Lysogenic Cycle

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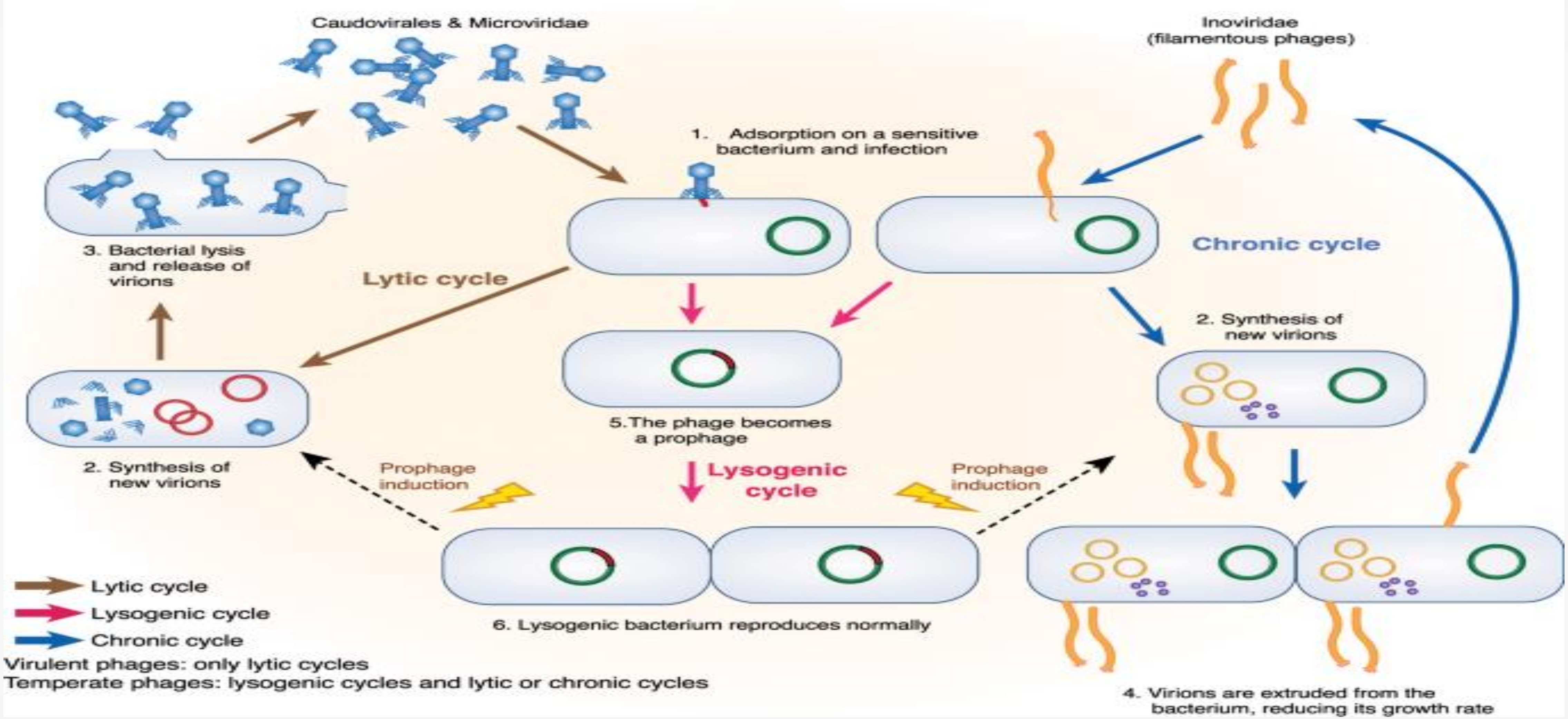
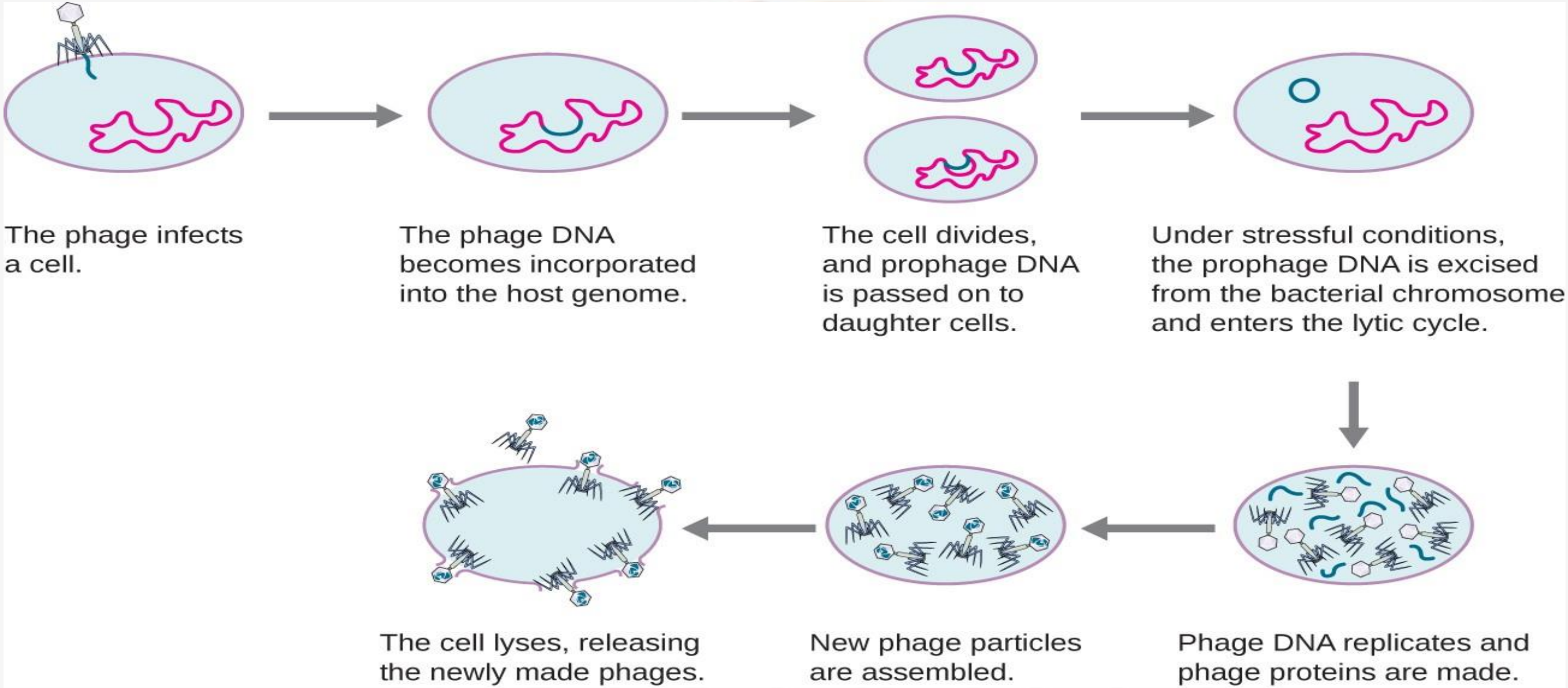
Lysogenic cycle

The phage infects a bacterium and inserts its DNA into the bacterial chromosome, allowing the phage DNA (now called a **prophage**) to be copied and passed on along with the cell's own DNA.



Lysogenic Cycle

- In the lysogenic cycle, the first two steps (attachment and DNA injection) occur just as they do for the lytic cycle.
- However, once the phage DNA is inside the cell, it is not immediately copied or expressed to make proteins.
- Instead, it recombines with a particular region of the bacterial chromosome. This causes the phage DNA to be integrated into the chromosome.


The phage infects a cell.
The phage DNA becomes incorporated into the host genome.
The cell divides, and prophage DNA is passed on to daughter cells.
Under stressful conditions, the prophage DNA is excised from the bacterial chromosome and enters the lytic cycle.
Phage DNA replicates and phage proteins are made.
New phage particles are assembled.
The cell lyses, releasing the newly made phages.

- The integrated phage DNA, called a **prophage**, is not active: its genes aren't expressed, and it doesn't drive production of new phages.

- However, each time a host cell divides, the prophage is copied along with the host DNA, getting a free ride.

- The lysogenic cycle is less flashy (and less gory) than the lytic cycle, but at the end of the day, it's just another way for the phage to reproduce

- Under the right conditions, the prophage can become active and come back out of the bacterial chromosome, triggering the remaining steps of the lytic cycle (DNA copying and protein synthesis, phage assembly, and lysis).
- DNA-damaging agents (like UV radiation and chemicals) trigger most prophages in a population to re-activate.
- However, a small fraction of the prophages in a population spontaneously "go lytic" even without these external cues

- In some cases, the genes encoded by prophages can alter the phenotype of the infected bacterium, a process known as lysogenic conversion.

- Some phages encode proteins or toxins called virulence factors that can facilitate bacterial infections.

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- A particularly well-studied example of lysogenic conversion is that of the *Escherichia coli* strain O157:H7.
- Several massive food recalls have stemmed from contamination by *E. coli* O157:H7.
- This strain of *E. coli* has been infected by a phage that encodes Shiga-like toxin (Stx), which can cause intestinal bleeding and kidney failure.
- In the lysogenic cycle, Stx is not produced, and the bacteria do not cause disease. The phage must re-enter the lytic cycle for Stx to be produced

Two advantages of lysogeny have been recognized.

- The first is that lysogeny allows a virus to remain viable within a dormant host.
- Bacteria often become dormant due to nutrient deprivation and while in this state, they do not synthesize nucleic acids or proteins.
- In such situations, a prophage would survive but most virulent bacteriophages would not be replicated, as they require active cellular biosynthetic machinery.

Multiplicity of infection (MOI)

- The second advantage arises when there are many more phages in an environment than there are host cells, a situation virologists refer to as a high multiplicity of infection (MOI).
- In these conditions, lysogeny allows for the survival of host cells so that the virus can continue to reproduce.

REFERENCES

- Madigan M, Martinko J (editors) (2006). Brock Biology of Microorganisms (11th ed.). Prentice Hall.
- Malys N (2012). "Shine-Dalgarno sequence of bacteriophage T4: GAGG prevails in early genes". Molecular Biology Reports. **39** (1): 33–9
- The lytic cycle of the T-even Bacteriophage nemetoadreviews.com. Retrieved January 9, 2018.

Thank you