Identifying the genetic material

Science, Biology

Frederick Griffith, a bacteriologist, was trying to prepare a vaccine against the pneumonia-causing bacterium, S. pneumoniae. A vaccine is a substance that is prepared from killed or weakened microorganisms and is introduced into the body to protect the body against future infections by the microorganisms. Griffin worked with 2 types, or strains of S. Pneumonia. The first strain is enclosed in a capsule made of polysaccharides. The capsule protects the bacterium from the body's defense systems; this helps make the microorganisms virulent, or able to cause disease.

Because of the capsule, this strain of S. Pneumonia grows as smooth-edged (S) colonies when grown in a Petri dish. The second strain of S. Pneumonia lacks the polysaccharide capsule and does not cause disease. When grown in a Petri dish, the second strain forms rough-edged R colonies Griffith knew that mice infected with the S bacteria grew sick, and died, while mice infected with the R bacteria were not harmed. To determine whether the capsule on the S bacteria were causing the mice to die, Griffith injected the mice with dead S bacteria. The mice remained healthy.

Griffith then prepared a vaccine of weakened S bacteria by raising their temperature to a point at which the bacteria were “ heat-killed” meaning that they could no longer reproduce (the capsule remained on the bacteria). When Griffith injected the mice with heat-killed S bacteria, the mice still lived. Thus, Griffith knew it was not the capsule on the S bacteria that killed the mice. He then mixed the harmless live R bacteria with the harmless heat killed S bacteria. Mice injected with this mixture of previously harmless preparations died.

When Griffith examined the blood of the dead mice, he found that the live R bacteria had required polysaccharide capsules. Somehow, the harmless R bacteria had changed and became virulent S bacteria. Griffith had discovered what is now called transformation, a change in phenotype caused when bacterial cells take up foreign genetic material. But the cause of the transformation was not known at the time.

Avery's experiments An elegant series of experiments showed that the activity of the material esponsible for transformation was not affected by protein-destroying enzymes, but the activity was stopped by a DNA-destroying enzyme. In this way, almost 100 years after Mendel's experiments were performed, Oswald Avery and his co-workers, biologists at the Rockefeller Institute, in NYC, demonstrated that DNA is the material responsible for transformation. DNA had the instructions for the making of the capsule in the S strain of S. Pneumonia. III. Hershey and Chase Show that Virus Genes Are Made of DNA.

Scientists knew that proteins were important to many aspects of cell structure and metabolism, so most of them suspected that proteins were the genetic material. They also knew very little about DNA, so they could not imagine how DNA could carry genetic information. A. Viruses reveal DNA's role Alfred Hershey, and Martha Chase, performed an experiment that settled the controversy. It was known at the time that viruses, which were much simpler then cells, are made of DNA (or sometimes RNA) surrounded by a protective protein coat.

Bacteriophage, also referred to as phage are viruses that infect bacteria. It was also known that when phage are able to produce more viruses, which are released when the bacterial cells rupture. Hershey and Chase knew that the only molecule in the phage that contained phosphorus was its DNA. Likewise, the only phage molecules that contained sulfur were the proteins in it coat. Hershey and Chase used these differences in chemical composition to carry out the experiment.

Steps T2 phages were grown with E. coli bacteria in a nutrient medium containing either 35S or 32P E. oli were infected with either 35S- or 32P-labeled phages. The infected E. coli were mixed and then spun. Each layer was tested for radioactivity. The 35S label was found only in the upper layer containing the virus's parts. The 32P label was found mostly in the lower layer containing the E. coli. Upon infection, the phages protein coat falls away. They inject their DNA into the E. coli, causing the E. coli to make more viral DNA and proteins. These important experiments, and many others since, have shown that DNA is the molecule that stores genetic information in living cells.