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MONOGRAPH

PROJECT CRISPR/CAS 9

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Gratitude

I want to thank God who is the one who gives me everything and who blesses me, I want to thank my family, especially to my mom who is the person that I most love in the world and also the person who support me in everything that I need and every day to be better person in different ways, the one who will give his life for her children no matter what and the person that will be by my side always and forever. I want to thank my friends who are the people that were to me in these 6 years of school together as a family and especially my best friends who were with me in every moment in my life and stand by my side in my good and bad moments. I want to thank to my teachers who are the people that taught me a lot of things and the people who taught me how will be my life when I graduated High School and with their taught knowledge I will remember for the rest of my life and use it when I need it.

Summary

The author chose this topic because of the influence that he lived through the pass of the years.

The author lived a rough time when he was a child because he had a surgery in the stomach to save his life; the cause was by an allergic. The allergies is a product of malfunction of DNA, a problem that is in this moments impossible to be cure forever, it can only be treat. The author thought that health was a garbage, something that is not really a priority but then, he realized that he was wrong and learned that health is more important than money or any material thing, you can have a lot of money but money won't save your life in some cases.

The author had many other motivations in the decision to choose this topic. One of them is that the author's best friend showed him a video by a YouTube channel. The channel is a really interesting one, its videos is basically everything about science, for the author is really entertaining and is really curious for every science advancement, his best friend showed him that video, the one about Gene Editing technology and the most important part: The CRISPR/CAS 9 project which is really fun and interesting, but the most important is to be aware of what are the science advancements that the scientists are developing.

The author also learned that is really important that everyone has to know about this project, not only by general culture, but also because of the fact that if we know about this, we can save the lives of many beloved people of our own and also, we can pass the voice to the others. In addition, the most important is that in a future, this project can save millions of lives around the world.

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Introduction

An important fact is that thanks to DNA we are the person that we are now, but how is that possible? DNA is transferred to another human being by reproduction, specifically from our parents, because their DNA is transferred to us to have a similarity to them, like a mix of both parents or to someone else in our family, like grandfathers. DNA allows or permits us the infinite possible combinations that we may inherit. Passed down from parent to child, we can inherit the type of hair of our mom or dad or simply have a different type of hair combining both types of our parents, the same with the color of our eyes; we could have them of the color of our mom's eyes or our dad's eye. The most interesting part is that we cannot inherit neither of those eyes color; we can have the eye color of our ascendants like grandfathers, etc.

This case is more common in our society. The world of science is really interesting, if we research more, we will find more answers too many questions that we have, but also science can make marvelous things that can save millions of lives around the world with these advancements. We have to consider that we haven't known 100% of DNA, it remains mysterious at the moment because is hard to research and also because there are not people who helps with this investigation, and this happen with many other investigations, because there are not enough economical budget, we can't achieve many things. The world of science is a huge one, with many mysteries to be unsolved and it comes more questions than answers every second, every minute, every year. When we thought that we answered a question is not over, that answer came with more mysteries.

Chapter I

To understand crispr/cas 9

1.1 What is DNA?

To understand what this amazing project is, we must know the most important facts from the project; we have to learn about DNA. Deoxyribonucleic acid, (by its acronyms DNA) is the principal substance that we can find in the cells of all living things. This substance is the one that makes up genes. DNA gives a code for all genes and also in every compartment, which can have more than 150,000 genes in a few creatures. DNA maintains the data that is employed by cells to create proteins and other particles. All of these bio components later carry through actions with the purpose of keeping hold of the cell with life. DNA can be found in eukaryotic organisms such as animals and plants, in humans we can find the DNA in cell structures better known as Mitochondria, an entire set of gene material present in a cell or organism it's known as genome, the genomes are really important because it have all the data that requires in order to build and keep safe a specific organism.

Do you know how and which elements have the DNA structure? DNA is invented by many tiny particles and is a macromolecule, which are bonded to make an extended chain. The tiny particles are familiar as nucleotides, what are his components? Are deoxyribose, a base and a phosphate group. Do you know that DNA can recreate and duplicate itself? This is a principal characteristic of DNA, another important characteristic is that DNA is the responsible of the proteins that are in your system, and this opens the door to many possibilities because proteins and gene editing play a big role in CRISPR/CAS 9 thanks by his properties (Basic Biology, 2016).

1.2 DNA mutations

DNA is a marvelous thing that we have, but every great discovery always will have bad things, this is the case of DNA mutations, but what is this? Mutations occurred when the DNA copy have mistaken, some of these mutations are good, bad or simply is just nothing that can affect us. In some cases not every living thing have experimented and had this mistakes, there are some mutations that are very lethal to the living thing who has it because a group mutations cause you a slowly death as you growing up. Another group of mutations don't cause you the death but you can have notable changes to you, in other scenarios, these mutations are not bad at all, this can help us to evolve as species because it can support us to make us better. What molecule is the responsible for the mutations?

The chromosome is the responsible and a process called cell division, but how? In human beings, we have 46 chromosomes, divided in 23 diploids and 23 haploids. The cell division is divided in two groups, one called Mitosis and the other one called Meiosis. Mitosis is a process that makes the cell reproduce all of its quantity and also containing the chromosomes and divide into to exact daughter cells, this process is so dangerous that if something goes wrong, can produce cancer, and that's why the stages of mitosis are delicately supervised by a big amount of genes. Moreover, the meiosis is a process, which its purpose is to guarantee that all of our chromosomes are complete, but when this process is not going well and happens an error, we can gain less chromosomes or more chromosomes in comparison of what a human needs to have, and because of this, is where the mutations are born.

There are mutations that has less of 46 chromosomes can have bad diseases like Down syndrome, Edwards Syndrome, and many others; and there is another group of diseases that are cause for having more than 46 chromosomes, examples of that we have Turner Syndrome, etc. But there's also more causes of mutations, big part of the mutations in our population came from our parents or ascendants, in other words are Hereditary Mutations, another group of mutations are acquired in some point of our life, the problem is that we might think that we are healthy but the mutation is in our cell since the beginning of our life but the mutation can be activate by some factors, like the UV exposition (Genetics Home Reference, 2018), (Carter & Learning) (s.f.).

1.3 Discovery of DNA

One of the biggest discoveries in the science field was the discovery of DNA in our organism, by the time they found it in our cells, the scientists who made it were amazed and the detection of it open a really big door to scientists to investigate about it and its properties and what we can do to improve the life of living things. All of these we have to thanks to a scientist called Walther Flemming, he made the first DNA discovery in 1879 while he was trying to see chromosomes dividing and he realized that the chromosomes were inside DNA. In 1944, 3 scientists realized that the purpose of DNA was completed.

In addition, they found that DNA was holding data for the expression of genes; these scientists are Avery, MacLeod and McCarty. DNA double helix is one of the most famous models and structures in the world in these days. In fact, its first discovery was made in 1950 by James Watson who was a biologist and Francis Crick who was a physicist, in that decade many

scientists tried to finish a race in science discoveries, a scientist called Linus Pauling the second protein structure which was really important because proteins play a huge role in many functions in our organism.

However, these two scientists need one more scientist to help them with their investigation so it happened and his name was Rosalind Franklin. By combining knowledge, the three of them researched a lot of data and hypothesis to find answers to their questions. Franklin was a specialist using X-ray technology to determine what could happen if DNA was exposed to X-rays. With many tests they have completed the experiment and in 1962 they showed to the world and many other scientists the first 3D model of DNA and also they won the Nobel Prize in Medicine for their big achievement, the only scientist who wasn't awarded was Franklin because he died early and thanks to these scientists we know the model of DNA, the one that we have learned in many occasions (Pray, L., 2008) ;(Aldridge, S., 2003); (Basic Biology, 2016).

Chapter II

Crispr/cas 9

2.1 What is crispr/cas 9?

CRISPR/CAS 9 is recent gene rewrite technology that gives the possibilities for significant improvement around other gene rewrite technologies in simplicity of use, quickness, effectiveness and cost. These attributes guided Science magazine to give the name of CRISPR/CAS 9 gene rewrite technology "Breakthrough of the Year" in 2015. Numerous in the business, engineering and scientific groups believe that CRISPR/CAS 9 might give revolutionary improves in the prevention, research and medical care of diseases, comprehension of gene work; becoming better crop yields and expanding new diversities.

Clustered regularly interspaced short palindromic repeats (by its acronym CRISPR) which are special DNA successions found in a small group of microorganisms and bacteria. To create immunity against virus and infections in our organism, this system is called CRISPR or CAS genes. As these successions as a partner to the genes that are found beside them. What CRISPR does is to identify every single problem in the DNA, then chops and eliminates the intruder DNA. Many scientists have found five different variety of CRISPR structures. The most famous system that has been researched by many scientists, is a special type of protein called CAS 9, it's an enzyme that separates and eliminates the intruder DNA and that's the reason why CRISPR is known as CRISPR/CAS 9, because in order to function, they need each other because of its components. Investigations made in 2012 and 2013, a group of scientists made the first

alterations of CRISPR/CAS 9 to do a successful and effective with the purpose of correct the genomes of all living things without any restriction. Many scientists ensure that this gene editing method will make marvelous things to all

Living things, also, it has a low cost in comparison to other methods of gene rewrite, and CRISPR/CAS has broken every impediment to global approbation and producing new investigations with the motive of new opportunities. We have to mention that this project is right now in progress to improving if is necessary and then use it. Various scientist and bioengineers hope to have good results so in that way they could start using it on animals, humans and plants.

2.2 Gene Editing

The genome of multiple organisms cipher a sequence of messages and indications within their DNA succession. Genome editing requires changing those successions and the messages. All of this can be accomplished by inserting a cut or a break in the DNA and cheating a cell's natural DNA auto healing system when you want to introduce those changes. In order to do all of these, we need the help of CRISPR/CAS 9 who provides what we need. The studies show that the Cas 9 protein is really helpful in this process because it can cut straight to any region of DNA.

Genome editing requires only two components: the Cas 9 enzyme protein and a guide.

"Operationally, you design a stretch of 20 [nucleotide] base pairs that match a gene that you want to edit," (Church, 2012, pp.1). This new technique is used for the only purpose to make changes to DNA and can be used to eliminate, put or adjust DNA in a genome and also it has been used only for editing a single gene but with CRISPR/CAS you can do that with various genes by targeting them.

2.2 How crispr/cas 9 component works

Bacteria and viruses have been fighting since the dawn of life. So-called bacteriophages or phages hunt bacteria, in the ocean, phages kill 40 percent of them every single day. Phages do this by inserting their own genetic code into the bacteria and taking them over to use them as factories. The bacteria tried to resist but failed most the time because their protection tools are too weak, but sometimes bacteria survive an attack. Only if they do so can they can activate their most effective antivirus system: they save a part of the virus DNA in their own genetic code in a DNA archive called CRISPR and here it's stored safely until it's needed.

When the virus attacks again, the bacterium quickly makes an RNA copy from the DNA archive and arms a secret weapon, a protein called CAS 9, the protein now scans the bacterium's insides for signs of the virus invader by comparing every bit of DNA it finds to sample from the archive. When it finds a 100 percent perfect match, it's activated and cuts out the virus DNA, making it useless, protecting the bacterium against the attack. What's special is that CAS 9 is very precise, almost like a DNA surgeon.

This began when scientists figured out that the CRISPR system is programmable, you can just give it a copy of DNA you want to modify and put the system into a living cell, if the old techniques of genetic manipulation were like a map, CRISPR is much better than that, is like a GPS system. Aside from being precise, cheap and easy, CRISPR offers the ability to edit live cells, to switch genes on and off, and target and study particular DNA sequences it works for every types of cell such as microorganisms, animals, plants or humans.

2.3 Gene drives

This project has discovered many things, which are important for the development of this, and the recent advancement are the gene drives. A gene drive is a system of biasing inheritance to grow the probability of passing on an edited gene. In addition, it gathered one copy of each gene from the parents. The materials of a gene driver cause the change DNA to imitate itself into the DNA from the unchanged parent. The product of this is the increase in a specific attribute from a generation to another, and the result could be to the entire population. CRISPR/CAS 9 has permitted to the scientists making more researches about inserting a rewrite gene and the gene drive materials. This resource has been catalogued as an effective way to destroy or reduce the transmission of diseases, extinguish foreign species in agriculture.

2.4 Human Being Health and Medicine

Humanity is the most important thing that everyone wants to preserve, from many influences such as attacks, accidents, etc. Nevertheless, the most common among them is the diseases caused by multiple factors. Scientists and researchers around the world work really hard trying to find cure for those diseases that cause many deaths every day or it may happen something worst, it could appear a bacteria, virus or disease that could cause a pandemic. However, with CRISPR/CAS 9, we can change that, we can end to those problems with a lost cost and in that, way we can preserve the life in our planet. The applications to the next diseases are not ready yet but is an example to be test and how it will works.

2.4.1 Diabetes.

This disease is one of the most dangerous to the human kind, so with the help of CRISPR/CAS 9 we can change many lives to many people who suffers it. The California Institute for Regenerative Medicine (by its acronym CIRM) gave an award to scientists from Children's Hospital Los Angeles because they were using CRISPR to establish a treatment for the genetic forms of diabetes, and by replacing cells who produce insulin in the blood. The expectations is to cure Type 1 Diabetes and if the patient's cell is used, we can reduced the risk from receiving outside donors without any risk.

2.4.2 Malaria.

A variation of CRISPR called CRISPR-enabled is being considered to be used in the elimination malaria and also reducing it, that is one of the most lethal diseases in the world. Malaria is a disease who is produced principally by a unique type of mosquito called Anopheles. One of the principal goals that many organizations have is to help the poor nations who suffer this disease with a low cost. In order to do this, CRISPR-enabled will use gene drives with the purpose to produce all Anopheles mosquitos to be infertile, making all of them male and this can be done with gene drives, genetic tools that can modified gene.

2.4.3 Duchene muscular dystrophy.

This is the most frequent genetic disease that a human being can have, until the date it doesn't exit a cure or a treatment for this. CRISPR is a tool that can reverse this genetic mistake to give a better life to the patience who suffers. Duchene Muscular Dystrophy is a disease that can lead you to dead in the third decade because you will start to have respiratory complications and what

this disease does is the progressive degeneration of muscles and begins to weaken them.

Scientists researched at the University Of Texas Southwestern Medical Center showed how CRISPR/CAS 9 could counter these effects in patience by repairing the damaged cell that produce the disease.

2.5 First tests

Like many other projects, after the hard research and study, now is the time to test it, to see his results and fails and if is necessary to check out what are the fails and correct and improve them and test it again. In the world of science, every test is important so there will be many tests with good or bad results and there is a little percentage that a test could success in the first attempt.

2.5.1 HIV elimination in animals.

In 2015, scientists use CRISPR to cut the HIV virus out living cells from patients in the lab, proving that it was possible. Only about a year later, they carried out a larger scale project with rats that had the HIV virus in all of their body cells. In the research, the scientist Kamel Khalili studied the properties of CRISPR to take out HIV from mice and rat. By simply injecting CRISPR into the rat's tails, they were able to remove more than 50% of the virus from cells all over the body.

“ It's very simple”, he says:

“If this technology gets into the clinic to threat human patients, it's not going to be very complicated. You don't have to bring the patient to the clinic and do a bone

marrow transplant or all kinds of complicated technology (You can basically apply this to any setting" (Khalili, 2016, p.1)

In a few decades, a CRISPR therapy might cure HIV and other retroviruses, viruses that hide inside human DNA like Herpes could be eradicated this way. CRISPR could also defeat one of our worst enemies, the cancer. CRISPR gives us the means to edit your immune cells and make them better cancer hunter.

2.5.2 First crispr- edited monkeys.

This is one of the most important moments of bio engineering history, the first potential gene rewriting technique, the result is the first monkeys engineered with targeted mutations. This is a wonderful achievement for science and this will change everything. Xingxu Huang, who is a geneticist at the MARCNUC (by its acronym Model Animal Research Center of Nanjing University in China) and with the help of his assistants, they had succeeded in making the first engineered twin monkeys using CRISPR/CAS 9 as a precision too. "This is an important step; it shows that the system is working " (Zhang, 2014, pp.1). Huang and his colleagues made a first test of the tech in a monkey cell, interrupting three genes with 10-25% success. Then they made 10 pregnancies and in those pregnancies were caused by 83 embryos. And they obtained 2 mutations: the first one helps to control metabolism and it's called Ppar-y, the second one gives a healthy immune faction and it's called Rag1. When you combined these two, they don't create a syndrome, they stays healthy and safe.

2.5.3 First CRISPR- edited human embryos.

The means to edit the genome of a human embryo already exists though the technology is still in its early stages, but it has already been attempted twice. In 2015 and 2016, Chinese scientists experimented with human embryos and were partially successful on their second attempt, they showed the enormous challenges we still face in gene rewriting embryos, but also that scientists are working on solving them. If we compare this, this is like the computer in the 70's and there will be better computers. Modified humans could alter the genome of our entire species, because their engineered traits will be passed on to their children, and could spread over generations, slowly modifying the whole gene pool of humanity. (Jinek, 2012, pp.816-821)

Chapter III

Future of CRISPR/CAS 9

3. What are the goals for the future of this project?

This project at the time is still in development, it had succeeds but not everything is perfect, it has a long way to go, but also is not a bad thing. Most scientists in history had succeeded in many of his discoveries because they learned from their mistakes, that's the principal reason why the scientists do a lot of experiments because some results are good and some are bad. Not every scientist had achieved some success in his/her test and this project is not the exception. It needs improvements and more research for its use in diseases or in gene editing. Many scientists are researching to achieve the first engineered kid using gene editing and CRISPR/CAS 9 to succeed it.

In addition, they are investigating and making more tests to find a cure to multiple diseases like diabetes, HIV that are the most lethal diseases that exist. Also with CRISPR could create new healthier foods to prevent diseases. One of the principal goals is to make a revolution in our society, in the way that we could be super humans with super abilities like more physical resistance, super strength (but not like the strength of the super heroes), super speed (but not like the super heroes like "Flash") and that kind of abilities, we have to remind that we can't get super powers like super heroes, at this point is more a fantasy than a reality but in a future it could be possible.

Scientists are like babies right now because they are in the first stages figuring out all the uses that CRISPR/CAS 9 can give us to change the humanity. But the power of this protein is so big that everything is possible and with this it also brings many questions in the ethical and moral area.

3.1 Ethical and Moral of the people

This topic is really interest because is a big discussion between ideologies from a big population and this is given by many reasons: religion is one of them; the other one is more about values. Religion is a great example because them believes is like a square, they don't expand his thinking limits. Catholicism is one of them, they believe that we have to accept what we are and how we are because is like God sent us to the world, that thought for some people is correct and they defend it, but another group they really don't care because this doesn't affect the ethical and moral of the people because we are making this with the purpose to change diseases or DNA mutations that we have. But there is another group who is against because they believe if we give a bad use of this genome editing tool, we will create super humans for bad purposes and use them in war or for our personal needs.

For other people is good and it doesn't have any consequence in the ethical and moral thinking because you are doing it for a great thing which is to eradicate all the diseases in your body and you want to live for a very long time. Some scientists think that making this is the only way to preserve the human kind from a catastrophic pandemic. Eugenics is the philosophic thinking that consist of making modification to our body and organism for any purpose we want.

3.2 Survey

The discussion of the last topic lead us to know how many people is against or is in favor of genetic modification and why if the people knows what is Eugenics and if they are in favor or against it. I made my own research to determine what their thoughts with respect are this topic.

3.2.1 Non-probabilistic Sampling

The sampling is a very important tool that I used to do my research because it helps me to determine what group of people do my survey. I did a non-probabilistic sampling because I choose the people according to my interests and consideration to them. Also because is not sure what kind of probabilities will be their answers.

3.2.2 Discretionary sampling

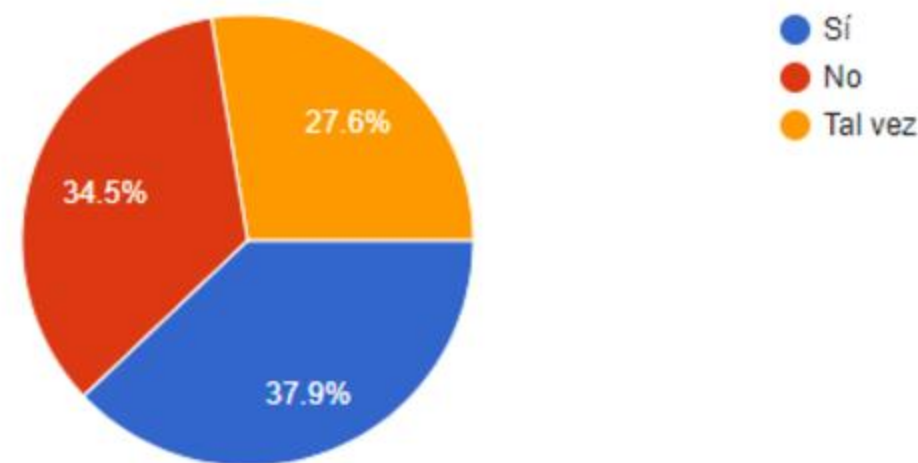
The sampling that I used because according of my needs and my judgment, I selected a small group of people to help me with my research, I survey 30 persons which includes my high school friends, family and random people, my survey contains 6 questions, 3 open questions and 3 close questions. The following topic is:

"Genetic Modification: in favor or against in its use in living things"

I got these results by making my survey to 30 persons of my personal choice.

¿Usted conoce ha oído sobre la Modificación Genética en seres vivos?

29 responses



According to this graphic, a big group of persons knows what genetic modification is with an amount of 37.9%, while the 34.5% don't know what is and the 27.6% maybe know about it.

In the next graphic, we can observe some questions of the people who answer this question:

Cuando las científicos recrean patrones de la genética artificialmente

Cuando se cambia el ADN para obtener un cambio en el individuo

Cambiar algo de un ser vivo para hacerlo diferente, mejor

Es la manipulación de genes por medio de la tecnología para clonarlos, eliminarlos o simplemente modificarlos

Método de eugenesia

Modifica la genética :D

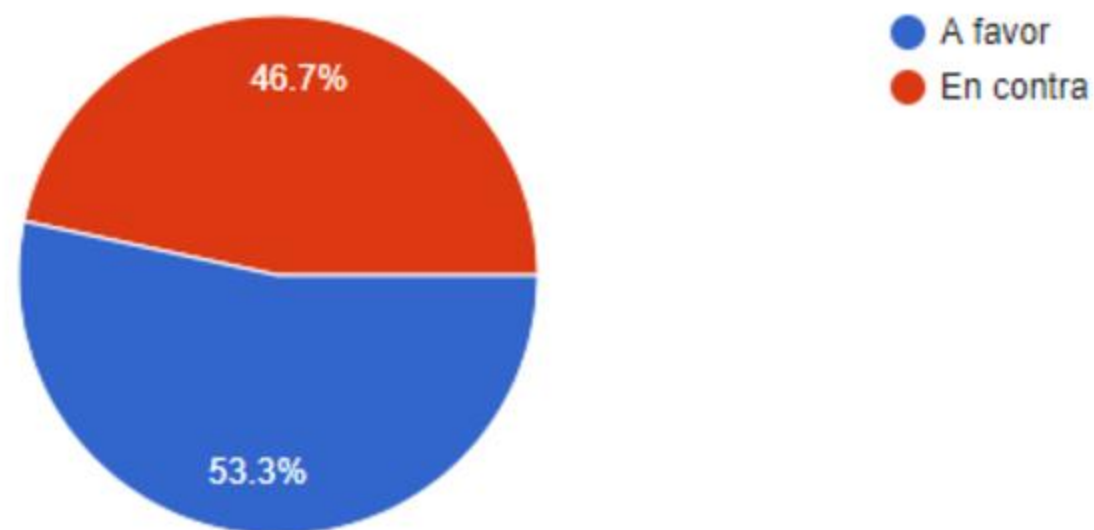
Modificaciones para mejorar la genética

Es la capacidad de alterar el ADN para poder cambiar anomalías en el cuerpo

In the following graphic we can see how many people is in favor or against Eugenics

¿Usted esta a favor de la Eugenesia?

30 responses



The majority is in favor while the other group is against it.

The reasons of the survey people are these:

No hay razon para que alguien se modifique

No es un estudio muy avanzado, tampoco se sabe con certidumbre los límites de la modificación genética

Xq no che

Porque puede ayudarnos y curar ciertas enfermedades y demas

No se debe cambiar algo, si es de una forma por naturaleza es porque esta bien

Asi podremos ser mejores personas

Porque chi

Es muy subjetivo afirmar que una persona es más inteligente que otra. Todos tenemos distintas capacidades que nos hacen únicos. Cosas como la belleza también son subjetivas, y estoy segur@ de que si se llega a hacer esto, existiría mucha discriminación social al utilizar clasificaciones establecidas por la sociedad para juzgar a los seres humanos en cuanto a qué es mejor. Lo mejor para un ser humano depende de la situación en la que viva y las necesidades que esta situación demande.

Porque siempre está bien investigar más y explorar nuevos métodos

Si no hace daño, porque no?

Asi los seres humanos podriamos ser mejores, mejorar en salud y ser mas eticos respecto a nuestro cuerpo y salud tanto fisica como mental

No estaria de acuerdo a las pruebas en seres humanos

Porque no veo una razón lógica

Esta mal

No tendrias personalidad propia.

Puede afectar algunas cosas supongo

Es mejor porqur asi las siguientes generaciones heredaran las mejoras biologicas.

Trae beneficios

Porque si estoy a favor

No habría tantas enfermedades

Yo simplemente prefiero todo lo que sea natural, por algo las cosas son como son

Porque cada día deberían mejorar las personas en cada aspecto y en caravana característica con el fin de tener una mejor vida

No estoy de acuerdo que exista el mismo estándar

No está bien alterar las cosas que ya están por naturaleza, siempre habrá una consecuencia

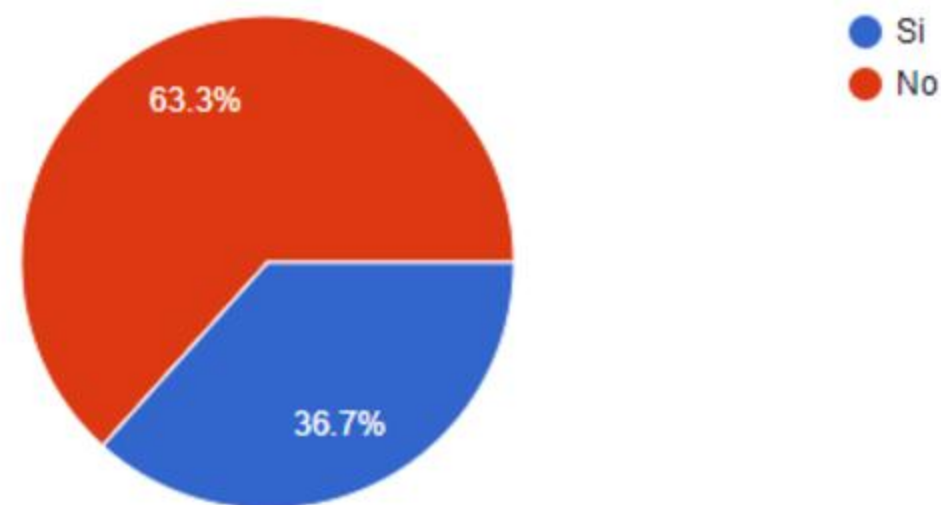
Porque es para buscar el bien humano que es el acabar con muchas enfermedades

Porque hay que aceptarnos como Dios nos mando al mundo

These are good answers, is quite interesting to see how the people thinks about this topic and how they defend their arguments with respect and solid arguments. A group of people is in favor, they explain why, the other group is against, and they explain why too.

¿Usted cree que va contra la ética y moral de las personas al querer ser parte de esta ideología?

30 responses



This graphic shows how many people chose if this goes against the ethical and moral of people and if they want to be part of this ideology. 63.3% think that "Yes", while 36.7% thinks "No".

In the last chart, we see the answers of these people arguing why this is against the ethical and moral of people.

si
Por que corren riesgos al modificarse
La Ética es importante para equilibrar el balance de lo factible y no en los laboratorios
Chi Chi
Porque esta bien usar la ciencia para mejorar la calidad de vida
Porque uno defiende lo que cree
Todos tenemos derechos a pensar y decidir
Estoy de acuerdo porque me parece bien
Como dije anteriormente, creo muy subjetivo juzgar a las personas por medio de estos conceptos
No porque pueden haber seres humanos que se creen para este método en específico
No siento que la gente sea lo suficientemente madura para estar de acuerdo con algo así
No porque querer evolucionar o mejorar la raza humana no tiene nada de malo, el mundo esta cambiando y hay que adaptarnos para poder sobrevivir
.
Porque esta mal
Cada quien piensa como quiere
Si, porque estan casi que jugando a ser Dios.

No creo que vaya en contra de ética o moral, no se solo no lo siento de esa forma

Porque hay que romper el esquema y seguir avanzando en lo que se necesita para vivir cada día mejor

Hay que romper el esquema

Si porque entra el tema de la religión

Porque cada uno es libre de hacer lo que quiera y tolerar su manera de pensar

Porque no esta bien cambiarte lo que no te gusta de tu cuerpo por algo que nunca te pertenecio

At the end, everyone shows their point of view of this topic and what they think about this, every answer is correct and we have to be liberal with this topics because everyone thinks different to you as you think different to them.

Conclusions

At the end of this monographic work, it is concluded that:

- DNA is one of the most important discoveries in the world of science but still it hasn't researched all of its capabilities and all its modifiers that you can apply to it.
- Project CRISPR/CAS 9 is still in developing and also it has not been researched at its totality and it needs economic support from governments or private entities to support the research and to progress the project.
- CRISPR/CAS 9 has few advancements, but in a future, it could be the answer and the solution to many questions and problems that living things are having right now. We could be a specie who doesn't know what is an illness or a lethal disease or in the best scenarios, we wouldn't know what is to be afraid to death.
- CRISPR/CAS 9 will be the perfect tool to make gene manipulation as we like and as we want, we could design our babies when they are embryos and also we can insert whatever type of genetic to make our perfect son or daughter.
- We must remember that scientists have planned to research the following diseases: malaria, diabetes, cancer, any type of syndromes, muscular dystrophy and HIV, which are lethal diseases who cause many deaths every year around the world, with the purpose to eradicate them forever.
- Nowadays, it has been experiments applying CRISPR/CAS 9 in animals to test it and verify which are his pros and cons in the use of this gene tool. All the tests gave good results and we can know for sure that scientists are leading this to a good path.
- Some people are not happy knowing about the achievements that this project had. A group of people thinks that this is a bad idea because we have to accept ourselves.

However, another group thinks that this is what humans have been waiting for, the final era of diseases.

- The author did a survey to a selected group of people to see what are their opinion about CRISPR/CAS 9, also if they are totally agree with the project or not and why and finally if they know or if they have heard about Gene Modification and its benefits.

Recommendations

At the end of this work, it is recommended that:

- It's recommended to stay tune of what are the current medical and scientific advancements because in that way, we can know any time when a new CRISPR/CAS 9 progression is out.
- Giving the situation that religions have a unique ideology, religions, as Catholicism will make protests to prevent or to stop the use of gene manipulation in all living things.
- Another point to review is the fact, how dangerous will be or not the use of gene tools for gene editing in the human body and if it will have secondary effects or not.
- After checking the good results that the firsts tests have, we must have hope for CRISPR/CAS 9 because it will revolutionize the entire world, also we must be patience for a succeed test in human beings.

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