

وراثة الأحياء الدقيقة Microbial Genetics

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مكتب ٢ ب ٤٥

أساسيات في علم الوراثة
Fundamentals of Genetics
Lecture 7

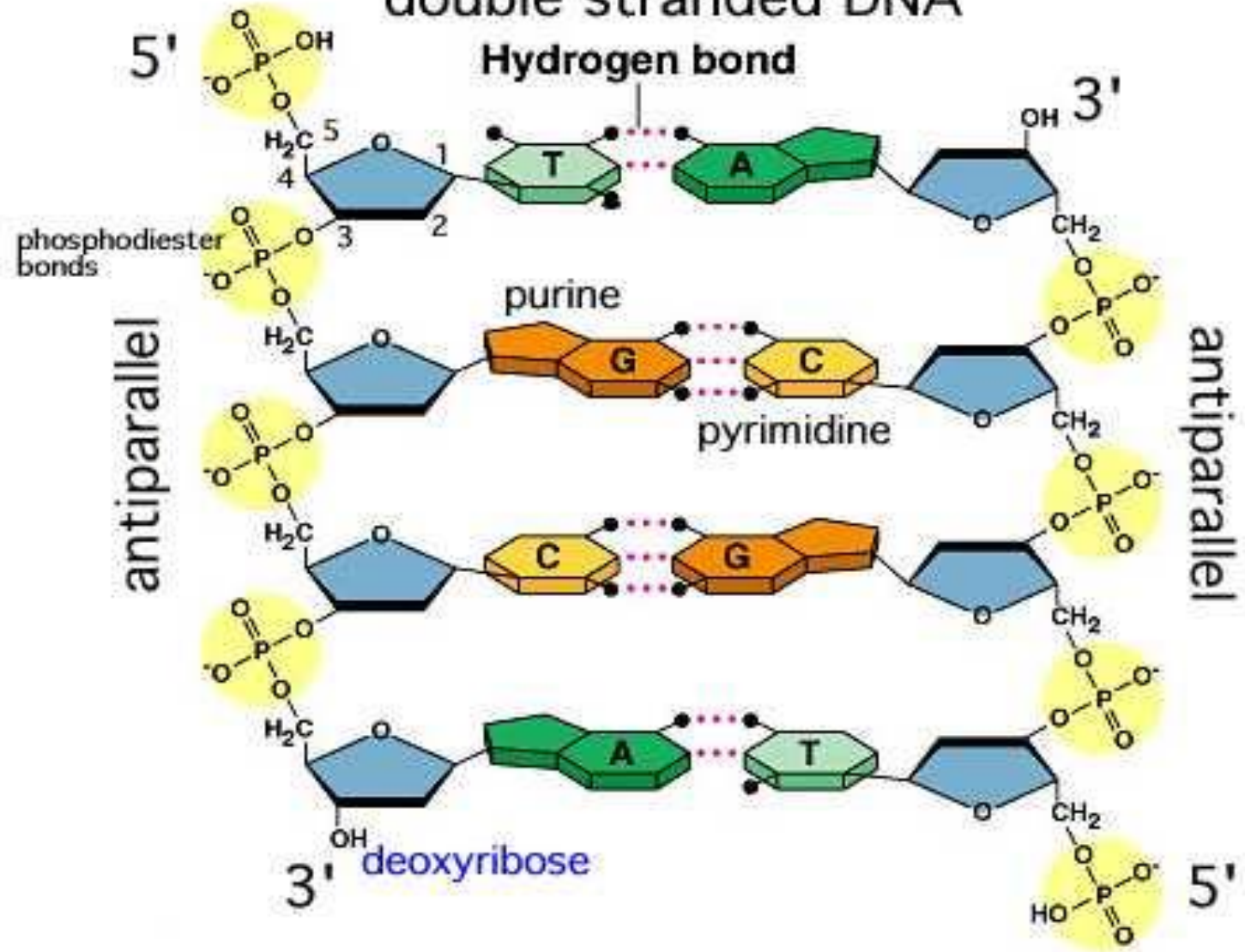
Causes of Mutation

- Heredity.
- Carcinogens and mutagens.
- Chance (Bad luck).

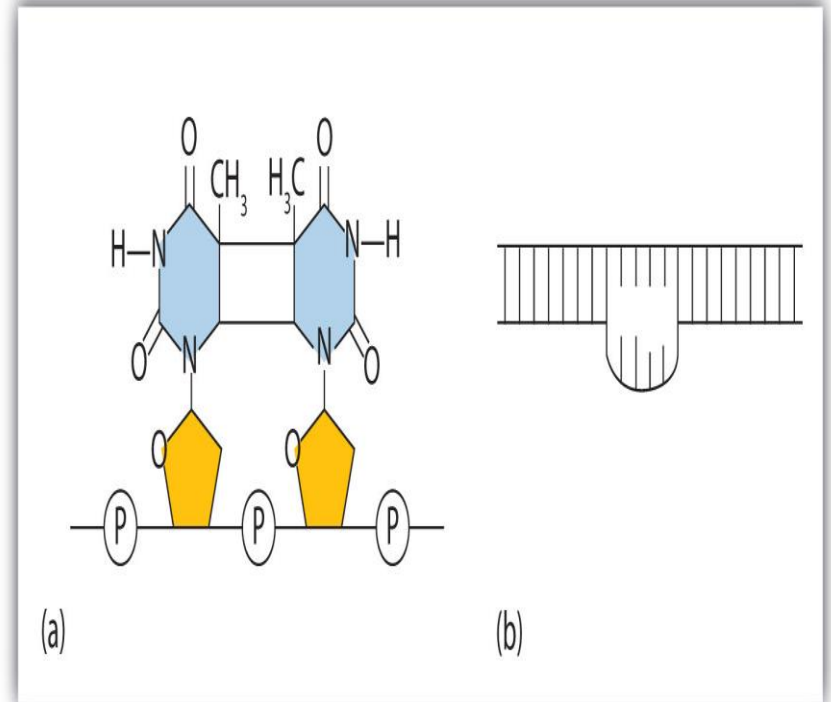
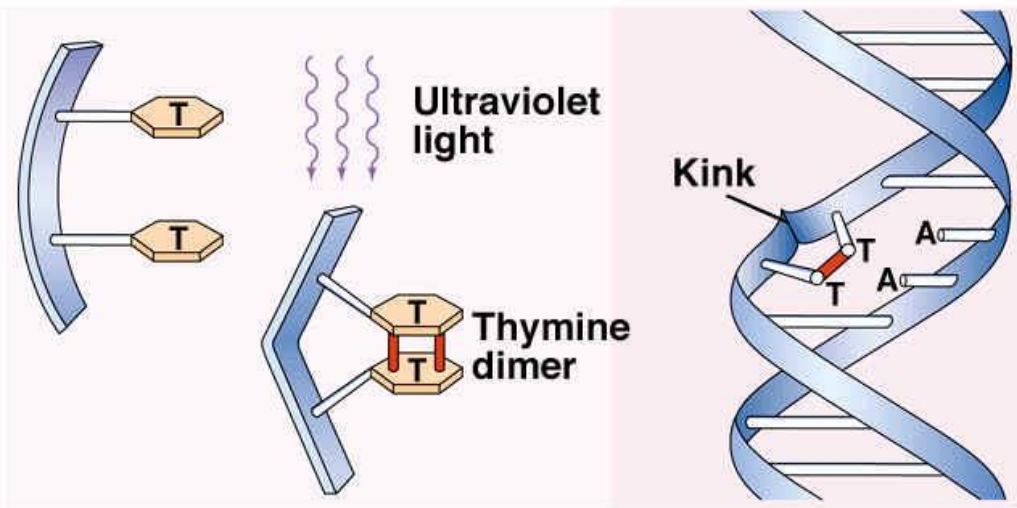
Mutagens

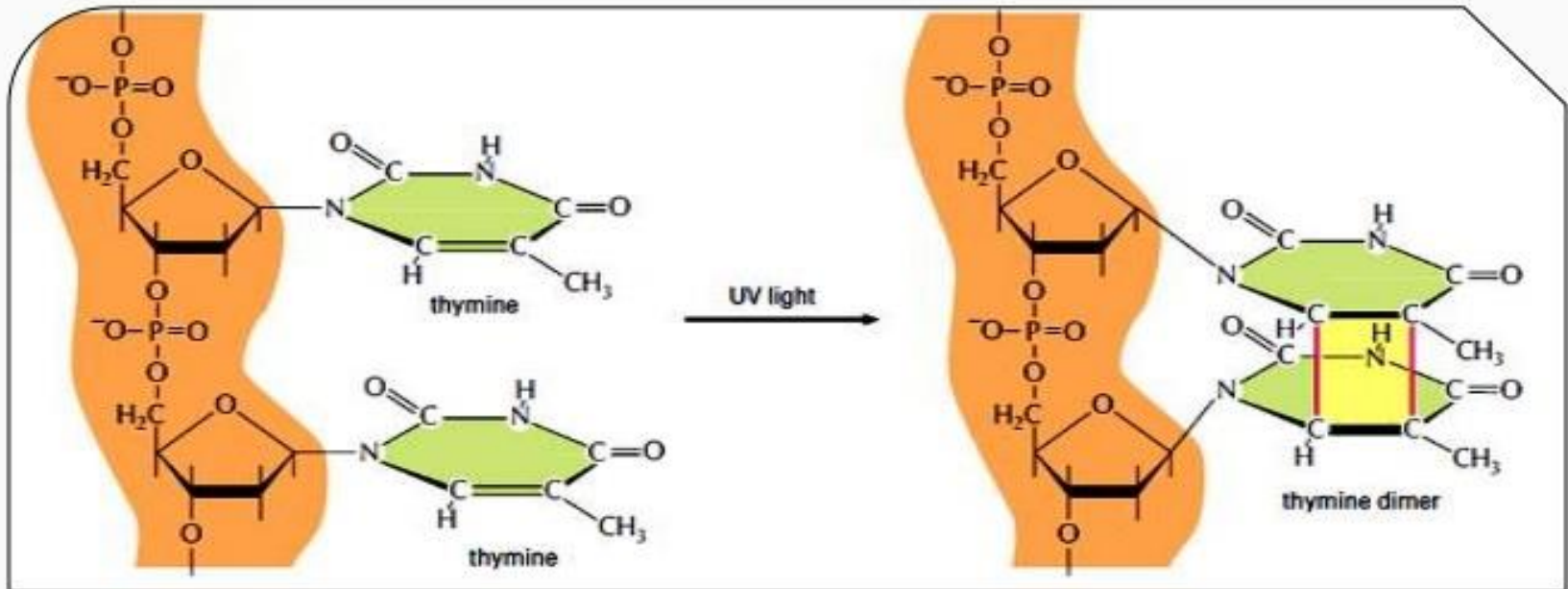
- A **mutagen** is anything that increases the mutation rate of an organism.
- Some common mutagens:
 - **Radiation:** Two types of radiation are commonly used: UV and x-rays.
 - X-ray, interacts with DNA resulting in a break in the phospho-diester backbone of the DNA.
 - UV, catalyzes a reaction in which nearby pyrimidine bases (on the same strand) form dimers.
 - **Chemical Modifiers:** Nitrous acid, de-aminize of A,C, and G residues.

double stranded DNA



Pyrimidine Dimer



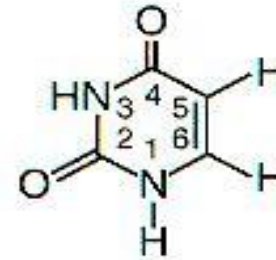
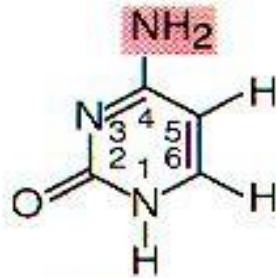


Thymine dimers: most common type of DNA damage caused by UV irradiation. (a) UV light cross-links the two thymine bases on the top strand. This distorts the DNA so that these two bases no longer pair with their adenine partners. (b) The two bonds joining the two thymines form a 4-membered cyclobutane ring (red).

<http://highered.mcgraw-hill.com/olc/dl/120082/micro18.swf>

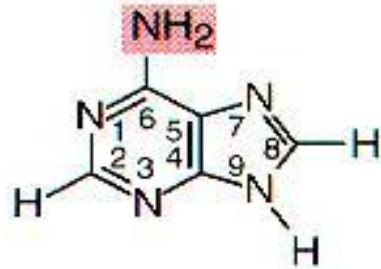
Deamination

Cytosine



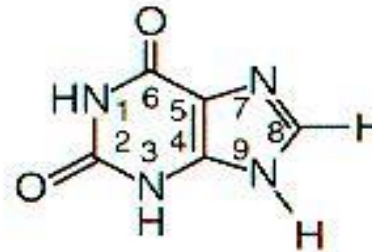
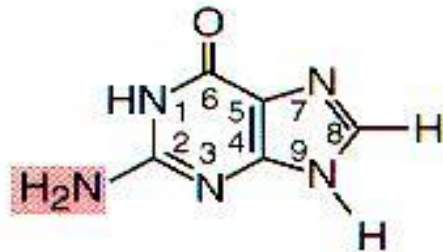
Uracil

Adenine



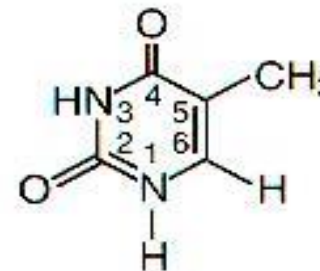
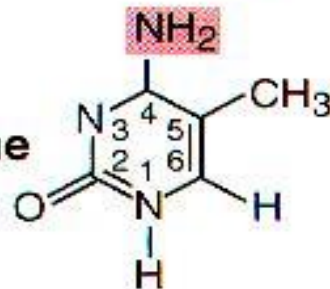
Hypo-xanthine

Guanine



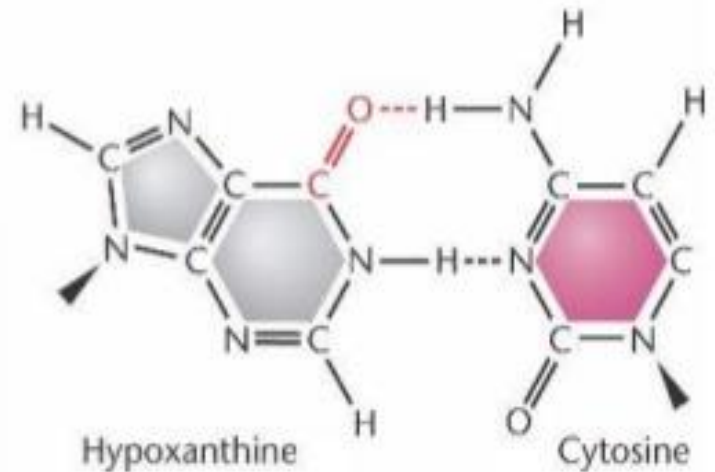
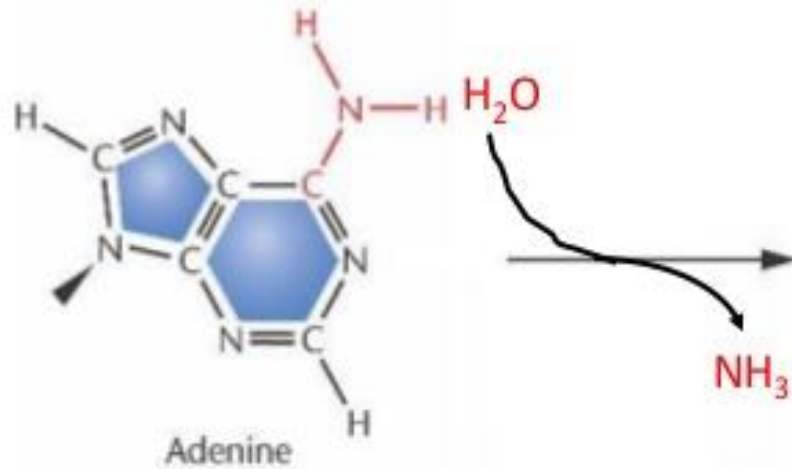
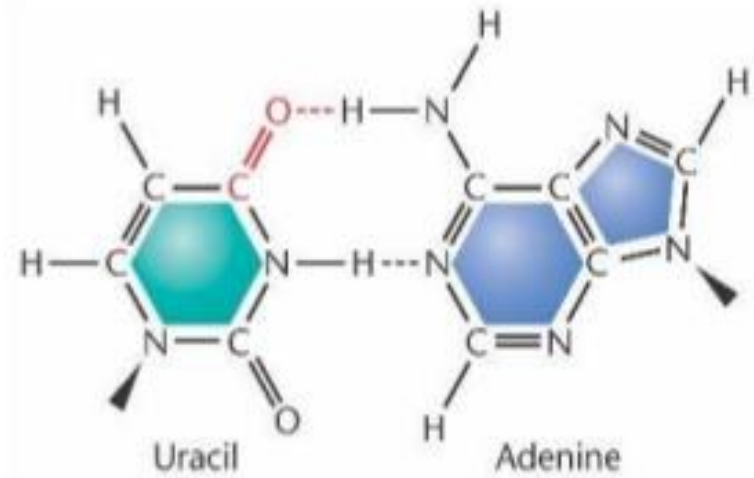
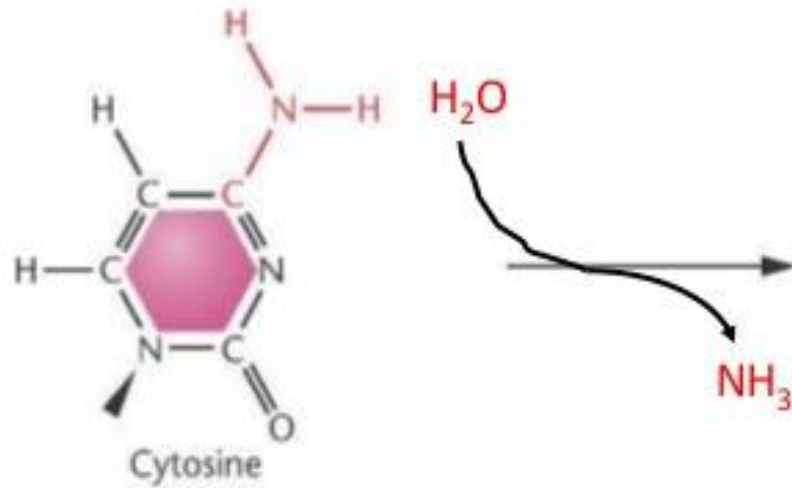
Xanthine

5-Methylcytosine



Thymine

Deamination



Mutagens

- **Some common mutagens:**
 - **Base Analogs:** is a chemical that has a ring structure similar to one of the normal bases found in a nucleic acid but does not have the same chemical properties- 5-bromouracil (5-BU) or 2-aminopurine (2-AP) incorporated instead of thymine and adenine.
 - **Transposons:** are units of DNA that move from one DNA molecule to another.

Mutagens & Caciongens

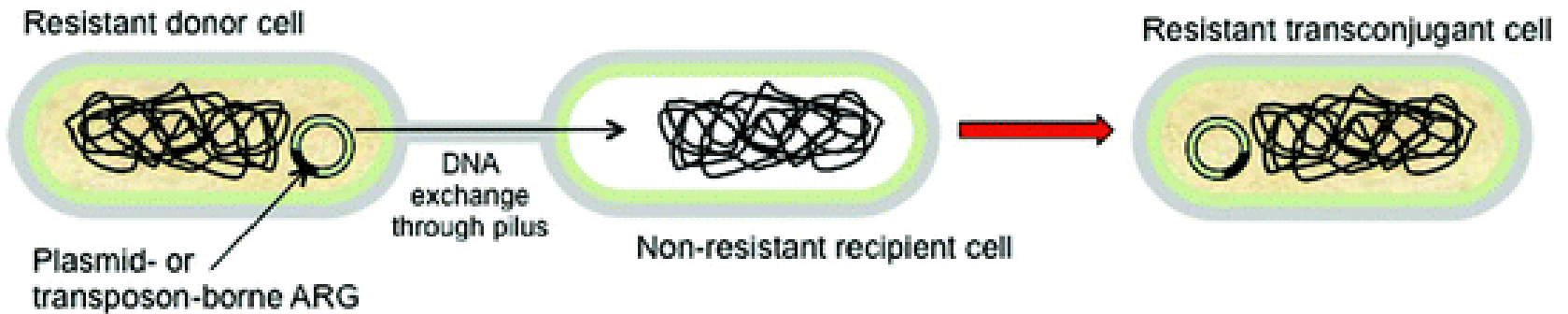
<https://www.khanacademy.org/test-prep/mcat/biomolecules/genetic-mutations/v/mutagens-and-carcinogens>

Major Genetic Transfer Processes

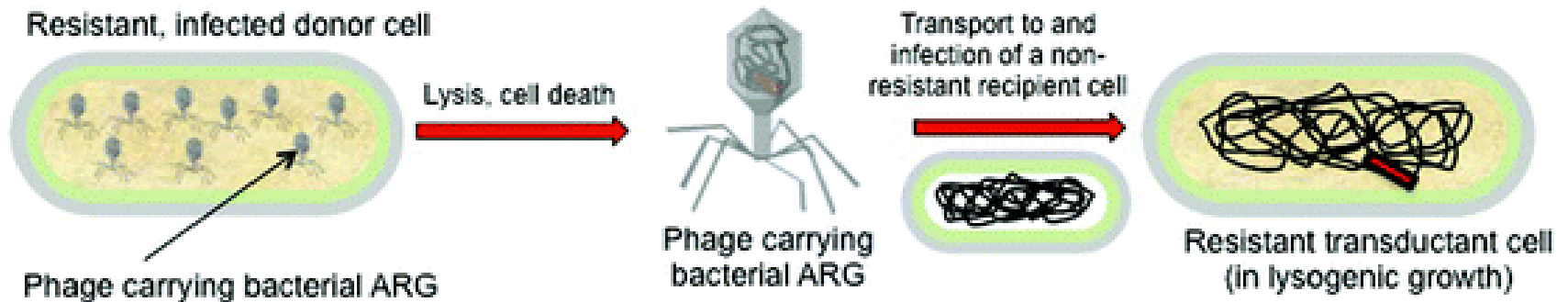
- Transformation.
- Transduction.
- Conjugation.

<https://www.youtube.com/watch?v=Fq0YSTyJlpk>

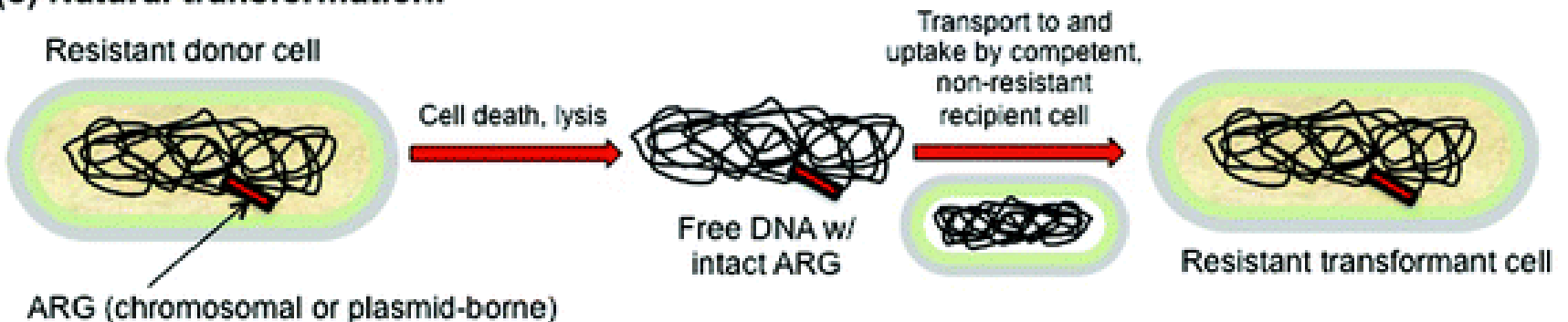
(a) Conjugation:



(b) Transduction:



(c) Natural transformation:



Mechanism of Gene Transfer

- **Conjugation**

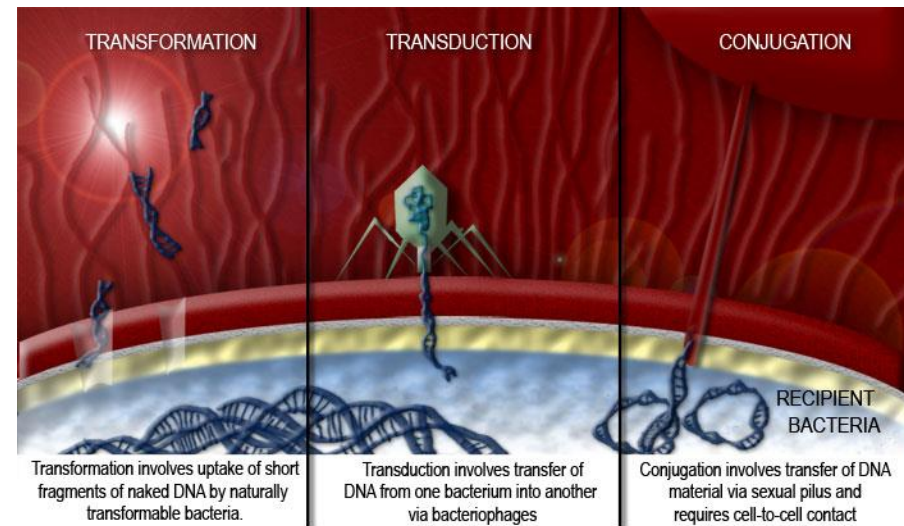
- Direct physical interaction between Donor and recipient cell

- **Transduction**

- When virus infects a bacterium and transfer genetic material

- **Transformation**

- Information is taken from a dead bacterium which releases it to the environment



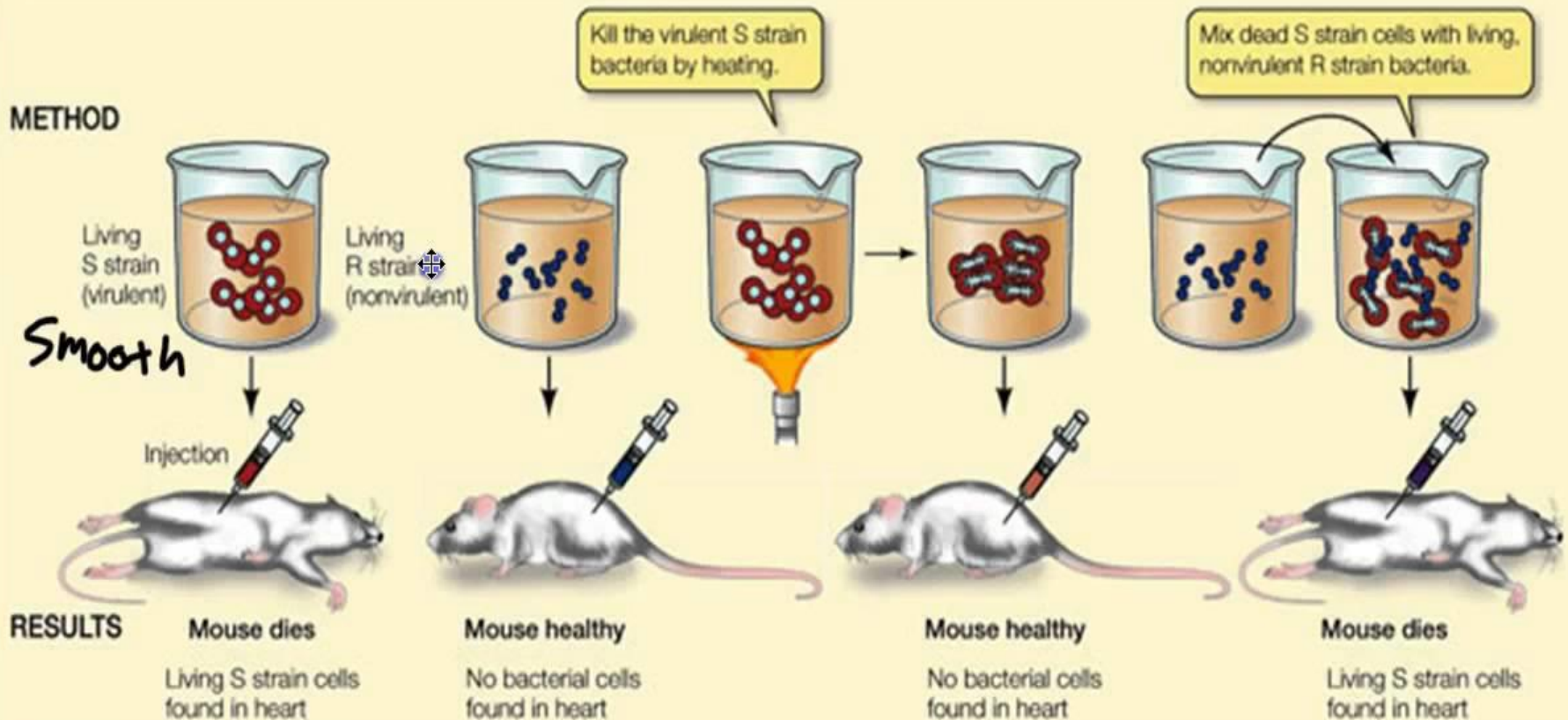
Major Genetic Transfer Processes

- Other Transformation Systems:
 - Electroporation.
 - Bacteriophage Genetic Exchange.
- Discovery of Genetic Transformation- Frederick Griffith (1928).
- Avery, MacLeod and McCarty- genetic transformation by DNA
- Competent Cells.

EXPERIMENT

HYPOTHESIS: Material in dead bacterial cells can genetically transform living bacterial cells.

METHOD



CONCLUSION: A chemical substance from one cell is capable of genetically transforming another cell.

QUESTIONS??

