

## 1.3 Viruses always grow in live cells

Welcome to a new class on diagnosis of virus. You will remember that one of the characteristics of viruses is that they only have one type of nucleic acid, and therefore they can only replicate in living cells, depending on the host for their survival (i.e., they are obligate intracellular parasites). They cannot grow in situations without cells, for example in agar, as bacteria do. Initially animals, mainly mammals, were used as support for the growth of viruses. Later, it was discovered that they could grow in chicken embryos. Currently, the most widely used system are cell cultures.

Why do we want to cultivate viruses? The reasons can be varied. Sometimes it is necessary to isolate and identify the virus in clinical samples, or determine their structure, their replication, how is their genome, or how they produce disease (this is known as pathogenesis). Finally, it is also necessary to obtain them in large quantities to produce vaccines.

In this video we will see the different types of cultures.

### Cell cultures

It is possible to remove cells from animals, people or plants and grow them artificially in the laboratory in favorable conditions. This is what is known as cell culture. There are different types of cell cultures: primary, secondary or diploid, and continuous cell lines.

#### Primary cultures

The primary cultures are made by cells that have been recently isolated from a tissue and that proliferate in the appropriate conditions. As they grow and multiply, they consume nutrients and periodically we need to transfer part of them to another container so that they have more space, and we add fresh nutrients. This is known as subculture or cell passage.

These cells maintain most of the features of the tissues from which they derive. This is a great advantage because viruses do not notice the difference with the original cells. But after a limited number of passes or subcultures, usually about 10-20, the cells reach the senescence and they cannot continue to multiply. The primary cultures are used for the isolation of viruses and vaccine production.

#### Secondary cultures

Sometimes the primary cultures can be passed 50 to 100 times before they reach senescence, becoming what is called diploid culture or semi-continuous cell line. They are called diploid because they retain the same number of chromosomes as the cells from which they derive.

They are also used for the cultivation of fastidious viruses and for the production of vaccines.

#### Continuous cell lines

When cells are passed the ones with a highest capacity for growth are selected, and they become uniform in their genotype and phenotype. During the process, or even from the beginning, they can be cancerous cells, with the potential to multiply indefinitely. This way they become continuous cell lines that may be subcultured serially during many passes, we could even say infinite, without losing the ability to grow.

#### Advantages of cell cultures

Cell cultures have many advantages over the use of animals or eggs that we will see in following videos.

- They are fairly inexpensive and do not require large investments in space.
- The cells are easy to maintain, and they can grow rapidly at high densities.
- It is easy to work with cells and we can design experiments with multiple replicas for different uses.
- Continuous cell lines can be passed an unlimited number of times, since they have become almost immortal.
- They may be frozen and thawed several times, as mentioned previously.

### **Disadvantages**

Due to these advantages, they have many applications, but they are not recommended for the production of vaccines, since they have a tumoral origin and they constitute a danger if any of these cells would reach the host.

Also, unlike the primary cultures, which retain most of the features of the tissues from which they derive, continuous cell lines have been accumulating mutations that distinguish them from original tissues. For this reason, the virus could not infect them.

So we have seen which is the most usual way of growing viruses in the laboratory. We have seen that there are primary, secondary cultures and continuous cell lines. We have seen their advantages and disadvantages as well as their applications. It is not the only system of cultivating viruses in the laboratory. In the following video we will see other systems.

Thank you very much for your attention.