

Biological Transformation

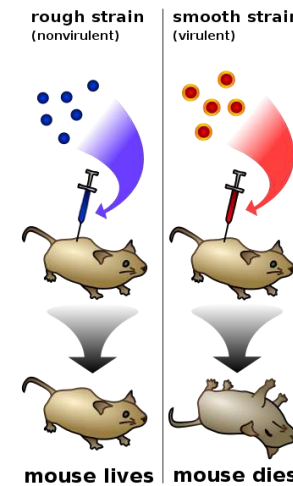
Griffith's Experiment

(Reported in 1928)

What is the 'GENETIC Material' in the Cells?

PROTEINS ??

DNA ??



➤ During Post World War - I: Spanish Influenza Pandemic

➤ Griffith was investigating to prepare vaccine.

➤ Two Strains of *Streptococcus pneumoniae*, which infect mice

- Rough Strain : NON-VIRULENT
- Smooth Strain : VIRULENT

☞ Interestingly, the combination of Rough Strain & Heat-Killed Smooth Strain, could kill the Mouse!

ROUGH NON-VIRULENT STRAIN WAS TRANSFORMED INTO SMOOTH VIRULENT STRAIN ??

These experiments showed that there was some form of 'transferrable material' present within the cells.
(perhaps 'genetic material' ?!)

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{ Source (Image): https://en.wikipedia.org/wiki/File:Griffith_experiment.svg }

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Biological Transformation

Which component in Smooth Virulent strain of *Streptococcus pneumoniae* is responsible for the observations in Griffith's Experiment ?

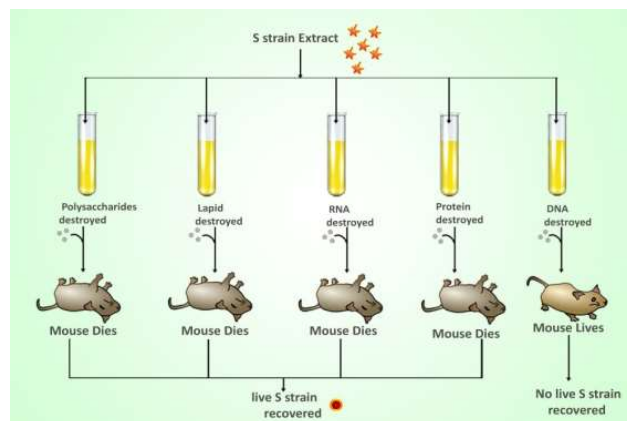
'Proteins' or 'DNA'

Avery, MacLeod, McCarty Experiment (Reported in 1944)

☞ 5 batches of Heat-Killed Smooth Virulent Strain of *Streptococcus pneumoniae*

(1) Polysaccharides Degraded ; (2) Lipids Degraded ; (3) Proteins Degraded ; (4) RNA Degraded ; (5) DNA Degraded

☞ Each of the batch was mixed with Rough Non-Virulent Strain & injected into individual mice



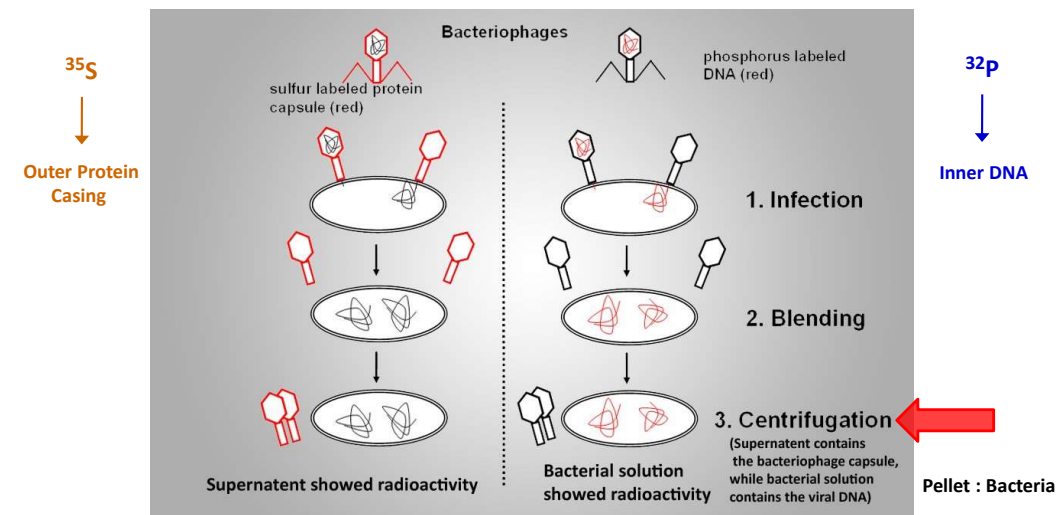
But, the debate continued:
Proteins or DNA ?

Hershey - Chase Experiment

☞ Bacteriophage T2 : Infects *Escherichia coli*

☞ Bacteriophage T2 - Two Components :
Outer Protein Casing & Inner DNA

- One Sample : Radioactive ^{35}S labelled Bacteriophage T2
- Another Sample : Radioactive ^{32}P labelled Bacteriophage T2



Inner DNA from Bacteriophage T2 is transferred to the *E. coli* bacteria

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Source: <https://www.scienceabc.com/pure-sciences/avery-macleod-and-mccarty-hershey-chase-dna-experiments.html>

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Biological Transformation

Transformation: Uptake of DNA into Bacterial, Yeast or Plant cells.

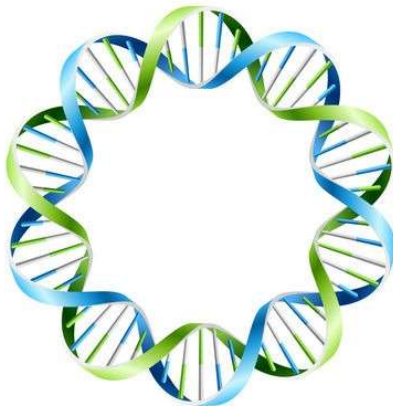
Heat-Shock is used temporarily to form pores in the cell membrane, allowing transfer of the exogenous DNA into the cell.

Electroporation is another method, where a short electrical pulse is applied to make the bacterial cell membrane temporarily permeable.

Source: <https://www.genscript.com/what-is-dna-transformation.html>

Plasmid DNA

Double Stranded CIRCULAR DNA



Source: <https://www.omegabiotek.com/plasmid-dna-3/?cn-reloaded=1>

Differences between Chromosomal DNA and Plasmid DNA

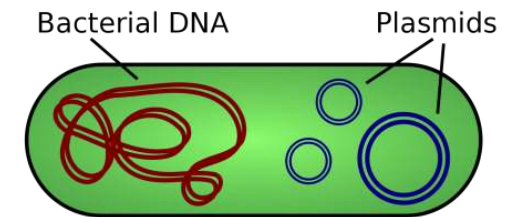
<https://www.youtube.com/watch?v=7xyhgZqh7y8>

“Chromosomal DNA”

- ☞ Genomic DNA : GENES
- ☞ Both Prokaryotes & Eukaryotes
 - Linear in Eukaryotes
 - Circular in Prokaryotes
- ☞ Larger Sized : About thousands of base-pairs
- ☞ Eukaryotes: Have Exons and Introns
- ☞ Prokaryotes : Only Coding sequences

“Plasmid DNA”

- ☞ Extra Chromosomal DNA (not from Chromosomes)
- ☞ Double Stranded CIRCULAR DNA
- ☞ Prokaryotes only : Always CIRCULAR
- ☞ Much Smaller than Chromosomal DNA: Up to about 200 kilobases
- ☞ Only coding sequences



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