Although diffusion cells are manufactured with many different designs, there are only two basic models: one-chambered and two-chambered cells. Each type has its own use for skin absorption experiments.

1. TWO-CHAMBERED CELL

For years, researchers have used variations of the two-chambered cell for measuring the diffusion of a compound in solution from one side of a membrane to the other.1 A dose that is large enough to maintain constant concentration during the course of an experiment (an infinite dose) is added to one side of the diffusion cell, and the rate of diffusion across a concentration gradient into a solution on the opposite side of the membrane is determined. Usually, the solution on each side of the membrane is stirred to ensure that the concentration of test compound remains uniform throughout the experiment. Studies that compare absorption through skin to principles of Fick's membrane diffusion theory are usually conducted with these cells. The two-chambered cell is also useful for studying mechanisms of diffusion through skin and for measuring skin permeation. In these studies, transdermal drug delivery devices can be used to apply drugs to skin at an infinite dose to achieve a steady-state rate of delivery.
2. ONE-CHAMBERED CELL

The actual exposure of skin to substances that are absorbed usually occurs under conditions different from those simulated by the two-chambered cell. Some substances are applied in thin layers to skin, as during the use of cream or lotion drugs and cosmetics. Chemicals of toxicological interest also come in contact with skin in a wide variety of vehicles in the environment. The amount of material applied to the surface of the skin is frequently small (finite dosage), and as permeation proceeds, a steady-state rate of absorption is not achieved. In these examples, percutaneous penetration of the chemicals can be measured only in a one-chambered cell. The surface of the skin in this type of cell is open to the environment, so that thin layers of material can be applied in a manner similar to in vivo exposure. The skin is not excessively hydrated by continued exposure to an aqueous solution, as in the two-chambered cell. The chamber beneath the skin holds the receptor fluid, which is continually mixed with a magnetic stirring bar. Aliquots of the receptor fluid are removed through a side arm for analysis, and the rates of absorption are determined. If desired, infinite doses can also be applied to the skin in the one-chambered cell for determination of steady-state absorption kinetics. There are two basic designs of one-chambered cells: static and flow-through.

2.1. Static Diffusion Cell Design

Finite-dose techniques and the design of a static one-chambered diffusion cell were described by Franz. The Franz cell (Figure 1) is probably the most widely used diffusion cell and has been commercially available (Crown Glass

![FIGURE 1. Franz diffusion cell.](image-url)