

Investigation on genetic information

Document 1: 1909 – The tetranucleotide hypothesis

Phoebus Aaron Theodore Levene (1869 – 1940), born Fishel Aronovich Levin, was a Russian born biochemist who studied the structure and function of nucleic acids. Amongst his more than 700 scientific articles, he established the components of DNA (the 4 bases, deoxyribose and a phosphate group).

However, what he is most known for is the tetranucleotide hypothesis, in 1909. Influenced by his beliefs that proteins were more complex than DNA, he proposed that DNA was composed of repeating sequences of the four nucleotides.

Document 2: 1950 – Chargaff's data

In 1944, Oswald Avery identified the DNA molecule as the basis of heredity. Right after reading the related paper, Austro-Hungarian biochemist Erwin Chargaff (1905 – 2002), then working at Columbia University, concluded that genetic differences among DNAs must be reflected in chemical differences among these substances: "I saw before me, in dark contours, the beginning of a grammar of biology".

Here are some of his data, known as Chargaff's data:

	A	T	G	C
Human	31.0	31.5	19.1	18.4
Fruit fly	27.3	27.6	22.6	22.5
Wheat	26.8	27.2	22.8	23.2
Fungus	23.0	23.3	27.1	26.6
Rat	28.7	28.4	21.4	21.5
E. coli	24.6	24.3	25.5	25.6

Document 3: 1952 – Hershey-Chase experiment

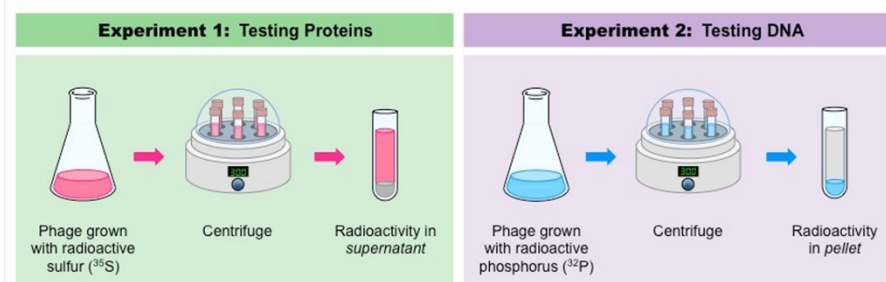
Martha Chase (1927 – 2003) and Alfred Hershey (1908 – 1997) were two American geneticists working on viruses at Cold Spring Harbor Laboratory, on Long Island, New York. They set up an experiment on the role of DNA in the conservation of genetic information.

To do so, they used bacteriophages, viruses that infect and replicate within bacteria. These viruses are solely made of DNA and a protein coat. During infection, only the replicating pieces, i.e. the genetic information of the virus, enters the bacteria.

Two sets of T2 bacteriophage were grown in different isotopic mediums, in order to radioactively label a specific viral component:

- Viruses grown in radioactive sulfur (^{35}S) had radiolabeled proteins (Sulfur is present in proteins only)
- Viruses grown in radioactive phosphorus (^{32}P) had radiolabeled DNA (phosphorus is present in DNA only)

The viruses were then allowed to infect a bacterium (E. coli) and then the virus and bacteria were separated via centrifugation. The larger bacteria form a solid pellet, while the smaller viruses remain in the supernatant.



Using information gathered in the 3 documents, show how the Chargaff's data and the Hershey-Chase experiment have falsified Levene's tetranucleotide hypothesis.