Biology and Life Sciences

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Scientific Paper

***Introduction***

 The biomedical researchers are looking for efficient and consistent ways to change the genome of a living organism according to their interests. A new tool CRISPR/Cas9 is used to perform successful experiments. Likewise, the chosen article also informs about research related to the gene editing of a human zygote by using the Cas9 protein. The test is performed by multiple Chinese Bio-medical researchers. It is based on the previous researches on a human zygote using the (CRISPER)/Cas9 as a tool in modifying the disease-causing genes in the human body. It gives a detailed report regarding the research conducted in 2016.

***Discussion***

The article further informs that there are so many diseases which are caused by gene-mutation and no treatments are identified for those diseases throughout life. The idea of modifying the defective genes seemed impossible because of the efficiency of practical performance. Therefore, this article notifies about a new tool, i.e. CRISPR/ Cas9 which is thought to be a reliable tool in order to improve the defective human gene. It is already known that CRISPR is the latest tool used in Molecular biology to amend the gene in a human cell. CRISPR was discovered in 2012 that consists of two components of trRNA and crRNA, which are used to develop a system used for genome editing later. Identifying the need of discovering cures for the gene related diseases, it was felt that CRISPR would be a better option to replace the mutated defective disease. It can help the bio-medical researchers to identify treatments for chronic diseases like Cancer, HIV and other gene-mutated disorders like Down's syndrome. It is relying on CRISPR/Cas9 which is a secure tool to build on. It will help the researchers to perform the experiment in an efficient and reliable manner. At the same time, it will save humankind from harmful diseases like cancer, colour blindness etc.

When the scientists were aiming to conduct research on the human zygote to change the defective gene using CRISPR/Cas9, they knew about the significances of CRISPR in modifying the gene. At the same time, altering genes was a topic that challenged the ethical challenges of the world. The feasibility of the role of CRISPR was not tested yet. However, the experiments using 3PN on human zygote gave only 10% efficiency in editing a gene. Therefore, the researchers were thinking of new tool, i.e. CRISPR. However, the researcher got an idea from the previous researches that gene editing is possible in cultured human cell and non-human zygote by using a single guide RNA (sgRNA) by targeting the Cas9 protein in order to modify the sequence position of a gene.

Consequently, the researchers aimed at addressing the questions like, is CRISPR/ Cas9 applicable in correcting a defective-gene in human zygote? Secondly, is it a useful tool in editing the human 2PN zygote? Likewise, the whole report is based on these two questions. By using the available tools, researchers will be able to experiment.

Furthermore, the bio-medical scientists used Cas9 protein and sgRNA, which were diluted in an injection. After that, they took different concentrations of Cas9 and sgRNA. Through microinjection it was injected into one-cell human embryo under the microscope. The embryos were provided by Patients who were seeking treatment for IVF at the Center for Reproductive Medicine at the Hospital of Guangzhou Medical University. Under the standard procedures, the zygote was formed at a Clinic. Cultured embryos provided Genomic DNA that was amplified with the REPLI-g Single Cell Kit by following the instructions of manufacturers. Further, the fetus was amplified by WGA DNA. Then, the genome sequencing was analysed through molecular analysis.

 After a successful injection, the efficiency of Cas9 was tested. The 3PN embryos taken by informed consent from the patients. After the maximum 18 h fertilization, the embryos were studied under the microscope. However, ten of the embryos were injected and out of which nine edited on the locus of G6PD while two were designed HindIII. The efficiency for it shows 20%. There were no any additional changes other than HDR. However, 20 3PN embryos were injected and 16 of that exhibited cleavage in the T7E1 test. On the other side, for 2PN human embryo, the same procedure was conducted.

 As a result, it was observed that it is an efficient combination of mediated modified gene in HBB and G6PD. The efficiency varies for both. HDR for G6PD happened to be 100% suitable for the mutant allele. Out of two embryos, one gene was completely modified, but the other one was half changed and half affected. On the other side, the results for HBB were totally different. The HDR for HBB showed 50% efficiency for the two of embryos. However, the researchers are not so sure about the conclusion. They are unclear about the differences they saw. Therefore, they recommend researching more number of embryos. At the same time, they are ambiguous about the genome sequencing because of the lack of evidence for the correction of the mutation on G1376T. It is one of the two embryos.

Moreover, the researchers have mentioned the limitations of the study due to which there is a lack of clarity in the research. At the same time, CRISPR/Cas9 is not possible for gene editing at a reproductive clinic because of the technical and ethical issues. There are other factors which can also influence gene editing. Therefore, the researchers are unable to conclude the results correctly.

However, this research needs successful experimentation by identifying the gap of the study which is the unclear explanation for the results of the experiment. A proper investigation will be conducted in a laboratory where that will be like a natural setting like at any reproductive clinic. It would be free of external factors like ethical and technical issues. It is identified that the research lacks the explanations for the differences. Therefore, in order to find out the role of helpful tools for correcting the disease-defective gene in a human zygote. For that, the experiment will be conducted on more number of embryos. This research will try to examine all the factors affecting the genome-correction by using the CISPR/Cas9 protein. The new research will address all the gaps identified in the previous study. It will also try to find out the variation in results. The study will aim to experiment with improved efficiency. However, there are minimal tools to examine the human gene under CRISPR approach. Using any other means for this proposal will be very helpful. The new device can be compared with CRISPR for the efficiency of the results. Molecular Biology needs more experiments to find out innovative ways to address the gene-related diseases.

 After the successful experiment, it would be identified why the tools of CRISPR/Cas9 give altered results for two same genes of the embryos. It would also determine the different factors which are affecting the efficiency of the procedure. Such experiments help to address more issues related to human beings and contribute to the improvement of the health of individuals. These experiments are supposed to design a cure for the disease.

***Conclusion***

 In conclusion, it has become essential to find out the treatment for diseases related to defective-genes. The Molecular Scientist are working on it, and they are planning to use CRISPR/Cas9 on a human zygote in a specific setting. As a result, some limitations were identified, and with the help of future research, improvements can be made for the experiment.

End Notes

 1. Tang L, Zeng Y, Du H et al. CRISPR/Cas9-mediated gene editing in human zygotes using Cas9 protein. Molecular Genetics and Genomics. 2017;292(3):525-533. doi:10.1007/s00438-017-1299-z