

three experiments that proved DNA, then how it packs, copies, and gets read



Proving DNA Is the Genetic Material

- 1869: Miescher isolated a phosphorus-rich acidic substance from WBC nuclei, **nucleic acid**
- by the early 1900s: known as a mix of proteins, DNA and RNA
- proteins (complex, varied) were long favoured over DNA (thought simple) as genetic material
- that assumption held from roughly 1928 to 1952, then was overturned

Three Experiments, in Sequence

Griffith (1928)

Live R + heat-killed S: mice died, live S recovered. dead S held a transforming principle

Avery, MacLeod, McCarty (1944)

only purified DNA transformed R into S. DNase blocked it, proteases and RNases did not: the principle IS DNA

Hershey-Chase (1952)

phage DNA (32P) entered E. coli, phage protein (35S) stayed outside: DNA carries heredity

Why DNA, Not RNA, Won as the Standard



- DNA is large, stable, chemically simple, stores vast information, replicates with fidelity
- **retroviruses** use RNA as sole genetic material, the exception that proves DNA is the cell rule

The Packaging Problem

- a mammalian cell's DNA stretches ≈ 2.2 m, the nucleus is only $\sim 10^{-6}$ m across
- **prokaryotes** (e.g. E. coli): no nuclear membrane; naked circular **nucleoid**, ~ 1560 μm , 4.6 million bp
- nucleoid coils into a ~ 500 μm circle, then 40-50 loops of ~ 30 μm , each supercoiled to ~ 2 μm
- HU proteins (positively charged) and DNA gyrase/topoisomerase I assist the coiling



the bare nucleoid folds down through coiling steps to fit the bacterial cell

