



## In vitro fertilization and its applications

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### Abstract

The basis of research on human reproduction is the search for solutions to infertility treatment. Alternative ways have been sought for couples who cannot have children naturally. In this context, in vitro fertilization studies have started. In vitro fertilization (IVF) is the process of artificial fertilization of sperm and egg taken from parents in the external environment. The first studies on IVF have been conducted in 1960-1970. The first baby born as a result of IVF pregnancy was born in the UK in 1978. Subsequently, studies on IVF have become increasingly widespread. Since the 1990s, IVF studies have gained momentum and developed in many parts of the world. It was aimed that healthier individuals would be born with IVF and it was wanted to prevent the birth of sick individuals with some methods.

### Introduction

IVF is the process of artificial insemination of an egg taken from a woman and sperm taken from a man in a laboratory environment [1]. This is an assisted reproductive technique [1]. In vitro fertilization studies began to be studied in the 1960s with the idea that it could cure the infertility problem [2]. In this context, the first baby was born with this technique in 1978 [2]. In vitro fertilization is applied for the purpose of giving birth to healthy babies as well as having children [3]. There are many studies on this. These studies are accepted studies in the medical and scientific world. One of these studies is the study aimed at the prevention of mitochondrial diseases [4]. The genome of the mitochondria is taken from the mother, and all mtDNA copies are identical to each other [4]. When the genomes of the mother's mitochondria are mutated, this is transferred to the baby, and the baby with mitochondrial disease is born. A lot of research is being conducted and developed to prevent this condition [4]. Chinese scientists conducting genetic research in the field of in vitro fertilization have signed new studies in recent years [5]. One of these studies is the study carried out by He Jiankui, in which he inactivated the CCR5 gene that causes the HIV virus in twin babies born in 2018 with CRISPR-Cas9 technology [5]. Although this study is a very important development in the scientific world, it is said that it is not based on a legal basis. In addition, the fact that the CCR5 gene has an important role in brain function has also raised new discussions about this study [5].

### Results

In vitro fertilization is an important point in the treatment of mitochondrial diseases. The treatment of mitochondrial diseases is not at the curative level. Due to the lack of a definitive treatment and the difficulty of its diagnosis, it was considered to prevent the transmission of mitochondrial-transmitted diseases by the gene replacement method [4]. For this purpose, in vitro studies have started. Mitochondrial DNA is taken from the

mother. If the mother's mitochondria are mutated, this can be passed on to the baby. In order for the disease to manifest itself in the phenotype, it must pass a certain threshold. So abnormal MTDNA should be in the December range of 60-90% [4]. Some techniques have been developed to prevent this condition. In the first technique, the nuclear genome taken from the mother's pronuclear stage zygote is transferred to the zygote of a nucleoleless recipient. The second technique is the transfer of the spindle threads in metaphase II from the unfertilized oocyte of the affected mother to the oocyte of a nucleated recipient [4]. Although the results obtained from these techniques are promising, more reliable and effective research needs to be done before they can be used in the clinic. In 2018, twin babies were born whose genes were altered to make them immune to HIV. He Jiankui; in couples where the male parent has the HIV virus, he inactivated the CCR5 gene that causes HIV, allowing babies with immunity to HIV to be born [5]. He accomplished this using CRISPR technology. Although these results are important development for HIV, the CCR5 gene has raised ethical discussions at the point of its application due to the important role it plays on brain functions. The compliance of the study with the basic laws was discussed. In addition, new discussions have emerged about the use of CRISPR gene technology [5]. Thanks to CRISPR-Cas9 technology, new genes were added, removed and replaced. This is a sign that new genetic variations may occur. This, in turn, gave rise to discussions that genetic changes made to a gene, in addition to being therapeutic for a disease, can also cause other risks [5].

## Discussion

As a result of all these studies, in vitro fertilization occupies a very important place in the field of science and medicine. It will both be a hope for parents who want to have children and will pave the way for new studies to bring healthier individuals into the world. Although the issue of ethics is always on the agenda in this field, reliable studies and research are being conducted.

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