

CRISPR CGBE1-based editing on CD34+ stem cells to grow Bombay blood group compatible red blood cells

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Bombay blood group is the result of a rare genetic disorder, where individuals with the Bombay phenotype do not express the H-antigen on their red blood cells (RBC); therefore, they cannot receive blood from any member of the ABO blood group system. The objective of this project is to create an artificial blood type which can be transfused to individuals with Bombay blood group in emergency situations. For this reason the use of CRISPR based-editing technology to mutate the FUT1 gene is proposed, which is responsible for the formation of the H-antigen in hematopoietic CD34+ stem cells, and induce the cells to produce RBCs lacking the H-antigen. We propose an in vitro experiment, which is comprised of designing guide-RNA (gRNA) and base editor constructs, delivering base editor and gRNA to the CD34+ stem cells, verifying on- and off-target mutations by whole genome sequencing, growing RBCs in a G-Rex medium, validation of CRISPR editing using leukoreduction filters and preparing for transfusion by cryopreservation. The project was implemented within the frameworks of IBO Challenge 2020 International Group Project.

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