How genetic engineering revolutionized human diseases research?

To study the complexity of human diseases, in vivo and in vitro models are required. Whether the chosen study model is a cell or an animal, their genome can be modified thanks to technologies and systems that have been recently discovered and are now used on a daily basis in medical research laboratories.

The genome modifications can aim at inducing a disease, rescuing a disease, investigating a gene effect by knocking out/in a gene or studying a cell lineage. Therefore, those engineered models allow the characterization of diseases and also to uncover their mechanisms.

Among those discoveries the well-established Cre-mediated recombination system and the innovative CrisprCas9 technology imposed themselves as reliable genetic engineering tools in research laboratories. Both systems have revolutionized health research by making genes easily accessible for manipulation, thus allowing the creation of a model of interest and reducing investigation time.

To understand how to use these fairly complex systems with all the nuances they imply, several questions must be answered: how are these systems designed? How to use them to study human diseases like cardiovascular disease, obesity, diabetes and others? What are their limits?