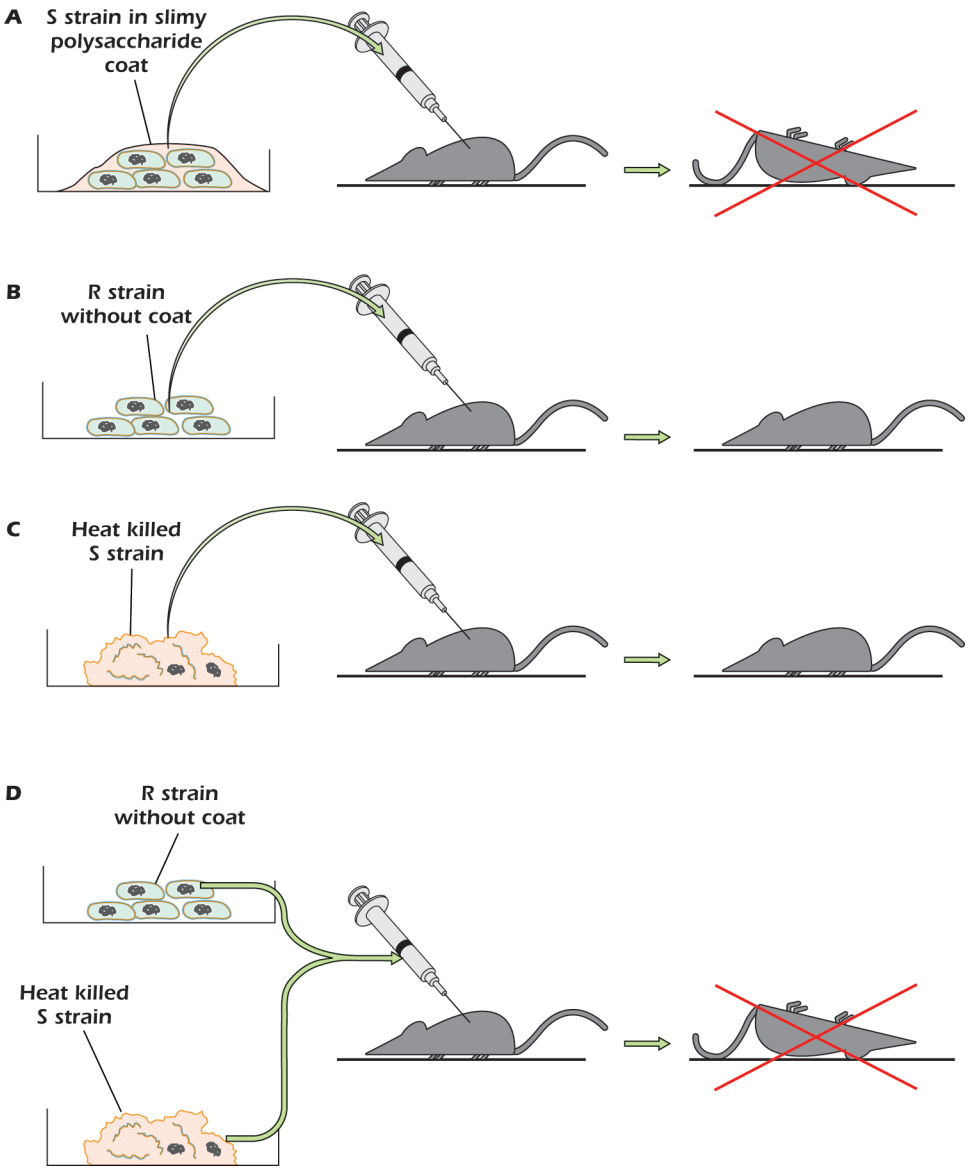
Chapter 4

Web Text Box1

A Gift from the Dead



A gift from the dead: the Pneumococcus transformation experiment

Deoxyribonucleic acid was known to contain genetic information several years before its structure was finally determined. As early as 1928 Fred Griffith carried out the now famous pneumococcus transformation experiment. There are several strains of the bacterium *Diplococcus pneumoniae.* Some strains cause pneumonia and are said to be virulent; others do not and are nonvirulent. The virulent bacteria secrete a slimy polysaccharide coat and, when grown on an agar plate, create colonies with a smooth appearance—these are S bacteria. Nonvirulent bacteria do not have this polysaccharide coat, and their colonies are rough in appearance—these are R bacteria. Mice injected with S bacteria died (A in the figure), whereas those injected with R bacteria were unaffected (B in the figure). When S bacteria were killed by heat treatment before injection, the mice remained healthy (C in the figure). However, a mixture of live R bacteria and heat-killed S bacteria was lethal (D in figure). This observation meant that something in the heat-killed S bacteria carried the information that enabled bacteria to make the polysaccharide coat and therefore to change—transform—the R bacteria into a virulent strain. Later experiments in the mid-1940s by Oswald Avery, Maclyn McCarty, and Colin MacLeod clearly demonstrated that the transforming factor was DNA. They made extracts of S bacteria and treated them with enzymes that destroy either DNA, RNA, or protein. These extracts were then mixed with R bacteria. Only the extract rich in DNA was able to transform R bacteria into S bacteria.

To read more, see an historical review by Lederberg (1994. Genetics, 136:423).