IMPORTANCE OF GENETIC ENGINEERING pdf

1: Economic importance of bacteria - Wikipedia

Genetic engineering is an important tool for natural scientists. Genes and other genetic information from a wide range of organisms are transformed into bacteria for storage and modification, creating genetically modified bacteria in the process.

In other words, it is the process of adding or modifying DNA in an organism to bring about great deal of transformation. We feared that soon we would be interfering with nature, trying to play God and cheat him out of his chance to decide whether we were blonde or dark haired, whether we had blue or bright green eyes or even how intelligent we were. The queries and concerns that we have regarding such an intriguing part of science are still alive and well, although they are less talked about nowadays than they were those few years ago. However, this does not mean that they are any less relevant. In fact, they are as relevant today as they ever were. There are a number of very real and very troubling concerns surrounding genetic engineering, although there are also some very real benefits to further genetic engineering and genetic research, too. It seems, therefore, as though genetic engineering is both a blessing and a curse, as though we stand to benefit as well as lose from developing this area of science even further. With genetic engineering, we will be able to increase the complexity of our DNA, and improve the human race. But it will be a slow process, because one will have to wait about 18 years to see the effect of changes to the genetic code. Here are just a few of the benefits: Tackling and Defeating Diseases Some of the most deadly and difficult diseases in the world, that have so resisted destruction, could be wiped out by the use of genetic engineering. There are a number of genetic mutations that humans can suffer from that will probably never be ended unless we actively intervene and genetically engineer the next generation to withstand these problems. For instance, Cystic Fibrosis , a progressive and dangerous disease for which there is no known cure, could be completely cured with the help of selective genetic engineering. Getting Rid of All Illnesses in Young and Unborn Children There are very many problems that we can detect even before children are born. In fact, the date by which you can have an abortion has been pushed back relatively late just so that people can decide whether or not to abort a baby if it has one or more of these sorts of issues. However, with genetic engineering, we would no longer have to worry. One of the main benefit of genetic engineering is that it can help cure and diseases and illness in unborn children. All children would be able to be born healthy and strong with no diseases or illnesses present at birth. Genetic engineering can also be used to help people who risk passing on terribly degenerative diseases to their children. You cannot simply stop people from having children if they suffer from a disease like this, therefore genetic engineering can help to ensure that their children live long and healthy lives from either the disease itself or from carrying the disease to pass on to younger generations. Potential to Live Longer Although humans are already living longer and longer â€” in fact, our lifespan has shot up by a number of years in a very short amount of time â€” because of the advances of modern medical science, genetic engineering could make our time on Earth even longer. There are specific, common illnesses and diseases that can take hold later in life and can end up killing us earlier than necessary. It could also help humans adapt to the growing problems of, for instance, global warming in the world. If the places we live in become either a lot hotter or colder, we are going to need to adapt, but evolution takes many thousands of years, so genetic engineering can help us adapt quicker and better. Produce New Foods Genetic engineering is not just good for people. With genetic engineering we can design foods that are better able to withstand harsh temperatures â€” such as the very hot or very cold, for instance â€” and that are packed full of all the right nutrients that humans and animals need to survive. We may also be able to make our foods have a better medicinal value, thus introducing edible vaccines readily available to people all over the world Cons of Genetic Engineering Perhaps more obvious than the pros of genetic engineering, there are a number of disadvantages to allowing scientists to break down barriers that perhaps are better left untouched. Here are just a few of those disadvantages: Many religions believe that genetic engineering, after all, is tantamount to playing God, and expressly forbid that it is performed on their children, for instance. Besides the religious arguments, however, there are a number of ethic objections. These diseases, after all, exist for a reason and

have persisted throughout history for a reason. Whilst we should be fighting against them, we do need at least a few illnesses, otherwise we would soon become overpopulated. May Lead to Genetic Defects Another real problem with genetic engineering is the question about the safety of making changes at the cellular level. Scientists do not yet know absolutely everything about the way that the human body works although they do, of course, have a very good idea. How can they possibly understand the ramifications of slight changes made at the smallest level? What if we manage to wipe out one disease only to introduce something brand new and even more dangerous? Additionally, if scientists genetically engineer babies still in the womb, there is a very real and present danger that this could lead to complications, including miscarriage early on , premature birth or even stillbirth, all of which are unthinkable. The success rate of genetic experiments leaves a lot to be desired, after all. The human body is so complicated that scientists have to be able to predict what sort of affects their actions will have, and they simply cannot account for everything that could go wrong. Limits Genetic Diversity We need diversity in all species of animals. By genetically engineering our species, however, we will be having a detrimental effect on our genetic diversity in the same way as something like cloning would. Gene therapy is available only to the very rich and elite, which means that traits that tend to make people earn less money would eventually die out. Can it Go Too Far? One pressing question and issue with genetic engineering that has been around for years and years is whether it could end up going too far. There are many thousands of genetic scientists with honest intentions who want to bring an end to the worst diseases and illnesses of the current century and who are trying to do so by using genetic engineering. However, what is to stop just a handful of people taking the research too far? What if we end up engineering the sex of the baby, for instance in China, where is it much more preferable to have a boy? The problems with genetic engineering going too far are and ever present worry in a world in which genetic engineering is progressing further and further every day. Genetic engineering is one of the topic that causes a lot of controversy. Altering the DNA of organisms has certainly raised a few eyebrows. Making yourself aware of all aspects of genetic engineering can help you to form your own opinion.

IMPORTANCE OF GENETIC ENGINEERING pdf

2: Benefits of Genetic Engineering

Genetic engineering is important because it provides benefits in the areas of agriculture, production of valuable proteins, production of vaccines and disease-resistant plants. These benefits are often realized with a lower cost, quicker production time and higher production volume than alternative solutions.

Polymerase chain reaction is a powerful tool used in molecular cloning Creating a GMO is a multi-step process. Genetic engineers must first choose what gene they wish to insert into the organism. This is driven by what the aim is for the resultant organism and is built on earlier research. Genetic screens can be carried out to determine potential genes and further tests then used to identify the best candidates. The development of microarrays , transcriptomics and genome sequencing has made it much easier to find suitable genes. Molecular cloning The next step is to isolate the candidate gene. The cell containing the gene is opened and the DNA is purified. If the DNA sequence is known, but no copies of the gene are available, it can also be artificially synthesised. The plasmid is replicated when the bacteria divide, ensuring unlimited copies of the gene are available. These include a promoter and terminator region, which initiate and end transcription. A selectable marker gene is added, which in most cases confers antibiotic resistance , so researchers can easily determine which cells have been successfully transformed. The gene can also be modified at this stage for better expression or effectiveness. These manipulations are carried out using recombinant DNA techniques, such as restriction digests , ligations and molecular cloning. Gene delivery A gene gun uses biolistics to insert DNA into plant tissue There are a number of techniques available for inserting the gene into the host genome. Some bacteria can naturally take up foreign DNA. This ability can be induced in other bacteria via stress e. Due to the damage caused to the cells and DNA the transformation efficiency of biolistics and electroporation is lower than agrobacterial transformation and microinjection. In plants this is accomplished through the use of tissue c ulture. Selectable markers are used to easily differentiate transformed from untransformed cells. These markers are usually present in the transgenic organism, although a number of strategies have been developed that can remove the selectable marker from the mature transgenic plant. The presence of the gene does not guarantee it will be expressed at appropriate levels in the target tissue so methods that look for and measure the gene products RNA and protein are also used. The technique of gene targeting uses homologous recombination to make desired changes to a specific endogenous gene. This tends to occur at a relatively low frequency in plants and animals and generally requires the use of selectable markers. The frequency of gene targeting can be greatly enhanced through genome editing. There are four families of engineered nucleases: Bacteria , the first organisms to be genetically modified, can have plasmid DNA inserted containing new genes that code for medicines or enzymes that process food and other substrates. The genetically modified animals include animals with genes knocked out , increased susceptibility to disease , hormones for extra growth and the ability to express proteins in their milk. One of the earliest uses of genetic engineering was to mass-produce human insulin in bacteria. FDA as a treatment for the cancer acute lymphoblastic leukemia. Genetically engineered viruses are being developed that can still confer immunity, but lack the infectious sequences. Genetically modified mice are the most common genetically engineered animal model. Also genetically modified pigs have been bred with the aim of increasing the success of pig to human organ transplantation. Scientists are creating "gene drives", changing the genomes of mosquitoes to make them immune to malaria, and then spreading the genetically altered mosquitoes throughout the mosquito population in the hopes of eliminating the disease. Genes and other genetic information from a wide range of organisms can be inserted into bacteria for storage and modification, creating genetically modified bacteria in the process. Once a gene is isolated it can be stored inside the bacteria providing an unlimited supply for research. This could be the effect on the phenotype of the organism, where the gene is expressed or what other genes it interacts with. These experiments generally involve loss of function, gain of function, tracking and expression. Loss of function experiments, such as in a gene knockout experiment, in which an organism is engineered to lack the activity of one or more genes. In a simple knockout a copy of the desired gene has been altered to make it non-functional. Embryonic stem cells incorporate the altered gene, which replaces the already present

functional copy. These stem cells are injected into blastocysts , which are implanted into surrogate mothers. This allows the experimenter to analyse the defects caused by this mutation and thereby determine the role of particular genes. It is used especially frequently in developmental biology. The simplest method, and the first to be used, is "alanine scanning", where every position in turn is mutated to the unreactive amino acid alanine. These are sometimes performed in conjunction with knockout experiments to more finely establish the function of the desired gene. The process is much the same as that in knockout engineering, except that the construct is designed to increase the function of the gene, usually by providing extra copies of the gene or inducing synthesis of the protein more frequently. While this is a useful technique, the manipulation can destroy the function of the gene, creating secondary effects and possibly calling into question the results of the experiment. More sophisticated techniques are now in development that can track protein products without mitigating their function, such as the addition of small sequences that will serve as binding motifs to monoclonal antibodies. Thus the time and place where a particular protein is produced can be observed. Expression studies can be taken a step further by altering the promoter to find which pieces are crucial for the proper expression of the gene and are actually bound by transcription factor proteins; this process is known as promoter bashing. Mass quantities of the protein can then be manufactured by growing the transformed organism in bioreactor equipment using industrial fermentation , and then purifying the protein. Genetically modified crops and Genetically modified food Bt-toxins present in peanut leaves bottom image protect it from extensive damage caused by European corn borer larvae top image. Crops have been developed to increase production, increase tolerance to abiotic stresses , alter the composition of the food, or to produce novel products. Fungal and virus resistant crops have also been developed or are in development. Soybeans and canola have been genetically modified to produce more healthy oils. Pharming uses crops and animals as bioreactors to produce vaccines, drug intermediates, or the drugs themselves; the useful product is purified from the harvest and then used in the standard pharmaceutical production process. Gene transfer through viral vectors has been proposed as a means of controlling invasive species as well as vaccinating threatened fauna from disease. Genetic engineering is also being used to create microbial art. Regulation of genetic engineering The regulation of genetic engineering concerns the approaches taken by governments to assess and manage the risks associated with the development and release of GMOs. The development of a regulatory framework began in , at Asilomar , California. Most countries that do not allow GMO cultivation do permit research. The US policy focuses on the product not the process , only looks at verifiable scientific risks and uses the concept of substantial equivalence. The criteria for authorisation fall in four broad categories: Regulatory agencies by geographical region Region.

IMPORTANCE OF GENETIC ENGINEERING pdf

3: The Importance of Genetic Engineering (Words)

Genetic engineering, promises to have an enormous impact on the improvement of crop species. Genetic transformation can boost plant breeding efforts for developing disease resistant varieties. Now the disease resistant genes can be isolated and transferred to high yielding susceptible plants to produce pathogen free plants.

It involves the isolation, manipulation and reintroduction of DNA into cells or model organisms, usually to express a protein to reach desired effects. The aim is to introduce new characteristics or attributes physiologically or physically, such as making a crop resistant to a herbicide, introducing a novel trait, enhancing existing ones, or producing a new protein or enzyme. Successful endeavours include the manufacture of human insulin through the use of modified bacteria, the manufacture of erythropoietin in Chinese hamster ovary cells, and the production of new types of experimental mice such as the OncoMouse cancer mouse for research. Since a protein sequence is specified by a segment of DNA called a gene, novel versions of that protein can be produced by changing the DNA sequence of the gene. There are a number of ways through which this could be achieved. After isolating a section of DNA that includes the gene, the gene or required portion of the gene is cut out. After modification of the sequence if necessary, it may be introduced spliced into a different DNA segment or into a vector for transformation into living cells. Together with ligase, which can join fragments of DNA together, restriction enzymes formed the initial basis of recombinant DNA technology. Some groups have argued[citation needed] that genetic engineering is wrong and is "doing the work of God", but most scientists believe that genetic engineering is essential to help future medical discoveries. They say that these organisms have the potential to spread their modified genes into native populations thereby disrupting natural ecosystems. The first genetically engineered drug was human insulin, approved by the United States Food and Drug Administration in Another early application of genetic engineering was to create human growth hormone as replacement for a drug that was previously extracted from human cadavers. In the FDA approved the first genetically engineered vaccine for humans, for hepatitis B. Since these early uses of the technology in medicine, the use of GE has expanded to supply many drugs and vaccines. One of the best known applications of genetic engineering is the creation of genetically modified organisms GMOs. There are potentially momentous biotechnological applications of GM, for example oral vaccines produced naturally in fruit, at very low cost. A radical ambition of some groups is human enhancement via genetics, eventually by molecular engineering. Genetic engineering and research: Although there has been a tremendous revolution in the biological sciences in the past twenty years, there is still a great deal that remains to be discovered. The completion of the sequencing of the human genome, as well as the genomes of most agriculturally and scientifically important plants and animals, has increased the possibilities of genetic research immeasurably. Expedient and inexpensive access to comprehensive genetic data has become a reality with billions of sequenced nucleotides already online and annotated. Now that the rapid sequencing of arbitrarily large genomes has become a simple, if not trivial affair, a much greater challenge will be elucidating function of the extraordinarily complex web of interacting proteins, dubbed the proteome, that constitutes and powers all living things. Genetic modification permits alteration of the primary structure of proteins and has therefore become a powerful tool in analyzing structure-function relationships in protein research. The use of the term "genetic engineering" to describe the experimental genetic modification of whole organisms, however, suggests a level of precision and an understanding of developmental biological principles beyond what has been achieved. Nonetheless, research progress has been made using a wide variety of techniques, including: Loss of function, such as in a knockout experiment, in which an organism is engineered to lack the activity of one or more genes. This allows the experimenter to analyze the defects caused by this mutation, and can be considerably useful in unearthing the function of a gene. It is used especially frequently in developmental biology. A knockout experiment involves the creation and manipulation of a DNA construct in vitro, which, in a simple knockout, consists of a copy of the desired gene which has been slightly altered such as to cripple its function. These stem cells are injected into blastocysts, which are implanted into surrogate mothers. Another method, useful in organisms such as Drosophila fruit fly , is to induce mutations in

a large population and then screen the progeny for the desired mutation. A similar process can be used in both plants and prokaryotes. Gain of function experiments, the logical counterpart of knockouts. These are sometimes performed in conjunction with knockout experiments to more finely establish the function of the desired gene. The process is much the same as that in knockout engineering, except that the construct is designed to increase the function of the gene, usually by providing extra copies of the gene or inducing synthesis of the protein more frequently. While this is a useful technique, the manipulation can destroy the function of the gene, creating secondary effects and possibly calling into question the results of the experiment. More sophisticated techniques are now in development that can track protein products without mitigating their function, such as the addition of small sequences which will serve as binding motifs to monoclonal antibodies. Expression studies aim to discover where and when specific proteins are produced. Thus the time and place where a particular protein is produced can be observed. Expression studies can be taken a step further by altering the promoter to find which pieces are crucial for the proper expression of the gene and are actually bound by transcription factor proteins; this process is known as promoter bashing.

IMPORTANCE OF GENETIC ENGINEERING pdf

4: 13 Important Genetic Engineering Pros And Cons | Bio Explorer

Genetic engineering, as the name suggest, means engineering (altering) the genome (DNA makeup) of an www.enganchecubano.com can be (precise) removal of a particular gene from the genome, or introducing a new gene into the genome of an organism.

The following points highlight the top four applications of genetic engineering. Application in Agriculture 2. Application to Medicine 3. An important application of recombinant DNA technology is to alter the genotype of crop plants to make them more productive, nutritious, rich in proteins, disease resistant, and less fertilizer consuming. Recombinant DNA technology and tissue culture techniques can produce high yielding cereals, pulses and vegetable crops. Some plants have been genetically programmed to yield high protein grains that could show resistance to heat, moisture and diseases. Some plants may even develop their own fertilizers some have been genetically transformed to make their own insecticides. Through genetic engineering some varieties have been produced that could directly fix atmospheric nitrogen and thus there is no dependence on fertilizers. Scientists have developed transgenic potato, tobacco, cotton, corn, strawberry, rape seeds that are resistant to insect pests and certain weedicides. Bacterium, Bacillus thurenginesis produces a protein which is toxic to insects. Using the techniques of genetic engineering, the gene coding for this toxic protein called Bt gene has been isolated from bacterium and engineered into tomato and tobacco plants. Such transgenic plants showed nee to tobacco horn worms and tomato fruit worms. These genotypes are awaiting release in USA. There are certain genetically evolved weed killers which are not specific to weeds alone but kill useful crops also. Glyphosate is a commonly used weed killer which simply inhibits a particular essential enzyme in weeds and other crop plants. A target gene of glyphosate is present in bacterium salmonella typhimurium. A mutant of S. The mutant gene was t cloned to E. Infection of plants with Ti plasmid containing glyphosate resistant gene has yielded crops such as cotton, tabacco maize, all of which are resistant to glyphosate. This makes possible to spray the crop fields with glyphosate which will kill the weeds only and the genetically modified crops with resistant genes remain unaffected. Recently Calogene, a biotech company, has isolated a bacterial gene that detoxifies; side effects of herbicides. These are yet to be released. The gene transfer technology can also play significant role in producing new and improved variety of timber trees. Several species of microorganisms have been produced that can degrade toxic chemicals and could be used for killing harmful pathogens and insect pests. For using genetic engineering techniques for transfer of foreign genes into host plant cells, a number of genes have already been cloned and complete libraries of DNA and mt DNA of pea are now known. Some of the cloned genes include: Efforts are being made to improve several agricultural crops using various techniques of genetic engineering which include: Genetic engineering has been gaining importance over the last few years and it will become more important in the current century as genetic diseases become more prevalent and agricultural area is reduced. Genetic engineering plays significant role in the production of medicines. Microorganisms and plant based substances are now being manipulated to produce large amount of useful drugs, vaccines, enzymes and hormones at low costs. Genetic engineering is concerned with the study inheritance pattern of diseases in man and collection of human genes that could provide a complete map for inheritance of healthy individuals. Gene therapy by which healthy genes can be inserted directly into a person with malfunctioning genes is perhaps the most revolutionary and most promising aspect of genetic engineering. The use of gene therapy has been approved in more than clinical trials for diseases such as cystic fibres emphysema, muscular dystrophy, adenosine deaminase deficiency. Gene therapy may someday be exploited to cure hereditary human diseases like haemophilia and cystic fibrosis which are caused by missing or defective genes. In one type of gene therapy new functional genes are inserted by genetically engineered viruses into the cells of people who are unable to produce certain hormones or proteins for normal body functions. Introduction of new genes into an organism through recombinant DNA technology essentially alters protein makeup and finally i body characteristics. Recombinant DNA Technology is also used in production of vaccines against diseases. A vaccine contains a form of an infectious organism that does not cause severe disease but does cause immune system of body to form protective antibodies against infective organism.

Vaccines are prepared by isolating antigen or protein present on the surface of viral particles. When a person is vaccinate against viral disease, antigens produce antibodies that acts against the viral proteins and inactivate them. With recombinant DNA technology, scientists have been able to transfer the genes for some viral sheath proteins to vaccinia virus which was used against small pox. Vaccines produced by gene cloning are contamination free and safe because they contain only coat proteins against which antibodies are made. A few vaccines are being produced by gene cloning, e. Until recently the hormone insulin was extracted only in limited quantities from pancreas of cows and pigs. The process was not only costly but the hormone sometimes caused allergic reactions in some patients of diabetes. The commercial production of insulin was started in through biogenetic or recombinant DNA technology and the medical use of hormone insulin was approved by food and drug administration FDA of USA in The human insulin gene has been cloned in large quantities in bacterium E. Genetically engineered insulin is commercially available as humilin. Interferon is used to fight viral diseases such as hepatitis, herpes, common colds as well as cancer. Such drugs can be manufactured in bacterial cell in large quantities. Lymphokines can also be helpful for AIDS patients. Genetically engineered interleukin-II, a substance that stimulates multiplication of lymphocytes is also available and is being currently tested on AIDS patients. A fourteen aminoacid polypeptide hormone synthesized by hypothalamus was obtained only in a small quantity from a human cadavers. Somatostatin used as a drug for certain growth related abnormalities appears to be species specific and the polypeptide obtained from other mammals has no effect on human, hence its extraction from hypothalamus of cadavers. Genetic engineering technique has helped in chemical synthesis of gene which is joined to the pBR plasmid DNA and cloned into a bacterium. The transformed bacterium is converted into somatostatin synthesising factory. ADA adenosine deaminase deficiency is a disease like combined immune deficiency which killed the bubble boy David in The children with ADA deficiency die before they are two years old. Bone marrow cells of the child after removal from the body were invaded by a harmless virus into which ADA has been inserted. Erythropoetin, a genetically engineered hormone is used to stimulate the production of red blood cells in people suffering from severe anaemia. Production of Blood clotting factors: Normally heart attack is caused when coronary arteries are blocked by cholesterol or blood clot. Genetically engineered tissue plasminogen activator tPA enzyme dissolves blood clots in people who have suffered heart attacks. The plasminogen activator protein is produced by genetech company which is so potent and specific that it may even arrest a heart attack underway. Cancer is a dreaded disease. Antibodies cloned from a single source and targetted for a specific antigen monoclonal antibodies have proved very useful in cancer treatment. Monoclonal antibodies have been target with radioactive elements or cytotoxins like Ricin from castor seed to make them more deadly. Such antibodies seek cancer cells and specifically kill them with their radioactivity or toxin. Recombinant DNA technology has tremendous scope in energy production. Through this technology Ii is now possible to bioengineer energy crops or biofuels that grow rapidly to yield huge biomass that used as fuel or can be processed into oils, alcohols, diesel, or other energy products. The waste from these can be converted into methane. Genetic engineers are trying to transfer gene for cellulase to proper organisms which can be used to convert wastes like sawdust and cornstalks first to sugar and then to alcohol. Genetically designed bacteria are put into use for generating industrial chemicals. A variety of organic chemicals can be synthesised at large scale with the help of genetically engineered microorganisms. Glucose can be synthesised from sucrose with the help of enzymes obtained from genetically modified organisms. Now-a-days with the help of genetic engineering strains of bacteria and cyanobacteria have been developed which can synthesize ammonia at large scale that can be used in manufacture of fertilisers at much cheaper costs. Microbes are being developed which will help in conversion of Cellulose to sugar and from sugar to ethanol. Recombinant DNA technology can also be used to monitor the degradation of garbage, petroleum products, naphthalene and other industrial wastes. For example bacterium pseudomonas fluorescens genetically altered by transfer of light producing enzyme called luciferase found in bacterium vibrio fischeri, produces light proportionate to the amount of its breaking down activity of naphthalene which provides way to monitor the efficiency of the process. Maize and soybeans are extensively damaged by black cutworm. Pseudomonas fluorescens is found in association with maize and soybeans. Bacillus thuringiensis contain a gene pathogenic to the pest. The pest

has, over the years, not only become dangerous to the crops but has developed resistance to a number of pesticides. When the gene from B.

IMPORTANCE OF GENETIC ENGINEERING pdf

5: Benefits of Genetic Engineering | Pros and Cons

What Is Actually Genetic Engineering? The "sharing" of genetic material among living organisms is known to be a natural event. This phenomenon is known to be very evident among bacteria, hence they are called "nature's own genetic engineer".

Communication Strategist and Sr. The wealthiest nation in the world is feeding its people an unhealthy dietâ€”and growing most of this food using unsustainable methods. A population threatened by a crisis of diet-related chronic illness; millions of acres of damaged farmland; chemical runoff spilling into our waterways. Our food system, for all its vaunted productivity, is failing us. Unhealthy food policy U. But the current system of agricultural subsidies mostly benefits large-scale growers of commodity crops such as corn and soybeans. Our diet is dominated by processed foods made from these subsidized crops, and a growing body of research connects this diet to increases in obesity and the diseases that go with it. We need to eat more fruits and vegetablesâ€”and therefore, we need policies that encourage farmers to grow them. But Big Ag benefits from the status quo and is fighting to protect it. Farms grew to enormous sizes, becoming focused on a few commodity crops and increasingly dependent on synthetic fertilizers and pesticides. And meat production became dominated by large CAFOs confined animal feeding operations. These methods of producing food leave a host of problems in their wake. Runoff from chemical inputs and CAFO waste pollutes our water and contributes to global warming; monocultureâ€”planting a single crop over a large area year after yearâ€”depletes soil and reduces biodiversity; overuse of antibiotics in meat production threatens our ability to fight human disease. Science-based sustainable farming methods can and do produce abundant food without the pitfalls of industrial agriculture. Local and regional food systems can help make fresh, healthy food available to everyone. And forward-looking policies can help these innovative practices grow and prosper. Expand healthy food access We know Americans need to eat healthier foodâ€”and that starts with producing more of it. But growing healthy food using sustainable methods is only half the equation. We also need to make sure that this food is available and affordableâ€”especially in lower-income communities, which are disproportionately affected by the health impacts of the industrial food system. And the future, increasingly, is now. Growing numbers of American farmers are using sustainable practices to grow healthy foodsâ€”and thriving businesses. But in a food system geared to serve the needs of industrial agriculture, these farmers often face an uphill battle. Policy solutions that will help farmers feed a healthy America are on the table, and UCS is helping to win them the support they need to become reality.

IMPORTANCE OF GENETIC ENGINEERING pdf

6: Journal of Genetic Engineering and Biotechnology - Elsevier

Genetic engineering is a stream of science where the genes of animals and all living organism are being researched, and molecular structure is formed depending on the biological effects when transferred to other living organisms.

Check new design of our homepage! The write-up focuses on the various benefits of genetic engineering. BiologyWise Staff Last Updated: Genetic engineering is defined as a set of technologies that are used to change the genetic makeup of cells and move the genes from one species to another to produce new organisms. The techniques used are highly sophisticated manipulations of genetic material and other biologically important chemicals. What are the Benefits of Genetic Engineering Genetic engineering in its present form has been around for approximately 25 years. It has also been a very widely debated topic from its beginning in s. There are many social consequences that are associated with genetic engineering, that makes the overall risk or benefit assessment very complicated. The benefits of genetic engineering in each field is mentioned below. Almost everyday, a scientist makes a new breakthrough in the field of human engineering. Mammals have been successfully cloned and the human genome project has been completed. This is pushing the scientists all over the world to research many different facets of human genetic engineering. These researches have allowed a better understanding of DNA and its role in medicine, pharmacology, reproductive technology and various other fields. Newly created animals by the process of genetic engineering are known as xenographs. In humans, the most promising benefit of genetic engineering is gene therapy which is the medical treatment of a disease wherein the defective genes are repaired and replaced or therapeutic genes are introduced to fight the disease. Over the past decade, many autoimmune and heart diseases have been treated using gene therapy. There is hope that a cure for such diseases can be found by either inserting the corrected gene or modifying the defective gene. Eventually, the hope is to completely eliminate genetic diseases and also treat non-genetic diseases with appropriate gene therapy. The latest research in the field makes it possible to repair or grow new muscle cells when they are not working or are damaged. Thanks to genetic engineering, the pharmaceutical products available today are far superior to their predecessors. These new products are created by cloning certain genes. Some of the prominent examples are the bio-engineered insulin which was earlier obtained from sheep or cows and the human growth hormone which was earlier obtained from cadavers. New medicines are being made by changing the genetic structure of the plant cell. Genetic engineering is also a boon for pregnant women who can choose to have their fetuses screened for genetic defects. These screenings can help the parents and doctors prepare for the arrival of the child who may have special needs during or after the delivery. A possible future benefit of genetic engineering which is very eagerly awaited is that a fetus with a genetic defect could be treated with genetic therapy even before it is born. Research is going on for gene therapy for embryos before it is implanted into the mother via in-vitro fertilization. The field of agriculture too greatly benefits from genetic engineering which has improved the genetic fitness of various plant species. Here is a list of some of the most upfront benefits of genetic engineering: Genetic engineering when used on microorganisms help in the creation of new pharmaceuticals which cannot be made in any other way. Genetic engineering helps in the process of bio remediation which is the process of cleaning up waste and pollution with the help of living organisms. Genetic engineering has helped lower the overall usage of herbicide and pesticide. Genetic engineering has helped with the production of vaccines and other drugs in plants. Genetic engineering has helped produce quicker and more predictable way of generating new cultivars. Further, the cultivar properties are better known today than it was ever known before. Today, genetic engineering can produce sustainable agriculture. Genetic engineering has produced very useful genetically modified breeds which can tolerate factory farming without any suffering. In humans, genetic engineering is used to treat genetic disorders and cancer. It also helps in supplying new body parts. Although, this has not been done today, genetic engineering has the potential of creating new types of human beings with many advantageous traits. Genetic engineering is used in the field of mining to extract useful elements from the ones they are actually embedded into. Certain bacterial sequences are manipulated to transform waste into ethanol, so that it can be used as a fuel. The pros of genetic engineering are far too many

to list. But it is important to understand the boundaries to which the human race can push itself and stop before man starts playing the role of God.

IMPORTANCE OF GENETIC ENGINEERING pdf

7: Benefits of Genetic Engineering | Chemistry Learning

Genetic engineering was born because scientists learned to manipulate DNA. This skill was derived mainly from the field of nucleic acid enzymology. Prior to , there was simply no technique available for cutting a duplex (double-stranded) DNA molecule into distinct fragments.

Enhanced efficiency of minerals used by plants to prevent early exhaustion of fertility of soil. Reduced post harvest losses Pic Credit: Link Another genetically modified food is golden rice Pro Vitamin A enriched. Several other genetically modified foods include, soybeans, corn, cotton, seed oil etc have been formed. But many controversies are associated with genetically modified food including environment and human safety, ethics, food security, poverty reduction etc. Some success has been achieved in developing varieties resistant to herbicides, viral diseases and insect pest. Genetic engineering promises rapid acceleration of plant breeding efforts for crop improvement. Benefits of genetic engineering: Production of valuable Proteins Another benefit of genetic engineering is realized in production of valuable proteins. Recombinant DNA made possible the use of bacteria to produce proteins of medical importance. One such example is that of genetically engineered human insulin which is of great importance and now marketed throughout the world. Some important genetically engineered proteins include: Human Insulin Human insulin or Humulin has great importance. Earlier, patients could not tolerate pig insulin, as it has slightly different amino acid sequence as compared to human. Humulin eventually became cheaper than that extracted from animal pancreas and is now available. Interferon Interferon is an antiviral agent which is secreted by cells which are attacked by virus. Several types of genetically engineered interferon are available in market and gives rise to antitumoral effect thwarting formation of cancerous tumors. Growth hormone In humans, growth hormone helps in treatment of hypopituitary dwarfs. Genetically engineered growth hormones may prove useful in the treatment of bone fractures, skin burns and bleeding ulcers of digestive tract. The human hormone is marketed in United States and bovine hormone is expected to yield bigger cattle and thus more beef. Hence growth hormones are commercially very demanding. Vaccine production Vaccines produced by genetic engineering offer an advantage that the microbial strains from which the proteins are extracted do not contain complete viruses. And thus, there are no risks of accidental inoculation with live virus. Cloning directly into vaccinia virus DNA holds great promise, although vaccines so produced are not yet in the market. Recombinant vaccinia viruses for example, a gene from genital herpes virus within its DNA, can multiply and can subsequently be inoculated into humans. The vaccinia virus produces mild infection, and expresses some of herpes virus protein and produces immunity. This is very similar in a way to what Edward Jenner did over years ago when he introduced the first vaccination scheme, which eventually led to the extinction of smallpox. Vaccines can be produced using recombinant DNA technology or using cell culture. Vaccines of common use are usually produced by cell cultures or animals. Such vaccines contain weakened or inactivated pathogens. Crop plants can bear cheaper bioreactors to produce antigens to be utilized as Edible vaccines. These edible vaccines are said to be a cheap alternative as compared to recombinant vaccines. The transgenic plants are treated as edible vaccines and consumption of these transgenic plants viz. Foot and mouth diseases can be cured by feeding them transgenic sugar beet. In the near future, these vaccines can be used as conventional vaccines. Humulin was the first therapeutic product to be made commercially by genetically engineered bacterium. Recently a genetically engineered malarial vaccine SPF â€” 66 has been produced. Benefits of Genetic Engineering: Production of Disease Resistant Plants Genetic engineering, promises to have an enormous impact on the improvement of crop species. Genetic transformation can boost plant breeding efforts for developing disease resistant varieties. Now the disease resistant genes can be isolated and transferred to high yielding susceptible plants to produce pathogen free plants. Through gene sequencing, it is possible to locate gene and after identification, gene is isolated and transferred to the host. Several disease resistant somaclones have been identified for resistance to severe potato disease, early blight of potato, caused by Alternaria Solani. Scientists are using Agrobacterium gene transfer system to produce tobacco plants with increased resistance to Tobacco Mosaic Virus TMV. Insect resistant plants are also developed, using biotechnological applications. Several

biopesticides are developed e. Bt cotton, Bt corn, rice, tomato, potato, and soybeans etc. Process of Insertion of Bt gene in corn to make it resistant from insect attack Pic Credit: Link Bt signifies Bacillus thuringiences. This bacterium contains insect toxin gene. Bt toxin gene is cloned from the bacteria and expressed in plant to provide resistance from insects, without requirement of insecticides. These modified disease resistant plants are called transgenic plants.

IMPORTANCE OF GENETIC ENGINEERING pdf

8: Importance of Genetic Research for Human Health and Disease Treatment

This might be the most important web search you do. The TruthFinder tool reveals personal records of millions of Americans with a simple computer search. Because, rather than waiting for evolution to occur, we can help evolution along by engineering crops that can grow in more arid areas, that are.

This essay deals with the restriction enzymes and other useful enzymes which are commonly used in genetic engineering. Genetic engineering was born because scientists learned to manipulate DNA. This skill was derived mainly from the field of nucleic acid enzymology. Prior to , there was simply no technique available for cutting a duplex double-stranded DNA molecule into distinct fragments. Discovery of DNA metabolising enzymes granted scientists to propose and initiate genetic engineering. In other words, it was based upon the discovery of type II restriction endonuclease enzymes. Smith and his coworkers that Haemophilus influenza extracts contained activities that cut large DNA molecules into defined fragments. In addition, an entire industry developed with the main purpose of discovery, characterization, purification and marketing of over different site-specific restriction enzymes. The bringing together of DNA fragments to form covalently linked chimeric molecules is the basis of recombinant DNA research. This step is essential in genetic engineering. This is attained by ligation which is catalysed by DNA ligase, an enzyme which was discovered much prior to that of restriction enzymes. Before the existing central dogma in molecular biology was that genetic information transfer occurred from DNA to RNA, and then to protein. The proof that RNA-to-DNA information transfer did occur is based on the discovery and characterization of reverse transcriptase enzyme by Temin and Baltimore The generation of cDNA, containing direct protein coding information is the normal step in cloning of eukaryotic genes. In fact the most revolutionary and most simplistic molecular biological technical development, is PCR i. The discovery of type II restriction enzymes demonstrated the enormous power and utility of site specific DNA cleavage reagents. This article deals with the restriction enzymes and other useful enzymes which are commonly used in genetic engineering Table Restriction endonucleases RE are special class of endonucleases which cleave DNA molecules only at specific nucleotide sequences, called restriction sites. These specific sequences are of four to six nucleotides. A tetranucleotide sequence will occur more frequently in a given molecule than hexanucleotide, therefore, more fragments will be produced by an enzyme which recognizes tetranucleotide sequence. At these restriction sites, restriction endonucleases cut the DNA by cleaving two phosphodiester bonds one within each strand of the double stranded DNA. However, the first restriction endonuclease enzyme to be isolated and studied was E. Now these enzymes have been classified into three different types viz. The discovery of these enzymes led to Nobel Prize for W. In gene manipulation technology, restriction endonuclease enzymes are popularly called molecular knives, molecular scissors or molecular scalpels. While exact cutting of DNA molecule is very useful for DNA cloning, its full potential is only exhibited when the fragments produced are joined together to give a new structure, known as recombinant DNA. This joining or ligation is achieved by the use of a DNA ligase enzyme. The most common ligase enzyme is isolated from the bacterial virus i. Primarily, ligase enzymes are involved in the repair of DNA molecule where sealing or union of DNA fragments takes place. These enzymes are widely used in genetic engineering for the production of hybrid DNA. Since ligase enzymes join DNA fragments or seal the nicks in the chain, they are called molecular structures. If two different DNA preparations are treated with the same restriction enzyme to give fragments with sticky ends, these ends will be identical in both preparations. Thus, when the two sets of DNA fragments are mixed, base pairing between sticky ends will result in the coming together of fragments which were derived from different molecules. Also there will be pairing of fragments derived from the same molecule. Such pairing are temporary, owing to the weakness of hydrogen bonding between the few bases in the sticky ends. Polynucleotide ligase enzyme of T4 bacteriophage catalyzes the end to end joining of DNA duplexes at the base paired end. This reaction could occur intermolecularly or intramolecularly. Researches confirm that intermolecular mode of reaction is correct. This reduces separation of paired sticky ends and are later stabilised by ligation. However, long reaction time is required to compensate for the low activity of DNA ligase enzyme in the cold. The enzyme concentration is kept high and

polyethylene glycol is added to reaction mixture for Stimulation. Since ligation reconstructs the site of cleavage, recombinant DNA molecules produced by ligation of sticky ends can be cleaved again at the joints, using the same restriction endonuclease enzymes that was used to generate the fragment initially. As a result, a fragment can be inserted into a vector DNA, and recovered again after cloning of the recombinant molecules. Fragments of blunt-ended DNA can be ligated, but since there is no base-pairing to hold fragments together temporarily, concentrations of DNA and ligase enzyme must be high. However, blunt-end ligation is a useful way of joining together DNA fragments which have not been produced by the same restriction enzyme, and which therefore have mismatched sticky ends. These ends are removed prior to ligation, using the enzyme S1 nuclease, which digests single-stranded DNA. In case of ligation of blunt-ends, a restriction site will not be regenerated and this may prevent recovery of a fragment after cloning. Linkers are short, double-stranded oligonucleotides, with blunt ends, containing at least one restriction site i. These linkers can be joined to one preparation of DNA by blunt- ended ligation and then sticky ends can be created by cleavage of the linkers with a suitable restriction enzyme. The linker is chosen so that the sticky end it produces is identical to that on the other DNA preparation. Consequently, the two can then be joined by ligation of their sticky ends. Some very versatile linkers are available which contain restriction sites for several different enzymes within a sequence of only eight to ten nucleotides. Blunt- ended molecules can also be ligated after building sticky ends. Thus, with this method it is now possible to insert a foreign DNA segment at a particular site in the linker region of the vector and then retrieve this foreign DNA segment whenever necessary. Sources of DNA Ligases: DNA ligases are isolated from E. The ligase enzyme isolated from E. The ligase obtained from T4 bacteriophage is 68 kDa. It requires ATP as a cofactor and a source of energy. For the routine laboratory requirement, T4 DNA ligase is obtained from an induced lysogen of lambda T4 lig phage. This enzyme has the capacity to ligate a variety of cohesive and blunt- ended DNA fragments. The enzyme concentration is kept higher and a fusogen called polyethylene glycol, is added to reaction mixture for stimulation. DNA ligase enzymes play an important role in genetic engineering. The important functions of DNA ligase enzymes are as follows: Ligase enzymes are used in the joining process. Ligase enzymes help in ligation of vector and inserting recombinant DNA. They help in ligation of linkers or adapter molecules at the blunt ends of DNA fragments. They help in sealing nicks in double- stranded DNA. This requirement can be advantageous as: This enzyme is a dimeric glycoprotein with a molecular weight 14, It is made up of two identical or similar subunits each with a molecular weight of Uses of Alkaline Phosphatase Enzyme: Linearized cloning vectors can be prevented from recircularizing by dephosphorylation with alkaline phosphatase enzyme. AP enzyme is used for mapping and DNA fingerprinting studies. This enzyme is frequently used to end- label the nucleic acids with 32P i. This can be accomplished by any method among following: However, very large amounts of S1 nuclease enzyme can completely hydrolyze double- stranded nucleic acids. The enzyme hydrolyzes single stranded regions in duplex DNA such as loops and gaps. S1 nuclease enzyme can also cleave single stranded areas of super helical DNA at torsional stress points where DNA may be unpaired or weakly hydrogen bonded. S1 nuclease enzyme is a monomeric protein with dalton molecular weight. The optimum pH requirement lies between 4 to 4. Uses of S1 Nuclease Enzyme: It can be used to remove singles stranded tails from DNA fragments to produce blunt ends. Hair pin loop structures formed during synthesis of double-stranded cDNA is digested by this enzyme. This enzyme has two-fold activities: DNA polymerase I enzyme is used with radioactive or biotinylated nucleotides to prepare labelled DNA of high specific activity. Uses of Klenow Fragment: Klenow fragments are used in the following ways: In DNA sequencing by dideoxy method. For the production of second strand of cDNA. Mutagenesis of DNA with synthetic oligonucleotides. In labelling the DNA by random primer method. This property allows radiolabelling of DNA fragment by replacement synthesis. DNA complementary to these single strands are synthesized with deoxynucleoside triphosphate enzyme in the presence of radiolabelling compounds. Application of T4 DNA polymerase: The enzyme can be used in radiolabelling of DNA. Taq enzyme consists of a single polypeptide chain with a molecular weight of Application of Taq Polymerase: Taq enzyme is used in DNA sequencing studies.

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9: Food & Agriculture | Union of Concerned Scientists

DEFINITION: Genetic Engineering is the scientific alteration of genes or genetic material to produce desireable new traits in organisms or to eliminate undesirable ones.

Limited to exchanges between the same or very closely related species Little or no guarantee of any particular gene combination from the million of crosses generated Undesirable genes can be transferred along with desirable genes Takes a long time to achieve desired results Allows the direct transfer of one or just a few genes, between either closely or distantly related organisms Crop improvement can be achieved in a shorter time compared to conventional breeding Allows plants to be modified by removing or switching off particular genes Source: Genes are molecules of DNA that code for distinct traits or characteristics. For thousands of years, genes have moved from one organism to another. It causes crown gall disease in a wide range of broad-leaved plants, such as apple, pear, peach, cherry, almond, raspberry, and roses. The disease gains its name from the large tumor-like swellings galls that typically occur at the crown of the plant, just above soil level. Application of genetic engineering in crop production Genetic engineering techniques are used only when all other techniques have been exhausted, i. Crops developed through genetic engineering are commonly known as transgenic crops or genetically modified GM crops. Modern plant breeding is a multi-disciplinary and coordinated process where a large number of tools and elements of conventional breeding techniques, bioinformatics, molecular genetics, molecular biology, and genetic engineering are utilized and integrated. Modern Plant Breeding Source: Development of transgenic crops Although there are many diverse and complex techniques involved in genetic engineering, its basic principles are reasonably simple. There are five major steps in the development of a genetically engineered crop. But for every step, it is very important to know the biochemical and physiological mechanisms of action, regulation of gene expression, and safety of the gene and the gene product to be utilized. Even before a genetically engineered crop is made available for commercial use, it has to pass through rigorous safety and risk assessment procedures. The first step is the extraction of DNA from the organism known to have the trait of interest. The second step is gene cloning, which will isolate the gene of interest from the entire extracted DNA, followed by mass-production of the cloned gene in a host cell. Once it is cloned, the gene of interest is designed and packaged so that it can be controlled and properly expressed once inside the host plant. The modified gene will then be mass-produced in a host cell in order to make thousands of copies. When the gene package is ready, it can then be introduced into the cells of the plant being modified through a process called transformation. The most common methods used to introduce the gene package into plant cells include biolistic transformation using a gene gun or Agrobacterium-mediated transformation. Once the inserted gene is stable, inherited, and expressed in subsequent generations, then the plant is considered a transgenic. Backcross breeding is the final step in the genetic engineering process, where the transgenic crop is crossed with a variety that possesses important agronomic traits, and selected in order to obtain high quality plants that express the inserted gene in a desired manner. The length of time in developing transgenic plant depends upon the gene, crop species, available resources, and regulatory approval. It may take years before a new transgenic hybrid is ready for commercial release. Commercially available crops improved through genetic engineering Transgenic crops have been planted in different countries for over twenty years, starting from With genetic engineering, more than one trait can be incorporated or stacked into a plant. Transgenic crops with combined traits are also available commercially. These include herbicide tolerant and insect resistant maize, soybean and cotton. New and future initiatives in crop genetic engineering To date, commercial GM crops have delivered benefits in crop production, but there are also a number of products in the pipeline which will make more direct contributions to food quality, environmental benefits, pharmaceutical production, and non-food crops. Examples of these products include: References Agricultural Biotechnology in Europe. Future Developments in Crop Biotechnology. Ministry of Foreign Affairs, Denmark. An Introduction to Genetic Engineering. Transgenic Plant as Factories for Biopharmaceuticals. Genetic Modification Technology and Food: Consumer Health and Safety. University of Nebraska â€" Lincoln. Overview of Crops Genetic Engineering.

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