Tutorial 2

Covers Lectures 2 and 3

On 21st March 2023 for D4 and 23rd March 2023 for D3

1. *Paradigm shifts – prokaryotes and eukaryotes*

   The distinction between prokaryotes and eukaryotes seems to be blurring. Do you expect the discovery of organisms that straddle (= here, it means being on both sides) the two domains? Why or why not?

   You may refer to two tables given at the end of this tutorial.

2. *Traditionally, viruses are considered non-living. However, in recent years, there have been arguments that viruses also are living.*

   (a) Give at least one reason why viruses cannot be considered as living

   (b) Give at least one reason why viruses ought to be considered as living

3. *Phage therapy*

   (a) It has been reported that, "*bacteriophages are very species-specific with regard to their hosts and usually only infect a single bacterial species or even specific strains within a species*." Base on this, do you think it is safe to use phage therapy?

   (b) A set of statements about "eating banana" are given below. Are the interpretations of these statements appropriate?

Statement	Interpretation
Only I ate banana	No one else ate bananas It does not tell whether or not I ate anything else
I only ate Banana	Tells that I ate banana and didn't do anything else with Banana. This statement does not tell if I drank anything (milk, water, ...). Nor does it tell what others ate or drank
I ate only Banana	Tells what I ate. This statement does not tell if I drank anything (milk, water, ...). Nor does it tell what others ate or drank

(c) Revisit the possible interpretations of the observation about host specificity reported in (a) above.
Note that concerns have been expressed about the use of phage therapy citing inadequate experimental data. If interested, read this and this.

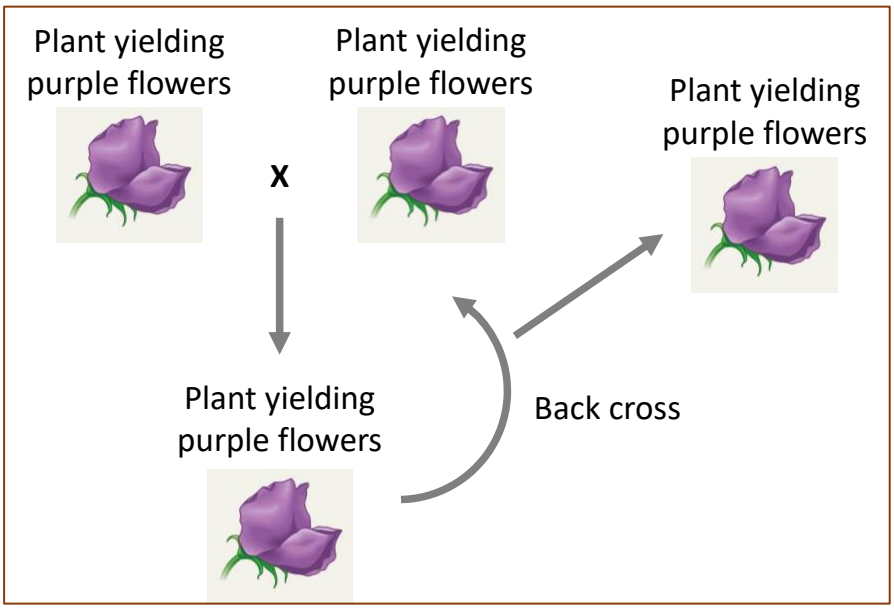
(d) Antibiotics have proven to be very beneficial as long as one avoids overuse and adheres to the dosage regimen.
Are there concerns about the use of phage therapy that are not applicable in the case of antibiotics?

(e) Additional reading:
https://edition.cnn.com/2022/07/08/health/phage-superbug-killer-life-itself-wellness/index.html

4. *Determining the genotype of a pea plant*

Suppose that we have a pea plant that bears purple flowers. What is the minimum number of crosses that one has to unambiguously determine the genotype of this plant with respect to flower color?

You may refer to the following from Slide 51 (Lecture 3).



5. An outcome that depends upon a single factor / multiple factors

Sugar dissolved in otherwise pure water

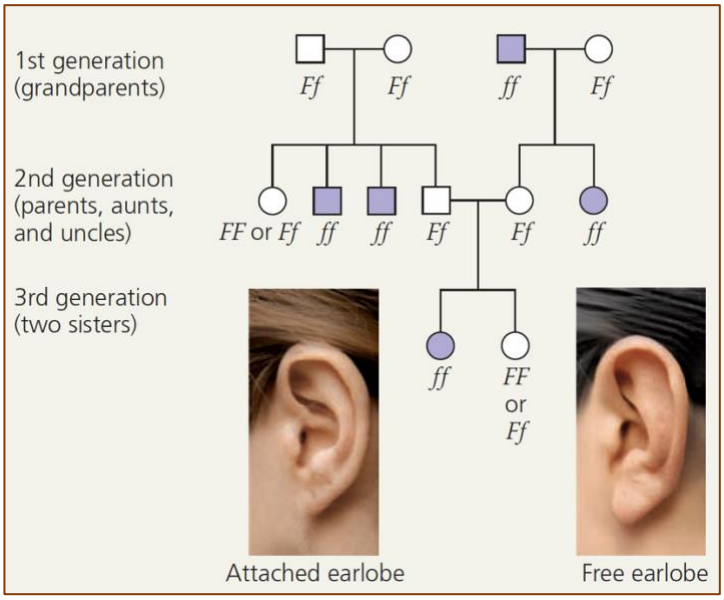
Hyderabadi biryani

(a) Shown above are a solution of sugar (in pure water) and a rice dish prepared by using a variety of spices. Using these, differentiate a single gene trait from a multi-gene trait.

(b) Give an example each for a single gene trait and a multi-gene trait in humans.

6. Dominant and recessive traits

Analyse the schematic given below (Figure 1.14 from Campbell's Biology, 10th edition) to find out if attached earlobe is a dominant or a recessive trait.

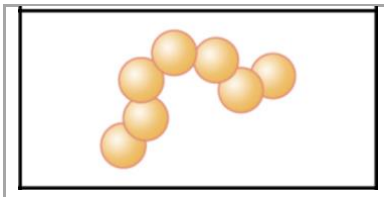
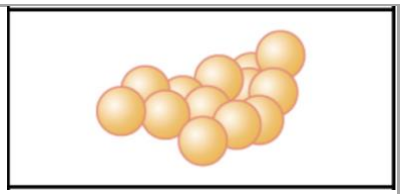
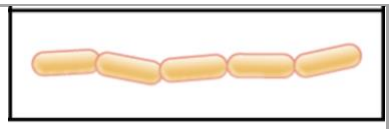
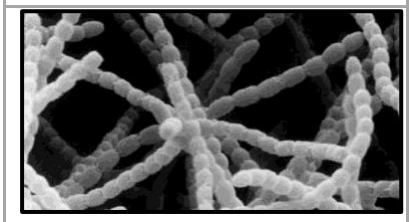


This table is NOT meant for memorization

Feature	Prokaryotes	Eukaryotes
Cellularity	Unicellular but display multi-cellular behavior	Unicellular as well as multicellular
Membrane-bound organelle (= compartment)	Reported in a few cases	Present
Membrane-less compartments	Present	Present
Ribosome (site of protein synthesis)	Named as 70S	Named as 80S
Cell wall	Characteristic variations within eubacteria, archaea, and eukaryotes	
Size	Invisible to naked eye but there are a few exceptions	Some are visible to naked eye, some others are not visible
Genome	Main genome is circular (exceptions known)	Are there any organisms known to have circular genomes?
Decoding of the information present in DNA	(technically, regulation of gene expression) Operons and splicing	
What else?	??	??

https://openstax.org/details/books/microbiology

[**NOT meant for memorization**] A few illustrative examples of bacteria showing multi-cellularity are given below. Even unicellular eukaryotes are known to switch from being unicellular to multicellular (e.g., *Dictyostelium discoideum*, a type of amoeba found in soil).

 Streptococcus Strepto- means chain Coccus means spherical	 Staphylococcus Staphylo- means cluster	 Staphylobacillus Bacillus means rod-like
 Actinobacteria Actino- means beam-like, radiating, ... https://alchetron.com/Actinobacteria	Biofilm	

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