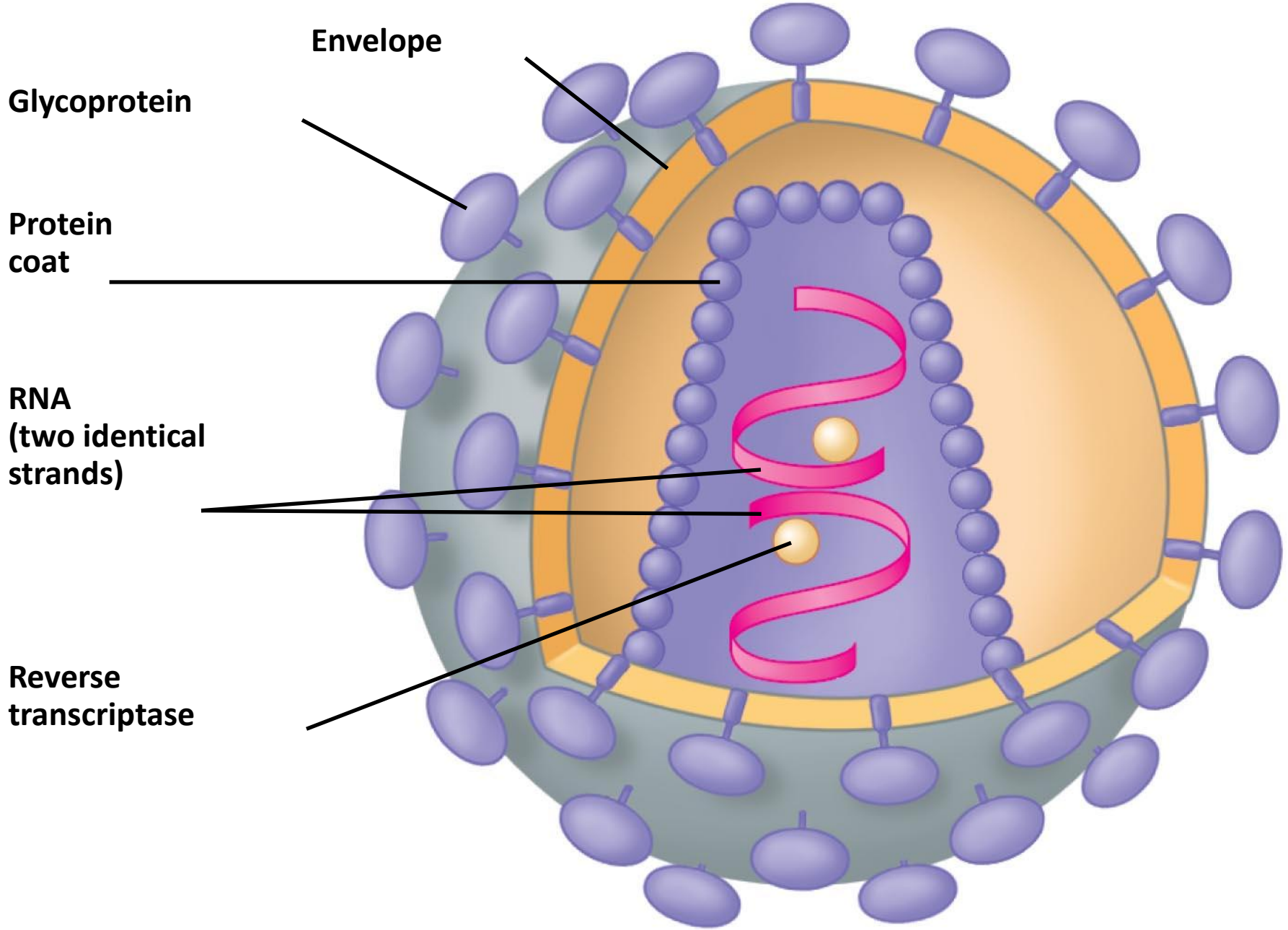
- Examples of emerging viruses
  - HIV
  - Ebola virus
  - West Nile virus
  - RNA coronavirus causing severe acute respiratory syndrome (SARS)
  - Avian flu virus

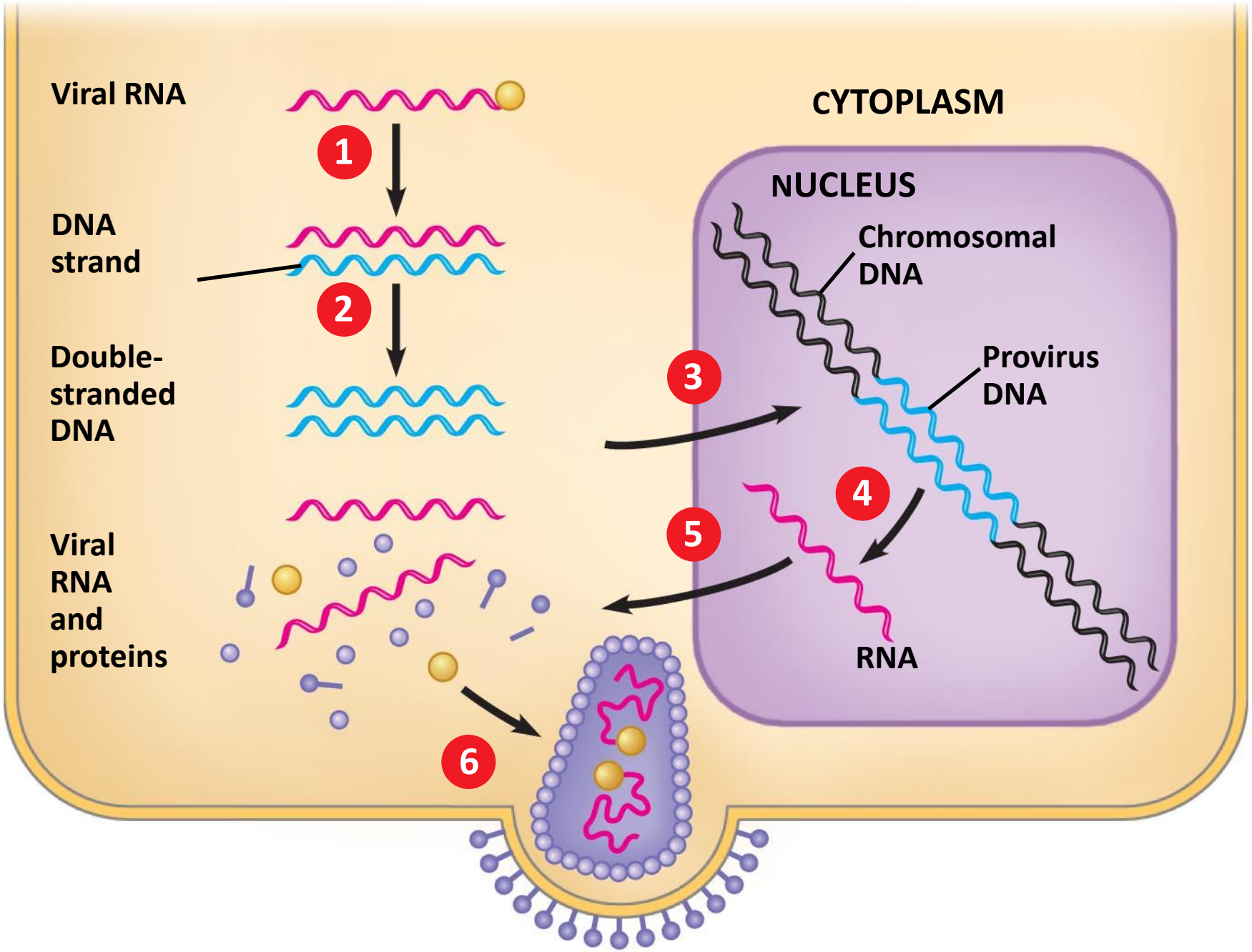
The AIDS virus makes DNA on an RNA template

- **AIDS** is caused by **HIV**, human immunodeficiency virus
- HIV is a **retrovirus**, containing
  - Two copies of its RNA genome
  - **Reverse transcriptase**, an enzyme that produces DNA from an RNA template

The AIDS virus makes DNA on an RNA template

- HIV duplication
  - Reverse transcriptase uses RNA to produce one DNA strand
  - Reverse transcriptase produces the complementary DNA strand
  - Viral DNA enters the nucleus and integrates into the chromosome, becoming a provirus
  - Provirus DNA is used to produce mRNA
  - mRNA is translated to produce viral proteins
  - Viral particles are assembled and leave the host cell



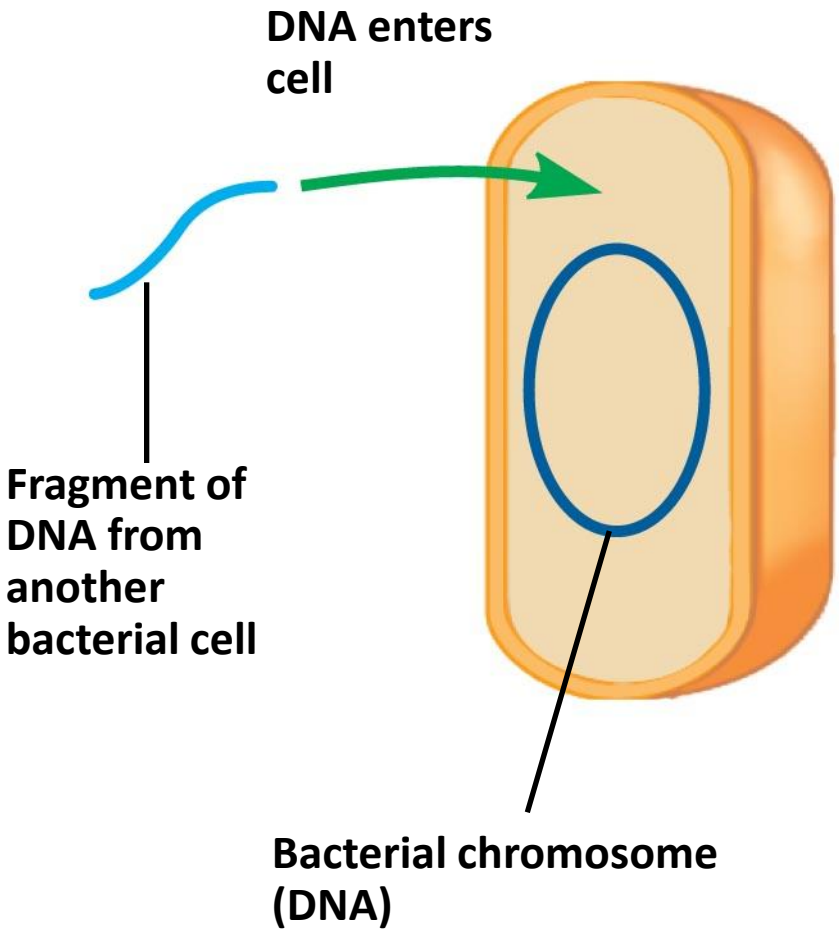


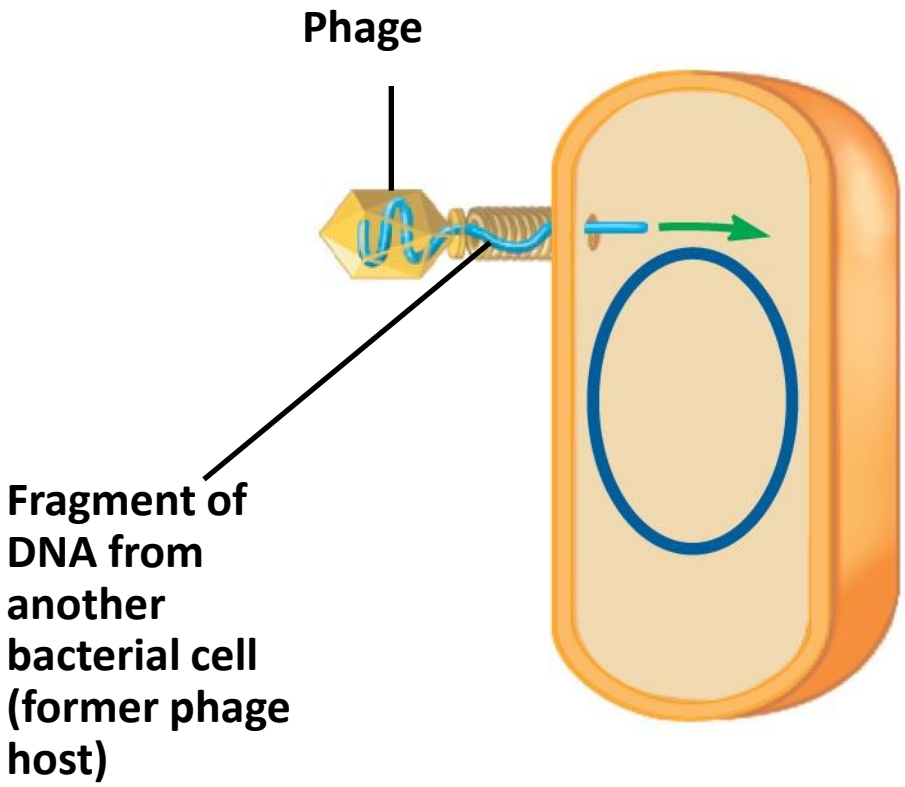
Viroids and prions are formidable pathogens in plants and animals

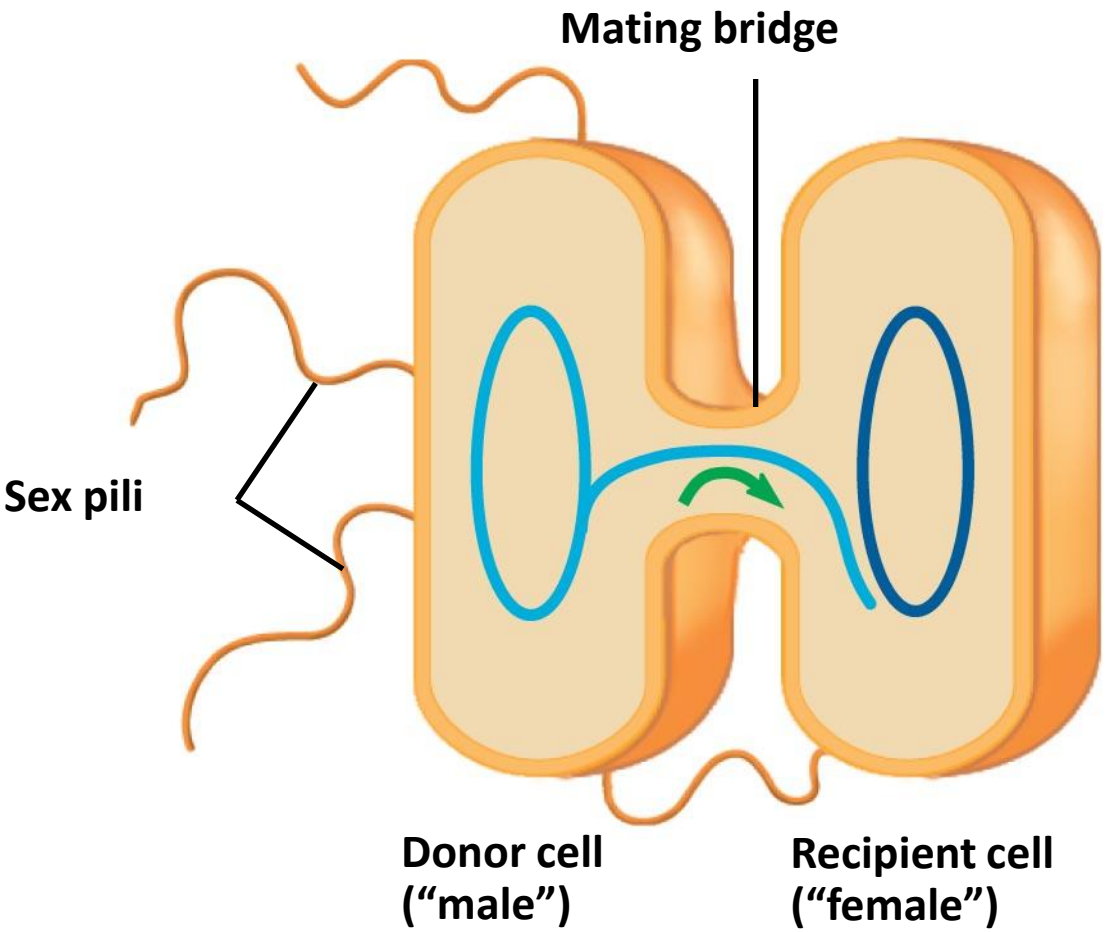
- Some infectious agents are made only of RNA or protein
  - **Viroids**: circular RNA molecules that infect plants
    - Replicate within host cells without producing proteins
    - Interfere with plant growth
  - **Prions**: infectious proteins that cause brain diseases in animals
    - Misfolded forms of normal brain proteins
    - Convert normal protein to misfolded form

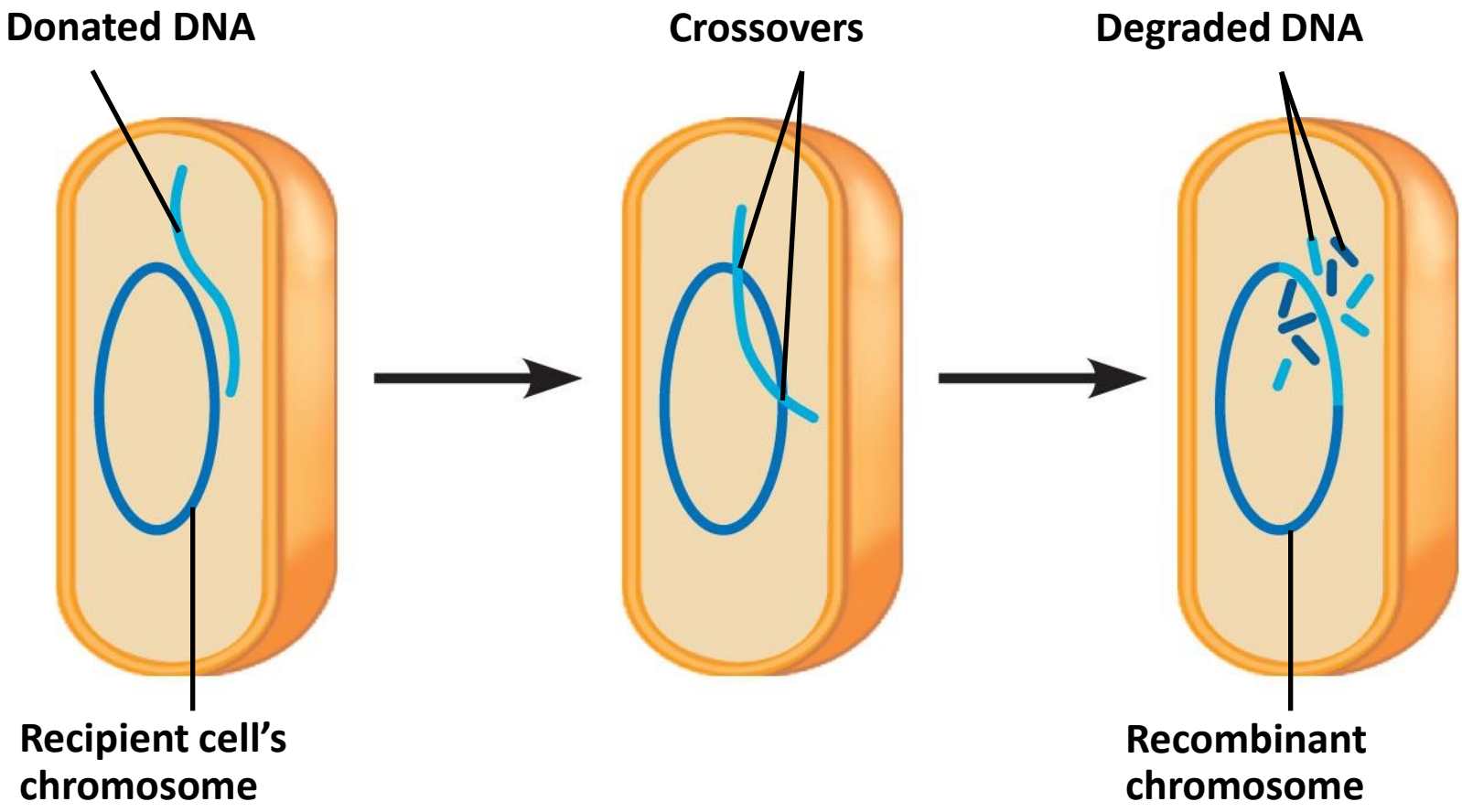
Bacteria can transfer DNA in three ways

- Three mechanisms allow transfer of bacterial DNA
  - **Transformation** is the uptake of DNA from the surrounding environment
  - **Transduction** is gene transfer through bacteriophages
  - **Conjugation** is the transfer of DNA from a donor to a recipient bacterial cell through a cytoplasmic bridge
- Recombination of the transferred DNA with the host bacterial chromosome leads to new combinations of genes



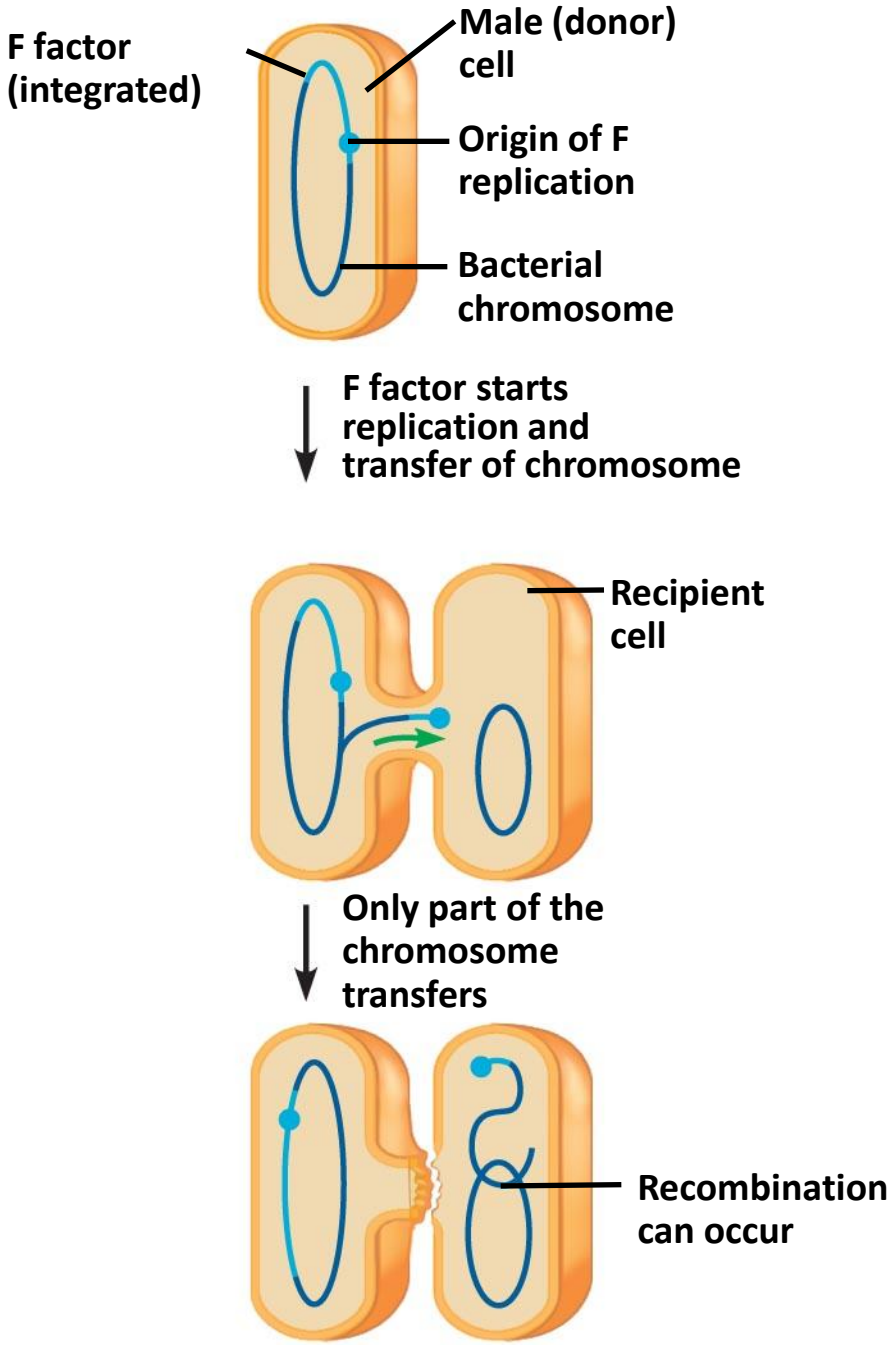


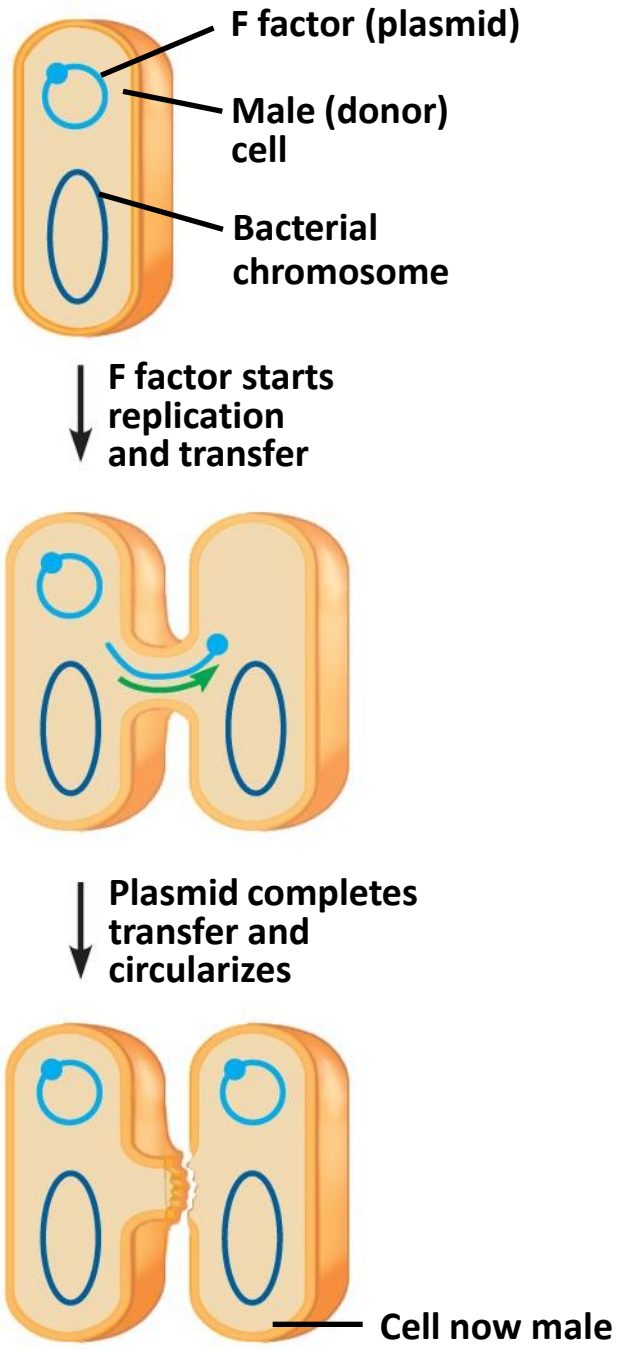


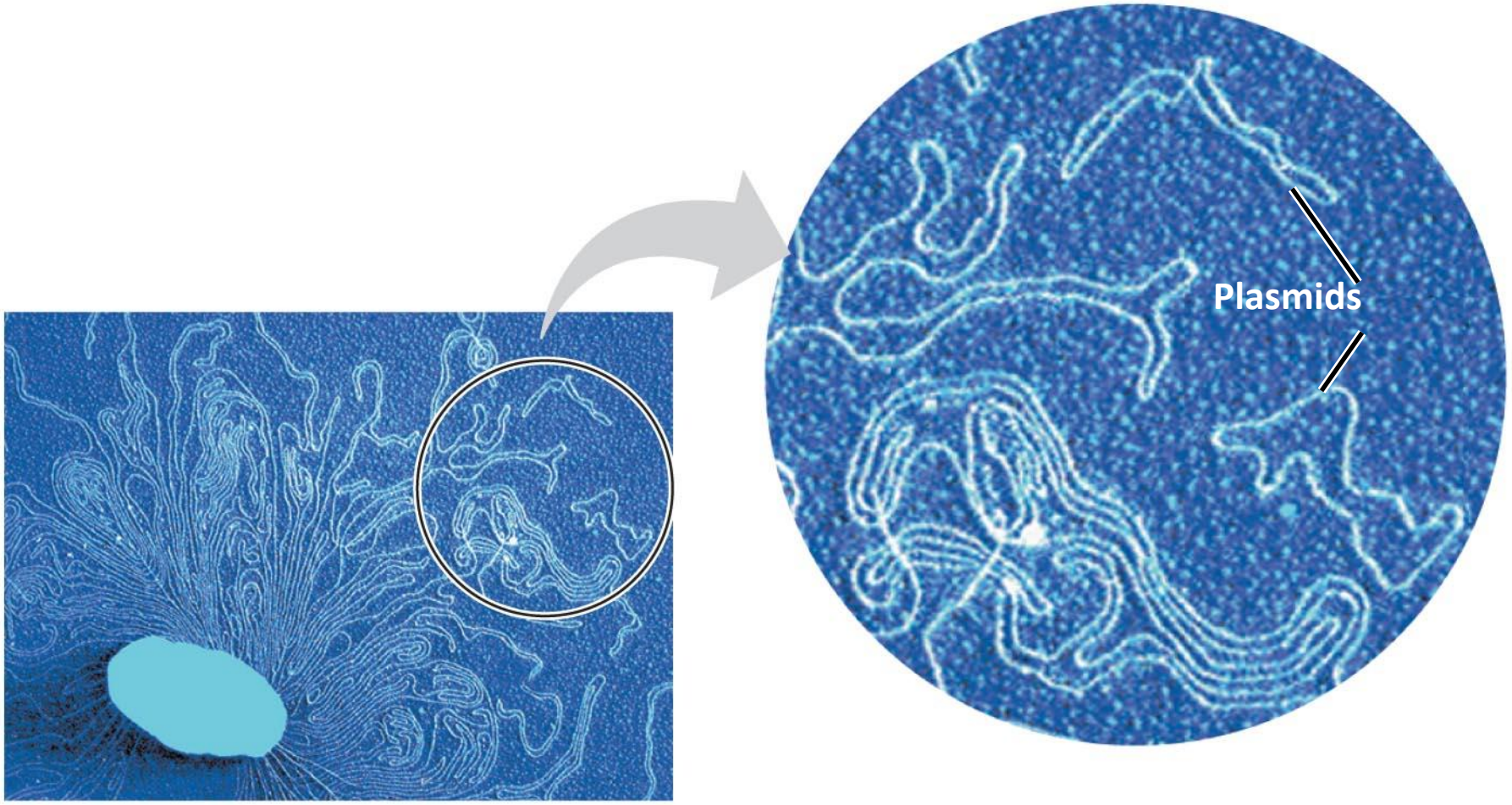


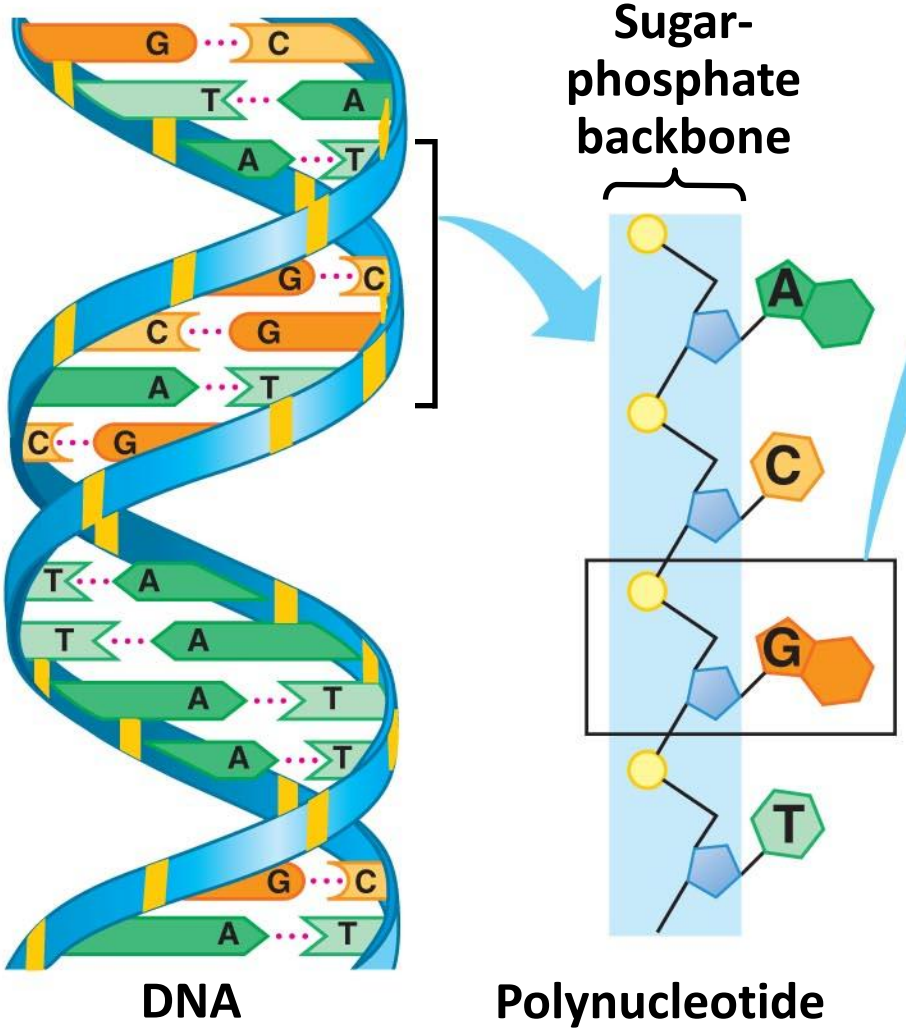
Bacterial plasmids can serve as carriers for gene transfer

- **Plasmids** are small circular DNA molecules that are separate from the bacterial chromosome
  - **F factor** is involved in conjugation
    - When integrated into the chromosome, transfers bacterial genes from donor to recipient
    - When separate, transfers F-factor plasmid
  - **R plasmids** transfer genes for antibiotic resistance by conjugation







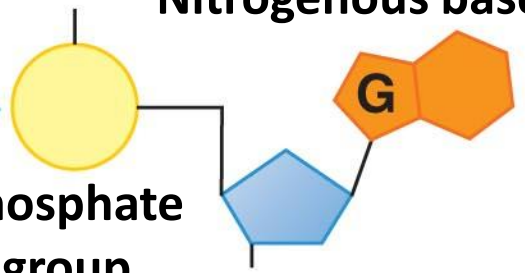


DNA

Sugar-phosphate backbone

Polynucleotide

Nitrogenous base

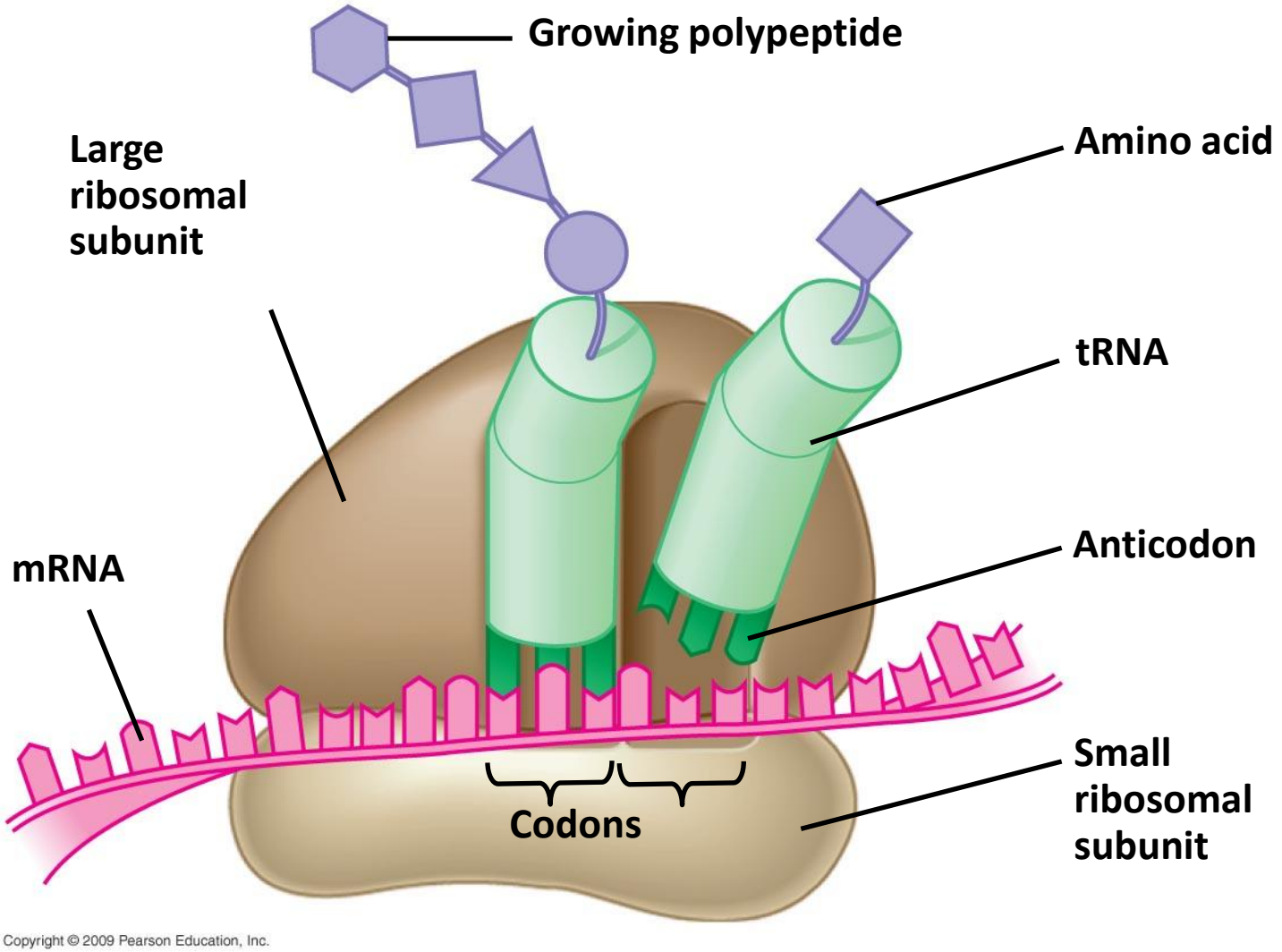


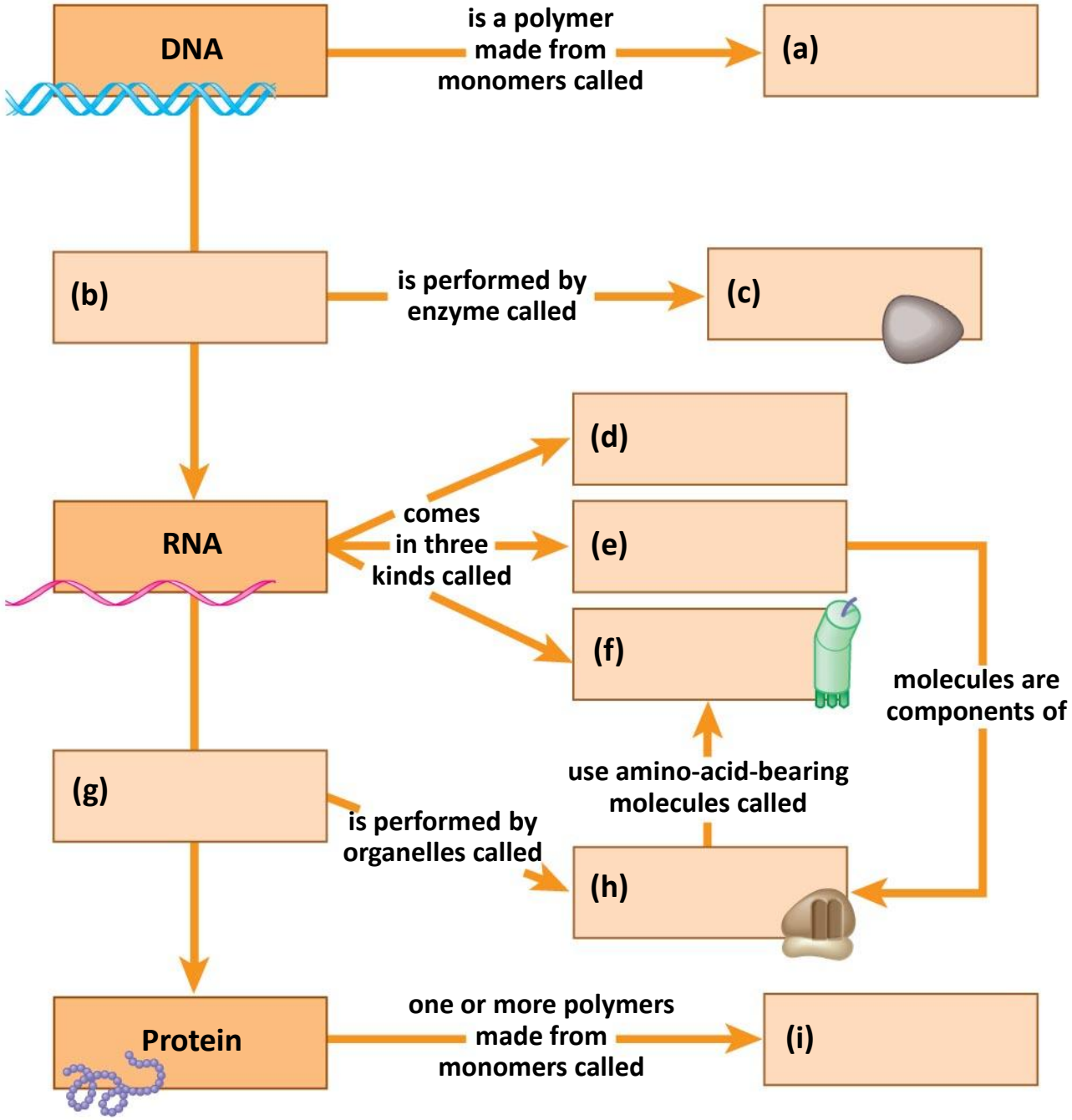
Phosphate group

Sugar

Nucleotide

	DNA	RNA
Nitrogenous base	C G A T	C G A U
Sugar	Deoxy-ribose	Ribose





You should now be able to

1. Compare and contrast the structures of DNA and RNA
2. Describe how DNA replicates
3. Explain how a protein is produced
4. Distinguish between the functions of mRNA, tRNA, and rRNA in translation
5. Determine DNA, RNA, and protein sequences when given any complementary sequence

You should now be able to

6. Distinguish between exons and introns and describe the steps in RNA processing that lead to a mature mRNA
7. Explain the relationship between DNA genotype and the action of proteins in influencing phenotype
8. Distinguish between the effects of base substitution and insertion or deletion mutations

You should now be able to

9. Distinguish between lytic and lysogenic viral reproductive cycles and describe how RNA viruses are duplicated within a host cell
10. Explain how an emerging virus can become a threat to human health
11. Identify three methods of transfer for bacterial genes
12. Distinguish between viroids and prions
13. Describe the effects of transferring plasmids from donor to recipient cells