



جامعة المستقبل
AL MUSTAQBAL UNIVERSITY

كلية العلوم
قسم الانظمة الطبية الذكية

Molecular Biology

Lecture: (1)

First Stage



Introduction of Molecular Biology

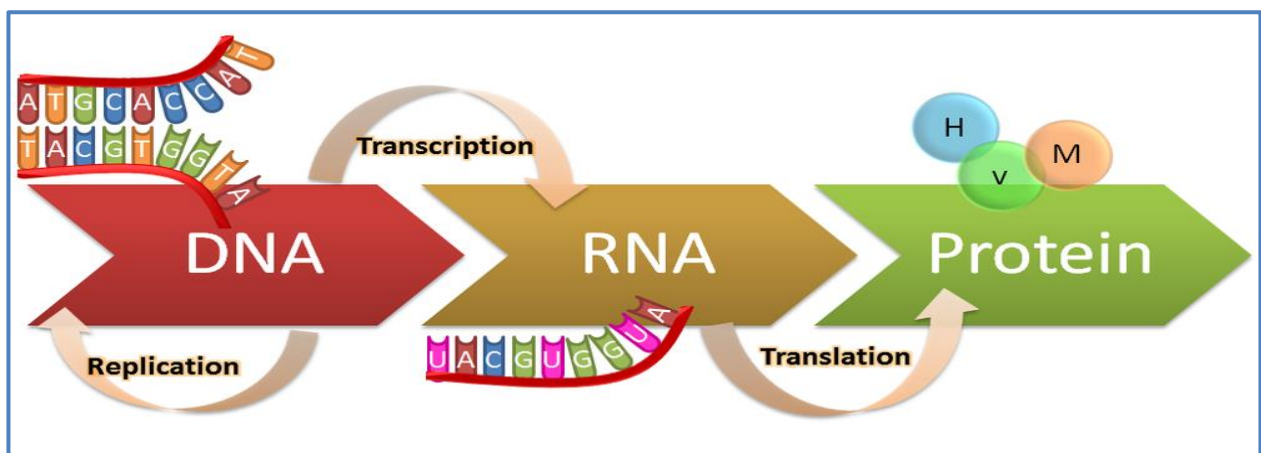
Molecular Biology Defining

The study of the formation, structure, and function of macromolecules essential to life, such as nucleic acids and proteins and their role in cell replication and the transmission of genetic information.

Central Dogma of Molecular Biology

In molecular biology, central dogma illustrates the flow of genetic information from DNA to RNA to protein. It is defined as a process in which the information in DNA is converted into a functional product.

It is suggested that the information present in a DNA is essential to make up all proteins and RNA acts as a messenger that carries information through the ribosomes. It was first stated by Francis Crick in 1957, then published in 1958.





DNA as the Genetic Material

Any organism must have a genetic material stored either in its nucleus for eukaryotic ones or in cytoplasm for prokaryotes. This material is called genetic material, and conserved in molecules that strongly being protected, these molecules called nucleic acids (**DNA** and **RNA**).

Cells contain material or matter that controls inheritance of traits from one generation to the next. It is also able to convey its effect through the formation and functioning of the traits. This material is referred as genetic material. In genetic material, the hereditary information is present in coded form in genes.

To clarify the exact nature of the genetic material (protein or DNA), variety of experiments were performed by researchers. Some of the milestone contributions are:

- 1. Transformation Experiment by Frederick Griffith.**
- 2. Phage Labeling Experiment by Alfred Hershey and Martha Chase.**
- 3. Bacterial Conjugation Experiment by Joshua Lederberg and Edward Tatum.**
- 4. Exception to DNA as a genetic material by Fraenkel Conrat and Singer .**

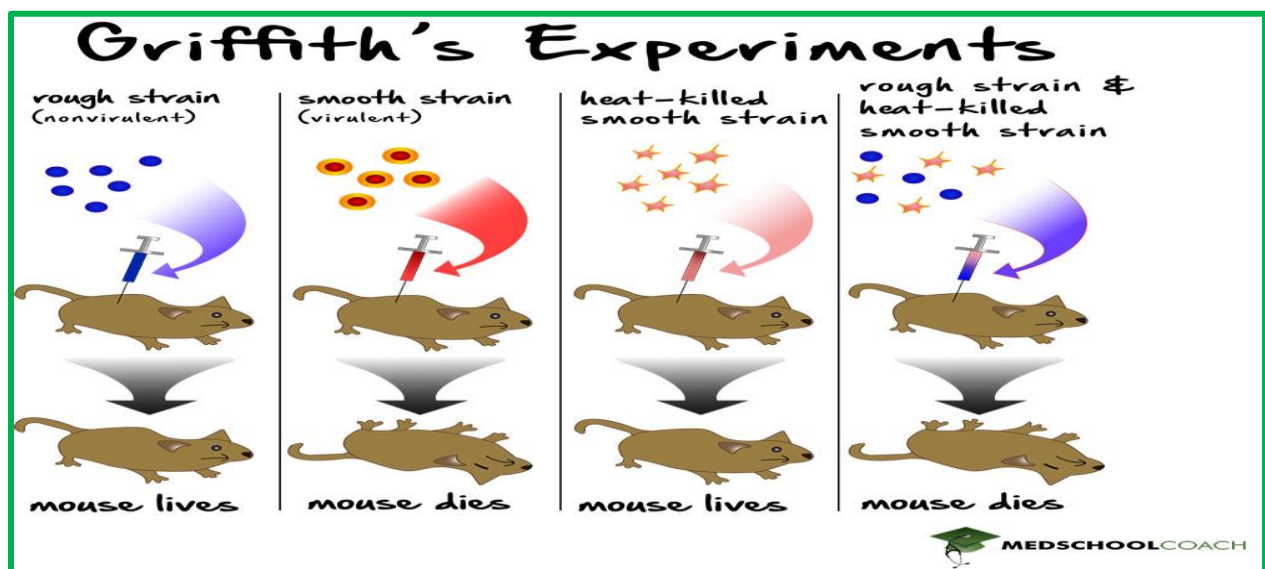
Griffiths Transformation Experiments

Griffith's experiment, conducted in 1928 by Frederick Griffith, was one of the first experiments suggesting that bacteria are capable of transferring genetic information through a process known as transformation.



He studied the difference between two strains of bacteria *Streptococcus pneumoniae* – a disease-causing strain and a strain that did not cause pneumonia. The pneumonia-causing strain (the **S-strain**) was surrounded by a **capsule**. The other strain (the **R-strain**) did **not have a capsule** and also did not cause pneumonia.

Griffith was able to induce a non-pathogenic strain of the bacterium *S. pneumoniae* to become pathogenic. Griffith injected the different strains of bacteria into mice. The S-strain (virulent) killed the mice; the R-strain (avirulent) did not. He further noted that if heat killed S-strain was injected into a mouse, it did not cause pneumonia. When he combined heat-killed S with live R and injected the mixture into a mouse (remember neither alone will kill the mouse) that the mouse developed pneumonia and died. Bacteria recovered from the mouse had a capsule and killed other mice when injected into them! Griffith referred to a transforming factor that caused the non-pathogenic bacteria to become pathogenic.



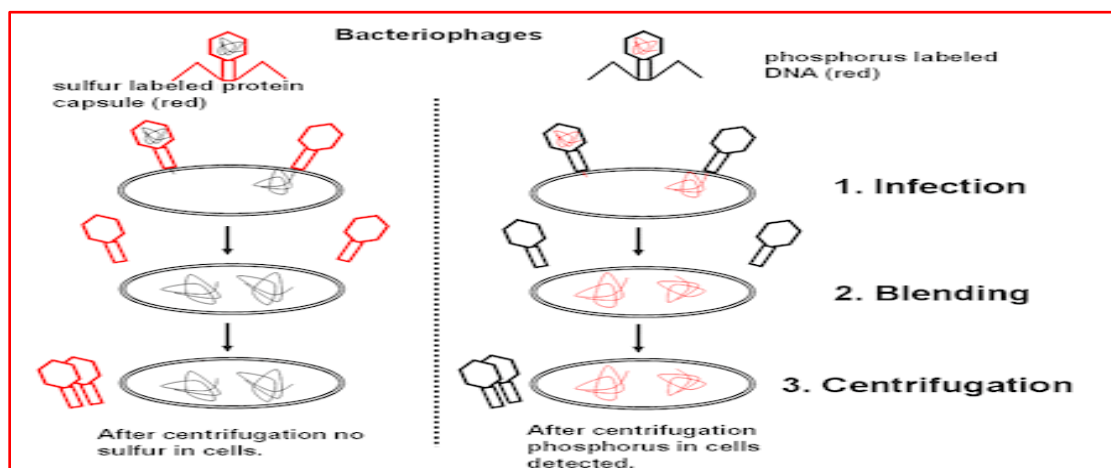


The Hershey and Chase experiments (1952)

The Hershey-Chase experiments were a series of experiments conducted in 1952 by Alfred Hershey and Martha Chase, confirming that DNA was the genetic material, which had first been demonstrated in the 1944 Avery-MacLeod-McCarty experiment. While DNA had been known to biologists since 1869, most assumed at the time that proteins carried the information for inheritance.

For their experiment, they used the bacteriophage T2. A bacteriophage is a virus that only infects bacteria. This particular virus infects *Escherichia coli*.

- Some T2 phages were cultivated in radioactive Sulphur (^{35}S) media, while the other T2 phages were cultured in a radioactive phosphorus (^{32}P) medium.
- While the T2 phages in (^{32}P) medium contained radioactive DNA because the protein coat does not contain phosphorus, the T2 in (^{35}S) medium contained radioactive protein due to the absence of Sulphur in the DNA.
- After that, the radioactive phages joined the *E. coli*. As the illness grew worse, centrifugation was used to separate the viruses.
- The fact that the radioactive DNA in the T2 phage-infected *E. coli* was similarly radioactive suggests that DNA was the substance that was transferred from the virus to the bacteria.





Joshua Lederberg and Edward Tatum experiment

Bacterial conjugation was first described by Lederberg and Tatum in 1946 as a phenomenon involving the exchange of markers between closely related strains of *Escherichia coli*. The agent responsible for this process was later found to be a site on the chromosome called the F ('fertility') factor.

