

Adherent Cell Culture vs. Suspension Cell Culture

There are two basic systems for growing cells in culture, as monolayers on an artificial substrate (i.e., **adherent culture**) or free-floating in the culture medium (**suspension culture**).

Characteristics of Each Culture Type

The majority of the cells derived from vertebrates, with the exception of hematopoietic cell lines and a few others, are anchorage-dependent and have to be cultured on a suitable substrate that is specifically treated to allow cell adhesion and spreading (i.e., **tissue-culture treated**). However, many cell lines can also be adapted for suspension culture. Similarly, most of the commercially available insect cell lines grow well in monolayer or suspension culture.

Cells that are cultured in suspension can be maintained in culture flasks that are not tissue-culture treated, but as the culture volume to surface area is increased beyond which adequate gas exchange is hindered (usually 0.2 – 0.5 mL/cm²), the medium requires agitation. This agitation is usually achieved with a magnetic stirrer or rotating spinner flasks.

Adherent Cell Culture	Suspension Cell Culture
Appropriate for most cell types, including primary cultures	Appropriate for cells adapted to suspension culture and a few other cell lines that are nonadhesive (e.g., hematopoietic)
Requires periodic passaging, but allows easy visual inspection under inverted microscope	Easier to passage, but requires daily cell counts and viability determination to follow growth patterns; culture can be diluted to stimulate growth
Cells are dissociated enzymatically (e.g., Gibco™ TrypLE™ Express, trypsin) or mechanically	Does not require enzymatic or mechanical dissociation
Growth is limited by surface area, which may limit product yields	Growth is limited by concentration of cells in the medium, which allows easy scale-up

Requires tissue-culture treated vessel	Can be maintained in culture vessels that are not tissue-culture treated, but requires agitation (i.e., shaking or stirring) for adequate gas exchange
Used for cytology, harvesting products continuously, and many research applications	Used for bulk protein production, batch harvesting, and many research applications

Video: Passaging cells

This video explains why, when and how to passage cells grown in both adherent and suspension cultures. This includes cell dissociation, counting cells, determining optimal seeding density and preparing new culture vessels for passaged cells.

Related protocols

- [Subculturing Adherent Cells](#)
- [Subculturing Suspension Cells](#)

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