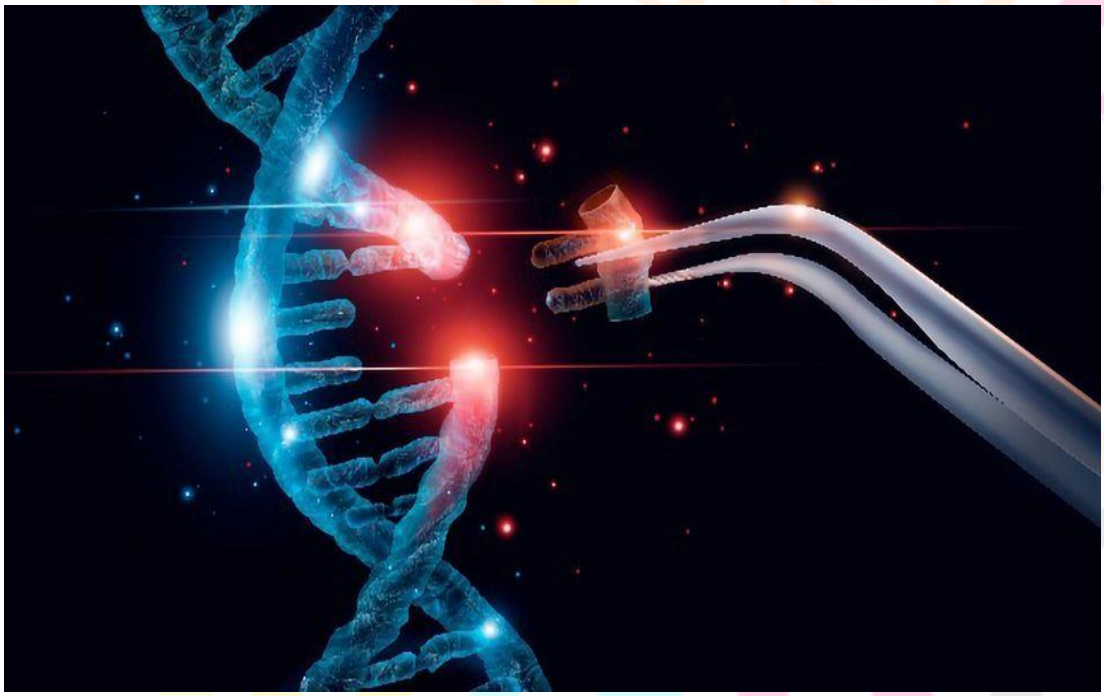
IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

Macrocosm of CRISPR

Evangelein rose



What is CRISPR?

CRISPR" stands for Clustered Regularly Interspaced Short Palindromic Repeats, which are the hallmark of a bacterial Defense system that forms the basis for CRISPR-Cas9 genome editing technology. In the field of genome engineering, the term "CRISPR" or "CRISPR-Cas9" is often used loosely to refer to the various CRISPR-Cas9 and -CPF1, (and other) systems that can be programmed to target specific stretches of genetic code and to edit DNA at precise locations, as well as for other purposes, such as for new diagnostic tools. researchers can permanently modify genes in living cells and organisms and, in the future, may make it possible to correct mutations at precise locations in the human genome to treat genetic causes of disease. Other systems are now available, such as CRISPR-Cas13, that target RNA to provide alternate avenues for use, and with unique characteristics that have been leveraged for sensitive diagnostic tools, such as **SHERLOCK.**

What is the main purpose of CRISPR?

CRISPR genome editing allows scientists to quickly create cell and animal models, which researchers can use to accelerate research into diseases such as cancer and mental illness. Which is an important passage for genetic disease solutions.

Evolution of sherlock in CRISPR?

Sherlock is an evolution of CRISPR technology, which others use to make precise edits in genetic code, as a diagnostic tool, sherlock can detect the unique genetic fingerprints encoded in virtually any DNA OR RNA sequence in any organism or pathogen.

How it works:

First, it hunts for viral RNA using an RNA guide. When it finds its viral target, cas13 becomes activated. In some circumstances it cuts any RNA it encounters a process termed collateral cleavage. It is this mechanism that scientists at the Mc govern institute broad institute and Harvard university harnessed to create sherlock, a highly sensitive tool to detect infectious diseases in humans. Researchers take a sample from a patient with a possible viral infection, like the flu. Then they amplify the levels of RNA in it and add reporters that are sensitive to cas13. Then the engineered CRISPR cas13 is added to the sample. This cas13 is programmed with a guide RNA that is designed to find only virus RNA and bind to it. when this happens, cas13 activates its cleaving mechanism and begins randomly slicing nearby RNA, including the reporters. Since each end of the reporters carries a different label, cas13 separates these two signatures, creating a unique signal within the sample. The sample is then applied to a commercial flow detection system. If the sample is negative for flu, then the reporters remain intact and collect at the first detection line. If the sample is positive for flu, it collects at a different location, making a diagnosis easy to spot.

Bacterial CRISPR Engineer:

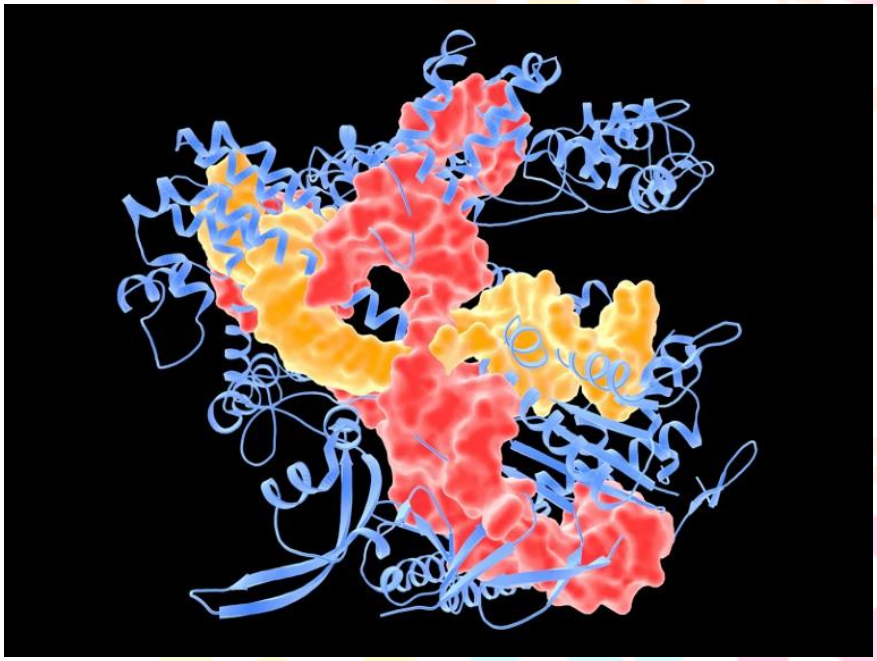
CRISPR were first discovered in archaea (and later in bacteria) by Francisco Mojica, a scientist at the University of Alicante in Spain. He proposed that CRISPRs serve as part of the bacterial immune system, defending against invading viruses. They consist of repeating sequences of genetic code, interrupted by “spacer” sequences – remnants of genetic code from past invaders. The system serves as a genetic memory that helps the cell detect and destroy invaders (called “bacteriophage”) Genome editing of bacteria is typically attained by homologous

recombination between the target gene and an editing substrate that can either be circular or linear DNA, the latter being single-stranded DNA oligonucleotides (oligos) or double-stranded PCR products.

Why do bacteria use CRISPR?

The bacterial cells can use CRISPR-Cas systems to protect themselves from renewed infection, as CRISPR-Cas gives the bacteria's infection Défense a kind of memory: when a phage dock at a bacterial cell and injects its DNA into the cell.

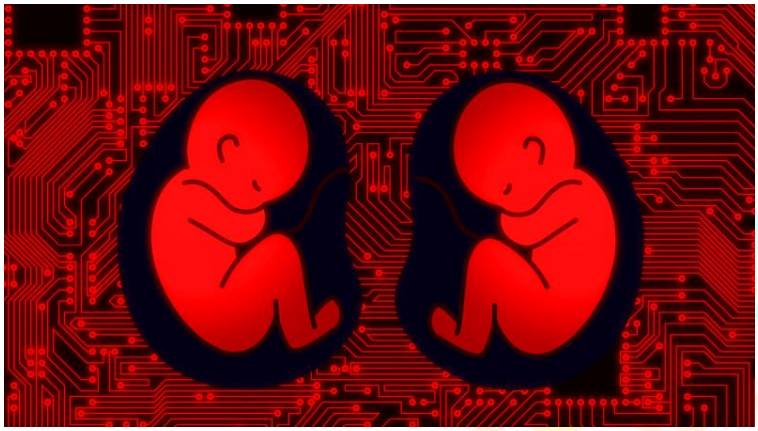
CRISPR Interconnects with Cancer?



Ever since scientists realized that changes in DNA cause cancer, they have been searching for an easy way to correct those changes by manipulating DNA. Although several methods of gene editing. CRISPR could alter theDNA of human cells like a very precise and easy-to-use pair of scissors. It is the first attempt to combine two hot areas in cancer research: gene editing to create personalized treatments, and engineering immune cells called T cells to better target tumors. The approach was tested in 16 people with solid tumors, including in the breast and colon. Past studies have used the gene-editing technology CRISPR to remove genes from immune systemcells to make them better at fighting cancer. Recent reports have suggested that modification ofCRISPR/Cas9 can provide plot form to probe the mechanisms in tumorigenesis and cancer therapies.

CRISPR sometimes cuts DNA outside of the target gene—what's known as “off-target” editing. Scientists areworried that such unintended edits could be harmful and could even turn cells cancerous, as occurred in a 2002 study of gene therapy. the Cas9 enzyme, which is supposed to slice a specific DNA sequence, will also make cutsin other parts of the genome that could result in mutations that raise cancer risk. This review focuses on the historical perspectives of CRISPR/Cas9. The study highlights the applications and also their role in cancer cell genome editing, which is helpful to understand the dynamics. But not the immediate cure, Intense research inprogress on the mechanism of action of CRISPR/Cas9 has been reviewed and critically discussed.

CRISPR in Human babies- [Lulu and Nana]



The first human gene-edited baby in history, the scientist, He Jiankui, said he used CRISPR, a gene-editing technique, to alter a gene in human embryos — and then implanted the embryos in the womb of a woman, who gave birth to twin girls **lulu and nana** in November. And he said that he will take the responsibility for these two twin babies. Embryo editing is only ethically justifiable in cases where the benefits outweigh the risks. Technical issues aside, the researchers did not even address an unmet medical need. While the twins' father was HIV-positive, there is already a well-established way to prevent an HIV-positive father from infecting embryos. This "sperm-washing method was used by the team. The onlybenefit of the attempted gene modification, if proven, would have been a reduced risk ofHIV infection for the twins later in life. That is illegal in many countries, including theUnited States. China has halted Dr. He's research and is investigating whether he broke anylaws there. Among the concerns are whether the couples involved in Dr. He's research were adequately informed about embryo editing and the potential risks involved.

Dr. He says he has submitted his research to a scientific journal. But nothing has been published yet, and he announced the births of the twins before his research could be peer-reviewed by fellow scientists. He also appears to have taken other secretive steps that defy scientific standards.

Which gene did he edit and why?

The gene is called CCR_5. It creates a protein that makes it possible for H.I.V., the virus that causes AIDS, to infect people's cells. Dr. He said that with the help of an H.I.V./AIDS advocacy organization in China, he recruited couples in which the man had H.I.V. and thewoman did not. He used the Crispr-Cas9 editing technique to try to disable the CCR_5 gene in their embryos, with a goal, he said, of creating babies who would be resistant to H.I.V infection.

Limitations in CRISPR:

CRISPR/Cas is an extremely powerful tool, but it has important limitations. It is:

- **Fear of spreading invasive species –**

  Genetically modified (GM) animals and plants are well-known for their ability to adapt to different environments better than regular ones. There are concerns about the possibility of uncontrollable growth, turning the species into invasive ones, to an extent where they harm the environment and the organisms themselves.

- **Uncontrollable population growth-**

  Since the disease is a major factor and one of the most effective tools that account for controlling the human population. Extending the lifespan of everyone through using genetic engineering in humans,

may result in outgrown numbers of humans. Serious issues may arise as a consequence, i.e., problems with job availability, economic disparity, the necessity to provide higher levels of medical care, and the lack of agricultural products to cover everyone's needs.

- **Higher risk of increasing allergies-**

The process here is a bit complicated, with the fact that allergens in GMO food areeasily transferred from one crop to another. Hence, pregnant women eating GMO food might endangering their offspring by altering their genetic codes and expressions. Genetic editing is an irreversible process; once taking place, it cannot be reversed. Unfavoured effects may emerge from the immediate evolutionary alterations done by our genetic engineering techniques, and the danger can reachsome critical scenarios, i.e., allergic reactions may develop some sort of spontaneous reactions that can jeopardize our entire planet and our existence.

CRISPR that can change the world:

CRISPR works by injecting a DNA construct into a living organism. The construct is composed of the Cas9 enzyme that cuts or deletes a segment of DNA, a sequence of RNA that guides the Cas9 to the correct location to cut, and a new DNA template that repairs the cut and alters the gene.

"We are getting to a point where we can investigate different combinations of genes, controlling when, where, and how much they are expressed, and investigate the roles of individual bases of DNA," states Nicola Patron, a molecular and synthetic biologist at the Earlham Institute in the UK. "Understanding what DNA sequences do is what enables us to solve problems in every field of biology from curing human diseases to growing enough healthy food, to discovering and making new medicines, to understanding why some species are going extinct."

Removing malaria from mosquitoes:

Scientists have created malaria-resistant mosquitoes by deleting a segment of mosquito DNA. The altered mosquitoes then pass on resistance genes to 99 percent of their offspring, even when mating with unaltered mosquitos.

Reducing our need for plastic:

CRISPR can be used to manipulate a type of yeast that transforms sugars into hydrocarbons, which can be used to make plastic—greatly reducing the need to rely on petroleum-based resources for plastic and easing stress on the environment.

Developing new cancer treatments:

CRISPR can modify immune cells to make them more effective at targeting and destroying cancer cells. It can also be used to evaluate how genes can be studied to determine their sensitivity to new anti-cancer drugs thereby developing a personalized treatment plan with the best possibility of success.

What is the future of CRISPR?

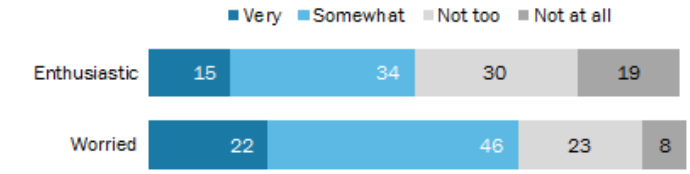
Carver Biosciences is developing next-generation gene editing technology using Cas13. By editing RNA, this method makes it possible to target and then edit or destroy RNA from the viruses that cause COVID-19, influenza, and other infectious diseases, and to prevent them from replicating. CRISPR Gene Editing Can Cause Unwanted Changes in Human Embryos, Study Finds. Instead of addressing genetic mutations, the Crispr machinery prompted cells to lose entire chromosomes. A New CRISPR-based tool inserts large DNA sequences at desired sites in cells. Known as **PASTE**, the technique holds the potential for treating a variety of diseases caused by faulty genes. "Within 30 years, it will probably be possible to make essentially any kind of change to any kind of genome," says Jennifer Doudna, Ph.D., a professor of chemistry and biochemistry, and molecular biology at UC Berkeley.

PUBLIC INTERVIEW ABOUT CRISPR:

Americans have mixed emotional reactions to the possibility of using gene editing to reduce a baby's risk of serious diseases, although more people express concern rather than enthusiasm. Fully two-thirds of U.S. adults (68%) say the prospect makes them either "very" or "somewhat" worried, while roughly half (49%) say they are "very" or "somewhat" enthusiastic about this technology. Three-in-ten adults are both enthusiastic and worried.

More worry than enthusiasm about the idea of gene editing for babies

% of U.S. adults who say the possibility of gene editing to give healthy babies a much reduced risk of serious diseases and conditions makes them ...

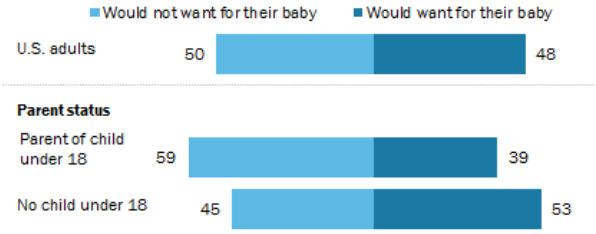


Note: Respondents who did not give an answer are not shown.
Source: Survey of U.S. adults conducted March 2-28, 2016.
"U.S. Public Wary of Biomedical Technologies to 'Enhance' Human Abilities"
PEW RESEARCH CENTER

Asked to consider whether they would want this kind of gene editing for their baby, Americans are split, with 48% saying they would want to use this technology for their child and a nearly identical share saying they would not. Parents who currently have a child under the age of 18 are less inclined than others to say they would want this kind of gene editing for their baby; a clear majority of these parents (59%) would not want to use gene editing for their child. Respondents also were asked whether they think "most people" would want to use the gene-editing technology. Overall, a slim majority of Americans (55%) expect most people would want this kind of gene editing for their baby, while 42% say most people would not want this.

Public closely divided over whether they would want gene editing to reduce their baby's risk of disease

% of U.S. adults who say the possibility of gene editing to give healthy babies a much reduced risk of serious diseases is something they would/would not want for their baby



Note: Respondents who did not give an answer are not shown. "Definitely" would/would not want and "probably" would/would not want responses combined.

Source: Survey of U.S. adults conducted March 2-28, 2016.

"U.S. Public Wary of Biomedical Technologies to 'Enhance' Human Abilities"

PEW RESEARCH CENTER