

Treatment of Cystic Fibrosis using gene therapy

- **Gene replacement:** defective gene is replaced with healthy gene
- **Gene supplementation:** in which one or more copies of the healthy gene are added alongside the defective gene. As the added gene have dominant alleles, the effects of the recessive alleles of the defective genes are masked

Techniques:

- **Germ-line therapy:** involves replacing or supplementing the defective gene in the fertilised egg. This ensures that all cells of the organism will develop normally, as will all the cells of their offspring. This is $\therefore$ a much more permanent solution, affecting future generations. However, the moral and ethical issues of manipulating such a long-term genetic change mean that the process is currently prohibited.
- **Somatic cell gene therapy:** targets just the affected tissues, such as the lungs, and the additional gene is not present in sperm or egg cells, and so is not passed on to future generations. As the cells of the lungs are continually dying and been replaced, the treatment needs to be periodically. Limited success. Long term - target stem cells that give rise to mature tissues. The treatment would then be effective for the lifespan of an individual.

Delivering cloned CFTR genes:

using a harmless virus: called **adenoviruses**, cause colds and other respiratory diseases by infecting their DNA into epithelial cells of the lungs. They $\therefore$ make useful vectors for the transfer of normal CFTR genes into host cells.

The process:

- The adenoviruses are made harmless by interfering with a gene involved in their replication
- The adenoviruses are then grown in epithelial cells in the lab along with plasmids that have had the normal CFTR gene inserted
- The CFTR gene becomes incorporated into the DNA of the adenoviruses
- These adenoviruses with the CFTR gene are isolated from the epithelial cells and purified
- The adenoviruses with the CFTR gene are introduced into nostrils of patient
- The adenoviruses infect their DNA, which includes normal CFTR gene, into the epithelial cells of the lungs