Apoptosis, or programmed death cell, is a highly controlled and complex process that occurs naturally in cells, differing from necrosis or accidental cell death. Apoptosis is a fundamental mechanism in the normal development of a living being. Apoptosis dysregulation can cause several diseases, including cancer. The study of the cell changes during apoptosis can be done with flow cytometry.

**Plasma membrane modifications**

A unique feature of apoptosis is the externalization of phosphatidylserine (PS) in the phospholipid bilayer. **Annexin V can bind externalized PS.** The conjugation of a fluorochrome to Annexin V coupled with a DNA-binding dye results in the evaluation of apoptosis.

**Activation of caspases**

Another characteristic of apoptosis is the **activation of caspases** through caspase dimerization or cleavage. By staining caspase with specific antibodies it is possible to quantify the number of cells dying through apoptosis.

**Mitochondrial function**

The increase in mitochondrial membrane permeability can be reflected in **decrease of membrane potential** and a **dysregulation in the redox activity**. Dyes like TMRM, DiOC$_6$, DilC$_1$, or JC-1 that can measure potential difference, mitochondrial membrane disruption or redox state, can be used to study