

Molecular biology first lecture

Introduction and brief history

Professor Dr. Sawsan Sajid Al-Jubori

assistant professor Dr. sawsan mohammed kareem

References :

1-Essential of molecular biology by George M. Malacinski
4th edition

2-Second references: Molecular biology (principles and practice)

Identification of molecular biology :

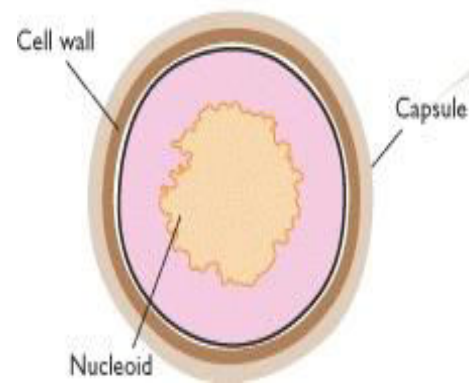
It is the science that deals with macromolecules and to understand the five basic behaviors patterns (**growth , division , specialization , movement and interaction**) in terms of the fine molecules responsible for them including (**DNA , RNA and Protein**)

- **Freidrich Miescher (1869)** : was a Swiss physician and biologist. He was the first researcher who isolate and identify nucleic acid. It was a phosphate-rich chemicals, which he called *nuclein* (now nucleic acids), from the nuclei of white blood cells without knowing its responsibility about **inheritance**. so he knew much of the nucleic acid chemistry but their function remained unknown till a century later . However, his discovery played an important part in the identification of nucleic acids as the carriers of inheritance
- **His student Altmaan (1889)**: succeed in isolation of nuclein in pure condition
- **Warren Weaver(1938)**: was the first biologist used the term **molecular biology** as new branch of science at that time the biochemists began to discover many fundamental chemical reactions and numerous properties of the cell

Griffith's experiment to identify the genetic material(bacterial model)

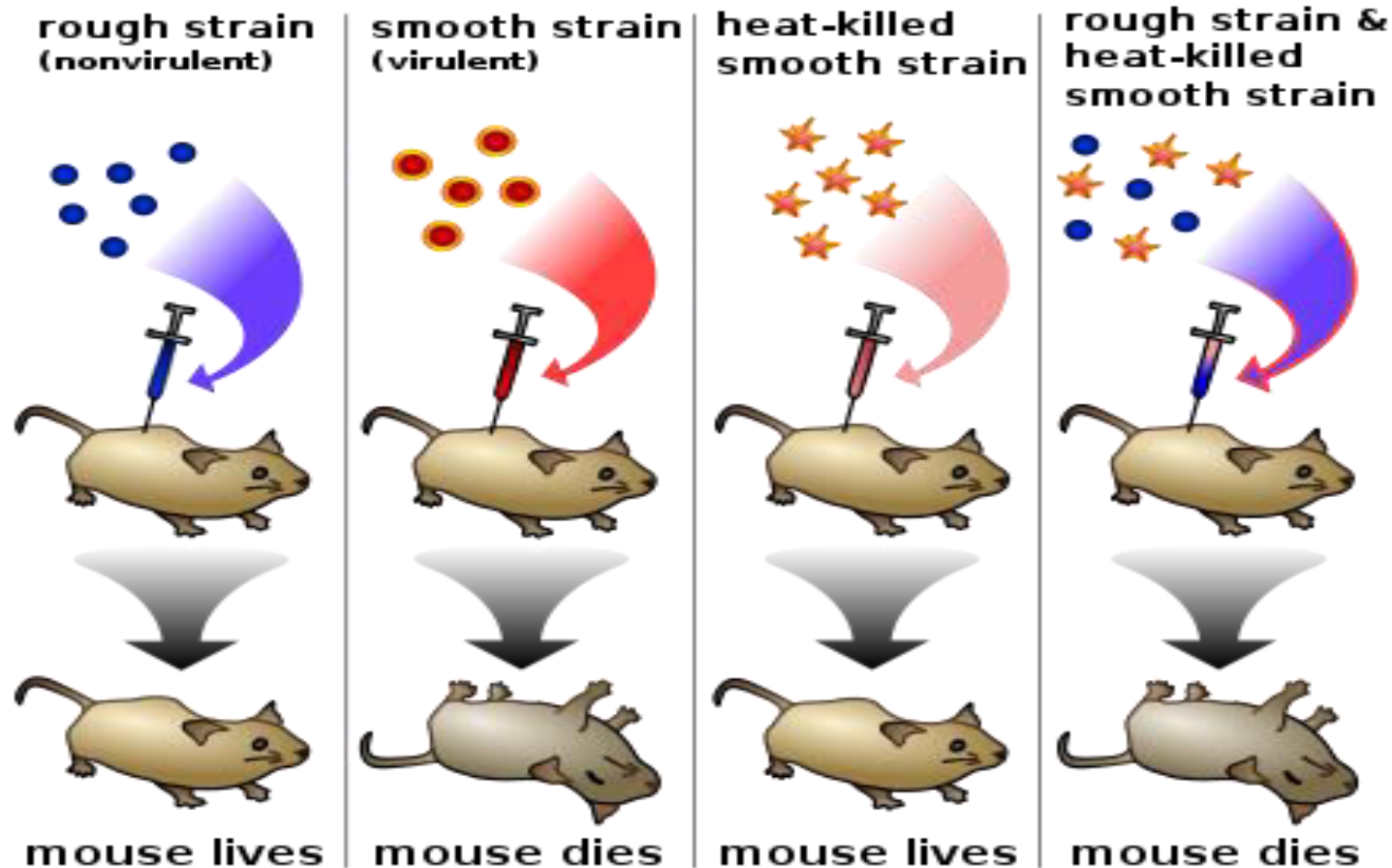
- **Griffith's experiment**, reported in 1928-29 by Frederick Griffith(british scientist) was one of the first experiments suggesting that bacteria are capable of transferring genetic information through a process known as transformation but he didn't realize the nature of the genetic materials
- Griffith used two strains of pneumococcus (*Streptococcus pneumoniae*) which is gr+ bacteria infect mice – a type **III-S (smooth)** and type **II-R (rough) strain**. The III-S strain covers itself with a polysaccharide capsule that protects it from the host's immune system, resulting in the **death of the host**, while the II-R strain doesn't have that protective capsule and is defeated by the host's immune system.

(A)



| Serotype | Capsule components |
|----------|------------------------------------|
| II | Rhamnose, glucose, glucuronic acid |
| III | Glucose, glucuronic acid |
| VI | Galactose, glucose, mannose |

Griffith's experiment discovering
the "transforming principle" in
Streptococcus pneumoniae bacteria



Avery–MacLeod–McCarty Experiment to prove the DNA is the genetic material

It was reported in 1944 (as first described by [Griffith's experiment](#) in 1928) by [Oswald Avery](#), [Colin MacLeod](#), and [Maclyn McCarty](#), to proof that [DNA](#) is the substance that causes [bacterial transformation](#). They repeated the same steps of Griffith as it Start with

- 1- heat -killing [Streptococcus pneumoniae](#) ([virulent strain type III-S](#)),
- 2- incubation along with living but non-virulent type II-R pneumococci,
- 3- resulted in production of smooth colonies on media and a deadly infection of type III-S)
- 4-then they designed new experiment depending on cell filtrate rather than the whole cells as follow**

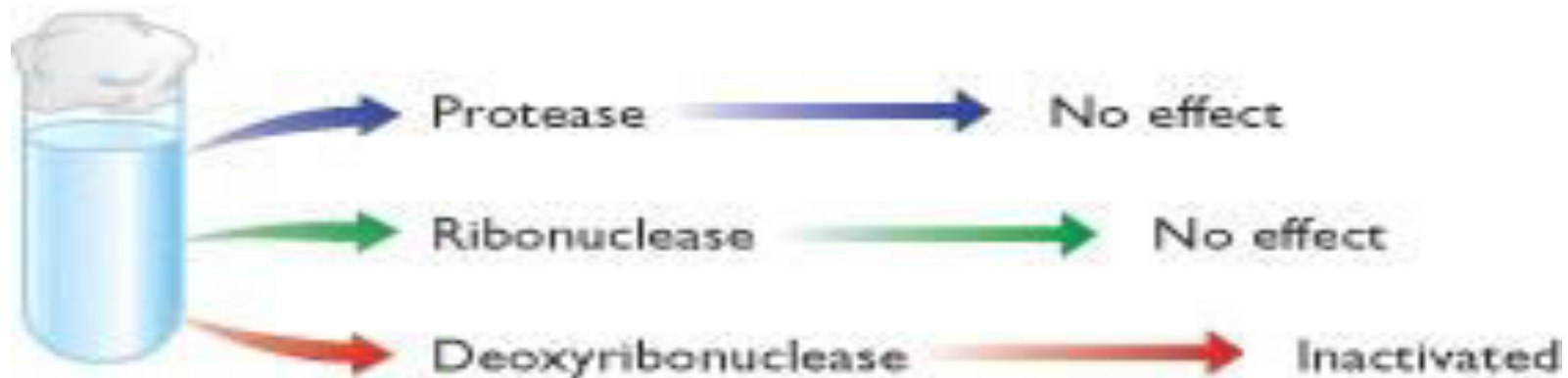
- Avery and his colleagues (زملاء) **start to prove DNA is the genetic material responsible for heredity by transformation process** تحول وراثي
- 1-They start with distraction cells of **virulence s strain** سلالة ضاربه to release the genetic material out side the cell then they took the extract and subjected to centrifuge to get rid from all intact cells
- 2-They incubated the extract with R strain in cooled condition(4 c°) with the addition of **CaCL2** كلوريد الكالسيوم **then transfer to 42 c° (heat shock)**
- The results showed that the R strain convert to S strain after culturing on agar media.
- They repeat the experiment by using only the DNA they notice the R strain converted to →S strain
- In the second experiment they used polysaccharide instead of DNA the result was differ cos the R didn't transform to S
- Finally they treat cell filtrate of S strain with **protease and ribonuclease and deoxyribonuclease**
- **the process succeed** with the first two enzymes but is inactivated by treatment with the third one.

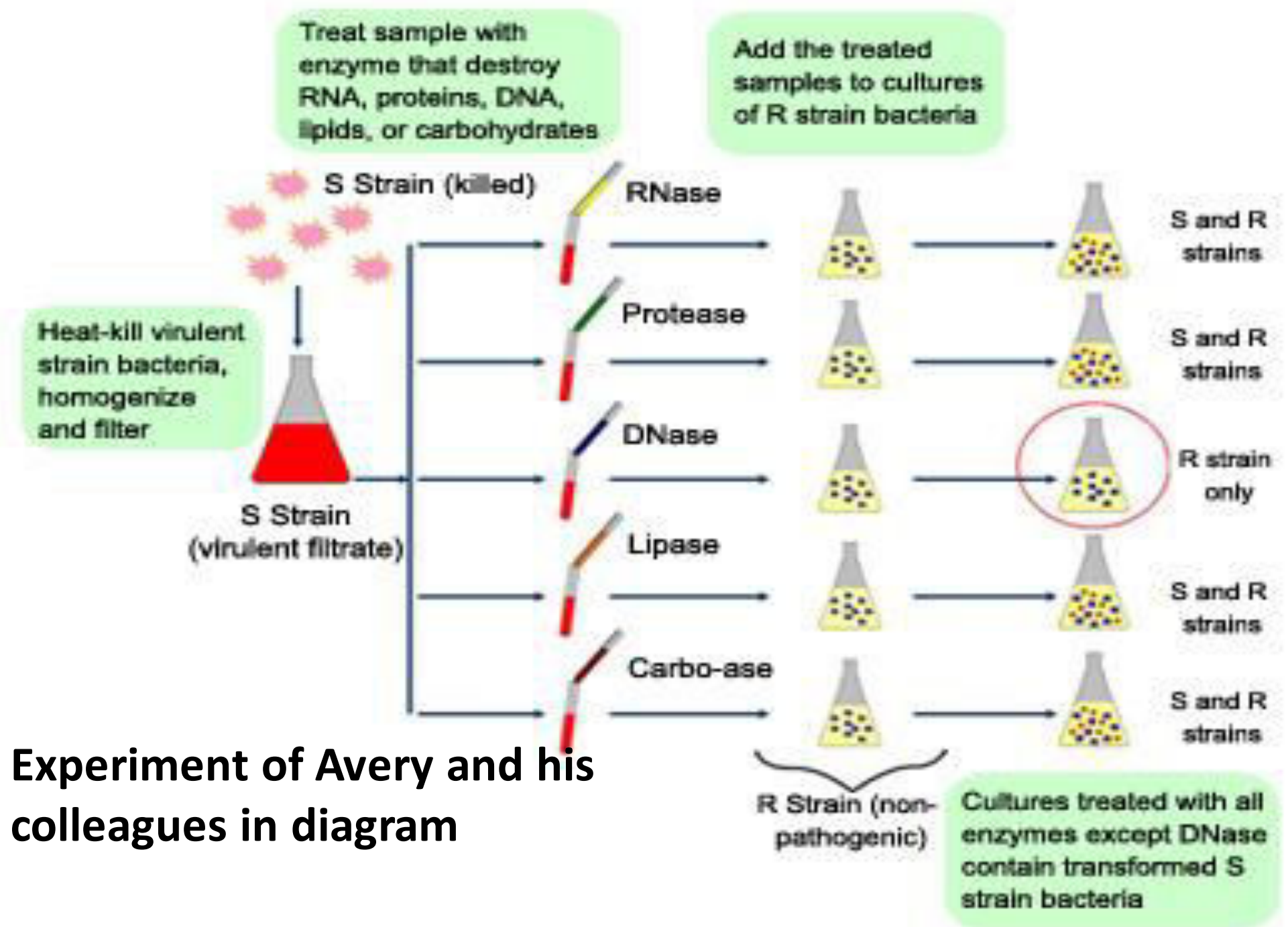
Final conclusion (1944) of Avery experiment

1-The **chemical** analysis for the **transformed cell** contain nucleic acid rather than portion or poly-saccharid

2-The **physical** analysis revealed that the nucleic acid was highly vicious rich with phosphoric acid Incubation the extract with **Trypsin** (**proteas**) or **RNase** didn't stop transformation process and only **DNase** cause complete inhibition to the process thus they realize that the genetic material is the DNA rather than RNA or the protein

3- **The final process called Transformation**





Experiment of Avery and his colleagues in diagram