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History of Genetic Transformation

Any uptake of genetic information from the external environment into cells that results in the expression of new traits is called **genetic transformation**. This process can occur naturally. Some bacteria are referred to as being “competent” to indicate that they are capable of taking DNA into the cell from the environment. This is referred to as **natural competence**. Bacteria are also capable of receiving DNA through the process of conjugation where plasmids from one bacteria are sent to another through the **conjugation pilus**. Other methods of introduction of foreign DNA include direct injection into the cytosol or through the use of viruses in a process called **transduction**. In eukaryotic cells, we refer to the introduction of DNA as **transfection**.

Frederick Griffith and the Transforming Agent

At the beginning of modern biology, the source of genetic material was not known to be DNA. In fact, many scientists thought DNA was too simple to perform this job. Scientists believed that proteins, with their 20 varied amino acids, were the carriers of genetic information. In an attempt to develop a vaccine for a bacterial induced pneumonia, Frederick Griffith was the first to describe the process of genetic transformation by accident in 1928. Griffith took a virulent strain of bacteria (smooth in appearance) that caused pneumonia and injected them into mice. This would result in death of the mice. He also observed that injection of a rough bacteria did not cause any disease. After heat-killing the smooth bacteria, he discovered that living bacteria of the virulent strain was required for the disease to progress. Finally, he observed that injecting the heat-killed virulent bacteria with living bacteria of the non-virulent strain resulted in pneumonia and death in the mice. From this experiment, a **transforming agent** with the capacity to pass on a trait was found to be within the contents of those dead cells. But no one knew this agent to be DNA at that point.



DNA as the genetic material

