Electroporation is a technique used in molecular biology and biotechnology to introduce molecules, such as DNA, RNA, or drugs, into cells by applying an electrical field. The process involves creating temporary pores or holes in the cell membrane through which the molecules can pass. Once inside the cell, the molecules can exert their effects or integrate into the cellular machinery.

The basic principle of electroporation involves applying short pulses of high-voltage electric fields to cells suspended in a conductive buffer solution. This electric field disrupts the lipid bilayer of the cell membrane, causing transient pores to form. Molecules present in the surrounding medium can then diffuse into the cell through these pores.

Electroporation is commonly used in various research applications, including:

Transfection: Introducing foreign DNA or RNA into cells for gene expression studies, genetic engineering, or gene therapy.

Cellular Delivery of Therapeutics: Delivering drugs, proteins, or other therapeutic molecules into target cells for research or medical purposes.

Cell Fusion: Fusing cells together to create hybrid cells with desired properties.

Electrochemotherapy: Enhancing the uptake of chemotherapeutic drugs into cancer cells, making them more susceptible to treatment.

In addition to its research applications, electroporation has found clinical use in fields such as cancer therapy, where it is utilized in techniques like electrochemotherapy and gene electrotransfer for tumor treatment.

Overall, electroporation is a versatile and widely used technique for introducing molecules into cells, with applications ranging from basic research to clinical therapy.