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CRISPR: On How it'll Change the Future

Alvina Aulia[1*], Rael Russel Hutapea[2], Prawira Setya Abdima[3], Akhmad Ali Emawan[4], Ivan Sebastian Edbert[5]

[1] Computer Science Department, BINUS Graduate Program - Doctor of Computer Science,
[2-5] Computer Science Department, School of Computer Science,
Bina Nusantara University,
Jakarta, Indonesia 11480
aaulia@binus.edu; rael.hutapea@binus.ac.id; prawira.abdina@binus.ac.id;
akhmad.ernawan@binus.ac.id; ivan.edbert@binus.ac.id

*Correspondence: aaulia@binus.edu

Abstract *– Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR) explain genetic illness and how people can treat it using. CRISPR, a gene editing technology, has altered what is now possible in animal modification and the development of human treatments. Technological advancements enable new enhanced plants, breakthrough concepts for human medicine, and appealing yet feasible techniques for reducing vector-borne illnesses. CRISPR is used as a diagnostic method for several critical diseases like cancer. CRISPR can detect and identify the DNA and RNA to identify the cause of the pathogen, like viruses or bacteria with high sensitivity. In this research, the researcher will explain how CRISPR will change the future, specifically for medical purposes. The researcher will do the Systematic Literature Review (SLR) to describe CRISPR. The goal considering CRISPR in the future is routinely used to edit the genetics of plant, bacterial, and even animal models for good purposes. It also nourishes and protects the human body from diseases by examining target genes in genome modification, investigating, and treating genetic disorders, infectious diseases, and immunological diseases. In CRISPR applications for hereditary illnesses, the CRISPR/Cas technology has been used for gene therapy to protect humans against sickness. Although the limitation of the technology is that still in the initial stages, CRISPR could be one of the groundbreaking methods in the future.*

Keywords*: CRISPR; Gene Editing; Genetic Disease*

I. INTRODUCTION

Genetics studies genes, genetic diversity, and heredity in organisms. The discovery of genes, the fundamental units responsible for inheritance, gave rise to genetics. Genetics studies genes at all levels, including how they work in cells and how they are handed on from heritage. A gene is a piece of DNA that contains instructions for building one or more molecules that help the organism perform its duties. According to researchers, humans are thought to have around 20,000 genes (NIGMS, 2022).

A mutation, or alteration in a gene or genes, can happen occasionally. The mutation modifies the gene's instructions for making a protein, causing it to malfunction or vanish entirely. Genetic diseases are a major medical problem that can result from this (MedlinePlus, 2022). A gene mutation can be inherited from one or both parents and might occur at any time during your life (National Geographic, 2022).

Some notable genetic modification academics like Jennifer Doudna publicly expressed their worries regarding human genetic alteration in early 2015. Doudna is a prominent scientist whose development of CRISPR-Cas9 technology, or "CRISPR" for short, has indirectly made human genetic alteration conceivable. CRISPR makes genome editing relatively simple. However, CRISPR needs a lot of focus when doing it because there is no autocorrect for a CRISPR-induced error in the human genome. Furthermore, we may be unaware of the mistake until it is too late (S. Robert, 2021). In this study, the researcher wants to explain what CRISPR is, gene modification, and possible future endeavors that CRISPR could achieve.

II. METHODS

2.1. Systematic Literature Review

The researcher used Systematic Literature Review (SLR) as the methodology in this research. SLR is a study to identify, evaluate and collect relevant studies on a particular topic. SLR becomes the standard by summarizing the previous research and identifying the gap in the specific case. The researcher used this approach as the methodology to explain what CRISPR is, gene modification, and the future of CRISPR.

2.2. Research Question

The purpose of the research question is to maintain the focus of the literature review of CRISPR, show in Table I.

Table I. Research Question

Id	Research Question	Motivation
RQ1	What is CRISPR?	To identify the CRISPR
RQ2	How does CRISPR work?	To identify the CRISPR Work
RQ3	What can CRISPR do?	To identify CRISPR, do
RQ4	Could CRISPR help cure genetic diseases?	To identify the CRISPR can cure genetic disease
RQ5	Does CRISPR have side effects?	To identify CRISPR a side effect

2.3. Result Finding

The researcher will review the literature to answer the questions in Table I. The study has researched the published papers established in the database journals we had examined, with a specific word to search. We are using "CRISPR" AND "Genetic Editing." Table II will show the result of the search

Table II. Search Results of the Database Journal

No	Database Journal	Number of Articles
1	Nature	16 706
2	AAMC	33
3	Frontiers	15 071
4	Synthego	1 785
5	Biomed Central	24 818
Total		58 413

The inclusion and exclusion criteria that the study implemented further filter the research. Table III will show the result of the search.

Table III. Inclusion and Exclusion Criteria

Criteria		
Inclusion	I1	Articles that are researched and written about CRISPR.
	I2	Articles that are researching and writing about Genetic Editing
	I3	Articles published from 2017 to 2022 (within the last five years).
Exclusion	E1	Articles that have similar contents but from a different database journal.
	E2	Articles that are not researching or writing about CRSPR or Genetic Editing

The filtering will be done using the inclusion and exclusion criteria table criteria. In this case, the study will further research the paper by applying the above criteria and be eligible for use. Finally, Table IV will show the result of the search.

Table IV. Number of Articles After the Filtering Process

No	Publication Media	Number of Articles
1	Nature	50
2	AAMC	31
3	Frontiers	1 569
4	Synthego	1 704
5	Biomed Central	1 241
Total		4 595

III. RESULTS AND DISCUSSION

What would happen if humans could create and change the substance that codes for our DNA if our genes were, to a large extent, our destiny? Whether it's the woes of sickle cell anemia or the horrors of Huntington's disease, millions of people can avoid the severe effects of hereditary disease or disability problems. However, the ability to "play God" poses severe ethical problems and risks abuse. These issues were confined to science fiction for decades, but as Kevin Davies eloquently points out in his latest book, that is about to change (Davies, 2020) Should we use our new evolutionary hacking abilities to make us less vulnerable to viruses and eradicate disease? It's fantastic, isn't it? How about preventing deafness or blindness from birth? (Kirshner, 2022). But is CRISPR the only solution? According to Greely in his book, "The same benefits can be obtained by using (other) technology. Before we proceed, we must carefully analyze the impact." (Greely, 2022). Greely's words can be considered in the case of He Jiankui, who illegally did gene editing on two baby girls in China. Recent research suggests that his intervention may have altered the babies' brains (Sand et al, 2019).

Before discussing the potential of CRISPR, we need to know what CRISPR is being used. Routine CRISPR is used to modify the genetics of plants, bacteria, and animal models (Michael W. Richardson, 2019). CRISPR is also used to improve fruit and plants' quality, taste, and even size (Emily Mullin, 2020). And the surprising treatment is the treatment of B-cell acute lymphoblastic leukemia, a type of cancer in which the bone marrow produces too many immature immune cells. And by using CRISPR to improve the quality of therapy in patients (Meenakshi Prabhune, 2021).

Genetic therapy aims to change our genetics to nourish the human body and protect the body from disease. Unfortunately, genetic therapy technology has declined due to the many failures at the time of its invention. But with the advent of CRISPR, genetic therapy has become the key to the future of humanity, with the hope of curing rare diseases, facilitating genetic inheritance, and even the concept of getting older. However, because the technology is still young, CRISPR has many limitations (Uddin et al, 2020).

Genome engineering techniques provide no lateral potential in human and non-human modifications. While this technique primarily aims to cure genetic diseases in humans, it also includes ways to reshape the biosphere to benefit the environment and human society in other animals. However, the undiscovered threat to human health and well-being remains unclear (Meiliana et al, 2017). Furthermore, it can be challenging to reverse genetic changes. However, other researchers are concerned, such as Francis Collins of the National Institutes of Health, who recently stated that the US government would not sponsor genome editing of human embryos. Nevertheless, researchers in the United States who could raise their funds and those in the UK, Sweden, and China were pressing ahead with their tests (Plumer et al, 2018).

Advances in the Clustered Regularly Interspaced Short Palindromic Repeats/CRISPR-associated system (CRISPR/Cas9) have drastically changed our ability to modify the genome. Scientists are using CRISPR/Cas9 for various biotechnological and medical applications. One of the most critical applications is the development of potential disease therapeutic techniques (Khan et al, 2018). Transfection or transgenesis can be used to apply this method in cultured or living cells. Recent advances in genome editing have made it possible to manipulate each gene at its locus in various species and tissues, including cultured animal cells and organs. Genome editing is a valuable tool for biomedical research and could someday be used to cure some genetic disorders (Rodríguez et al, 2019).

CRISPR, a gene editing method, has changed what is currently achievable in animal modification and the creation of human therapies. Technological advances make improved plants, revolutionary concepts for human medicine, and attractive yet practical strategies for eliminating vector-borne diseases like malaria possible. However, while scientific progress has been remarkable, it has been forged by the concerns created in various other professions. Several biosafety issues arising from off-target effects, genomic rearrangements, and unexpected interactions with the p53 system are the major hurdles facing CRISPR human gene therapy and therapeutic development. These problems could be avoided in the future if more appropriate variations of CRISPR were developed (Singh & Dhar, 2020).

CRISPR technology's usefulness feels too good to be accurate, but the statement is arguably true. Because CRISPR has excellent potential, genetic modification is a complex field with intricacies we are unaware of. However, using CRISPR still causes side effects, be it on the genetics to be changed or on the surrounding genetics of the genetic target. CRISPR is still considered unethical in biotechnology as long as these side effects have not been resolved (Gonzalez-Avila, 2021). CRISPR instability occurred in a genetically modified human embryo assay in 3 events. The three events have one thing in common: the instability of the results of genetic modification using CRISPR in the three embryos (Ledford, 2020).

CRISPR technology is essential for human development; how can CRISPR potentially eliminate the concept of age, even though it only works as a theory? The use of CRISPR itself has been applied to prevent diseases such as lung cancer (Tiruneh et al, 2021). However, as long as there are side effects when using CRISPR in humans, these risks are still not feasible to be implemented in general and must still be used independently without involving humans (Greg Licholai, 2018). But the hope of CRISPR as the future of humans is not extinct. Even though in its early stages as a technology, CRISPR has made outstanding achievements, one of which is treating sickle cell disease. Updates about CRISPR being used to fight cancer tumors are improving and progressing well. So stay tuned for any opportunities that can be achieved using CRISPR technology (Bridget Balch, 2021).

The advancement of CRISPR technology in actual events in recent years in the form of the Cas9 protein is still being explored and produced as a genome editing tool. Nme2Cas9, for example, is a minor Cas9 protein produced from Neisseria meningitides with gene editing efficacy comparable to SpCas9 (Edraki et al, 2019). This smaller Cas9 is better suited for in vivo administration than the larger SpCas9. Cas9 can also be used to visualize data. Chen and colleagues observed repetitive DNA sequences with a single sgRNA or nonrepetitive loci with several sgRNAs using Cas9-coupled green fluorescent protein enhancement (EGFP). (Wu et al, 2019) (Chen et al, 2018). Thus, CRISPR-based RNA editing can transiently and independently alter target genes at the transcript level. This method can provide a manageable approach to disease therapy.

The CRISPR/Cas 9 system has been used to study target genes in genome modification (Oakes et al, 2019), splicing (Yuan et al, 2018), and epigenetic control (Xie et al, 2019). As well as to research and cure genetic illnesses (Papasavva et al, 2019), infectious diseases (Kennedy & Cullen, 2017), and immunological diseases (Ferdosi et al, 2019). The translational application of CRISPR/Cas in monogenic human genetic disorders is one of the most exciting advances, with the possibility of providing long-term therapy after a single treatment. This section discusses recent CRISPR/Cas system applications in disease model development and in vitro and in vivo genetic disease therapy.

IV. CONCLUSION

The substance that this research identified codes for DNA and genes. Genetics is the study of genes, genetic variation, and heredity in organisms. It can result in a genetic illness, a significant medical issue.

CRISPR allows for comparatively straightforward genome editing. CRISPR is routinely used to edit the genetics of plant, bacterial, and even animal models. CRISPR can also increase fruits' and plants' quality, flavor, and size. Genetic treatment is a therapy that tries to modify our DNA to nourish and protect the human body against sickness.

CRISPR has several limits because the technology is still in its initial stages. While this methodology is intended to heal genetic illnesses in people, it also involves methods

for reshaping the biosphere in other species to benefit the environment and human civilization. Reversing genetic alterations can be challenging.

These issues might be avoided if more appropriate CRISPR variants were generated. Because, despite CRISPR's immense promise, genetic modification is a complicated subject with complexities that we are not entirely aware of. CRISPR still has side effects, whether on the genetics to be modified or the genetics around the genetic target. However, if there are side effects from employing CRISPR in people, these risks cannot be incorporated in general and must be used independently without engaging humans. The CRISPR/Cas system has been utilized to examine target genes in genome editing, splicing, and epigenetic control.

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