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Novel approach towards advanced tools in biosciences and their applications

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Abstract

Recombinant vaccines have been used for the treatment of various diseases and important advancements have been made in the field of health sciences for prevention of infectious diseases. Recombinant vaccines are those vaccines that rely on the principle of making only a small fragment of antigen responsible for triggering antibodies response. Bacterial expression systems are widely used for their ease of production and higher levels of expression of these vaccines. For vaccines that require post-translational modification we use eukaryotic cells like yeast or mammalian cells. Most of the vaccines that are being synthesized today in recombinant DNA technology are highly purified recombinant proteins. CRISPR is underway to eliminate or rectify the gene causing the cancerous mutation. Microarray is helpful in the identification of differentiation of gene expression after exposure to a toxic chemical to identify which of the tissues or proteins are being affected by that specific toxin or chemical. The microorganisms that live in our guts have been found to legitimately impact numerous aspects of our physiology such as probiotics that containing bacteria used for digestive system. Improvement of engineered pathways and creatures to blend biofuels and medications will proceed.

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Introduction

In the recent years, biomedicine has helped the healthcare officials with the techniques of smart drug delivery and personalized medicines. There is no risk of toxicity of substances co-purified with the attenuated organism, because we do not inject organism in this method, instead we inject DNA which produces its own antigen particle. Another problem successfully solved by recombinant vaccine is the vast production of this purified organism for vaccination. In 2010, scientists synthesized a new synthetic bacterium made entirely in the lab from a genome taken from another bacterium. This new bacterium was named as *Mycoplasma laboratorium*, owning to it being synthesized in the laboratory. Its genome was taken from *Mycoplasma genitalium* (Baker *et al*., 2011).

Advancement in proteomics has enabled the scientists to have a deep insight of cellular processes and to have a better understanding of synthesis of proteins and post-translational modifications. Many times a protein function is changed due to change in post translational modifications and same protein performs a different function after different kind of post translational modifications. Not, we have a better control and watch over the post translational procedures and know the function of a specific PTM. Genetic engineering promises a better future by changing physical abilities of humans. Not only physical abilities can be enhanced but also their mental abilities will be changed with the help of genetic engineering by engineering a desirable gene and inserting it in human cells in an appropriate tissue. In this way, genetic engineering will be able to increase the memory and intelligence levels of humans. DNA microarray is primarily used to check the expression of thousand of genes simultaneously before and after the treatment with some therapeutic agent to check the effectiveness of that drug. Also, we check the expression of different genes after an attack of pathogen to check what genes or proteins that agent is affecting (Adomas *et al*., 2008).

Next-generation genomics techniques and methods allow healthcare specialists to obtain large amounts of genomics data for better understanding of genomics classification and causative agents of various diseases. This genomic data when integrated with many other fields, experts can understand the basics of various diseases and response to different treatment methods. This region is probably going to be utilized in new manners in 2025 for creation of vitality and controlled combination of pharmaceuticals and biochemicals. New biomanufacturing approaches utilizing bacterial infection proteins are ready to convey similar, lightweight batteries that could incredibly relieve the troopers burden (Brar *et al*., 2013).

Recombinant Vaccines

Previously vaccines were based on empirical bases instead of theory and experimentations. They were made from attenuated or dead or weakened viruses or microbes, these weakened organisms when enter in the body elicit an antibody response against that specific microbe and these antibodies killed it

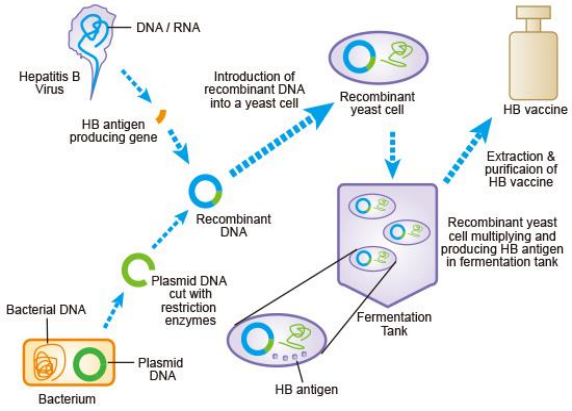

Fig. 1. Shows formation of Recombinant Vaccine.

Role of Recombinant vaccines

These vaccines successfully executed their function of triggering antibodies production, but some of them also have side effects like attenuated live organism may sometimes regain their pathogenicity and can cause disease in host organism. Dead virus can also pose serious health hazards sometime. Recombinant vaccines are those vaccines that rely on the principle of making only a small fragment of antigen responsible for triggering antibodies response. These recombinant vaccines do not produce a living microbe in the cell instead it is integrated in the DNA of the

cell and direct the cell to produce that specific part of antigen. That part of antigen is responsible for antibodies production initiation(Gleba *et al.*, 2005)

For cloning purposes, we have been using various vectors like bacteria, mammalian cell and insects or yeast. Some of the recently synthesized vaccines made by recombinant methods are against Hepatitis B virus, by expressing Hepatitis B surface antigen in eukaryotic cells like yeast cells. Vaccine against Human Papilloma virus is also synthesized by utilizing the L1 recombinant protein of many subtypes of HPV (Govan *et al.*, 2008).

Table 1. List of Biopharmaceuticals.

Name of Product	Name of product manufacturing company
IFN	PoyeshDaro
G-CSF	PoyeshDaro
EPO alpha	Notarkib
IFN beta	CinnaGen
PTH	CinnaGen
Interferon beta	Zistdaro
Interferon from pig	PoyeshDaro
factor VII	AryoGen
HBS(Vaccine)	Pasteur Institute

Role of Genomics

Many different genes have been compared to select a suitable candidate for biotechnological manipulation. This is considered in comparative genomics and is a very revolutionary field to select a gene for better and more promising yield of required product. This comparative analysis has been used for the comparison of various kinases, phosphatases, and transcription factors (Abberton *et al.*, 2016).

Role of Proteomics

Study of protein at a large scale is known as proteomics. All the proteins produced in an organism by different mechanism and processes are collectively known as proteome. Environment of living cells is constantly changing. Every cell is all the time in the process of cell cycle, differentiation, carcinogenesis and adaptation to the environment. It is not possible to study a cell at all these stages but with the help of proteomics we can determine the quantity and names of proteins produced during these stages and based on these proteomics study we can identify and characterize each cell process. All the proteins present in human blood plasma constitute "Human Plasma Proteome". Next big challenge in proteomics is characterization of Human plasma proteome. It is a very challenging and daunting procedure. Germline genetic engineering is involved in the modification of fetus cells to produce some desirable characteristics in the child to be born. A fetus is protected by international ethical law to be born without any modifications and genetic modifications to be made in the child are only prerogative of parents. Genetic engineering can be an additional procedure to child enhancement in addition to the already present techniques of diet, exercise, cosmetics and plastic surgery (Govan *et al.*, 2008).

Role of CRISPR in Healthcare

CRISPR gene editing is a new technology in gene therapy that employs the CRISPR/Cas9 antiviral system of bacteria to cut DNA at required specified sequences. CRISPR is "Clustered Regularly Interspaced Short Palindromic Repeats" are regularly repeated sequences in bacterial DNA originally derived from bacteriophages. Cas9 protein is CRISPR associated protein and recognize the CRISPR complementary sequences and cut them.In this method we place our own synthetic DNA instead of CRISPR and direct the Cas9 to cut at our desired sites (Hendel *et al.*, 2015).

Applications of CRISPR gene editing in Healthcare

CRISPR technology is also modified to recognize a specific sequence and neutralize it instead of cutting it, by turning off its Cas9 domain. This function of CRIPSR is similar to RNAi to silence or knockout a gene instead of cutting it. In July 2019, a 34-year-old patient suffering from Sickle Cell anemia have been treated by employing the method of CRISPR for the first time. CRISPR-Cas technology has huge potential in the treatment of disease specially those associated with genetic disorders. It can be used to treat a wide range of disease like cancer, thalassemia, sickle cell anemia, hemophilia and heart diseases (Cai *et al.*, 2016).

Role of DNA Microarray

DNA microarray, also known as DNA chips or Biochips, is a collection of ssDNA (cDNA)or RNA

used as probe immobilized on solid surface in the form of micro spots. Each of these spots contain very small amount of DNA in picomoles. A sample of DNA to be analyzed is passed over this DNA microarray and DNA complementary to the DNA in the spots is attached via complementarity. This is then visualized by fluorophores or chemiluminescence to quantitatively measure the expression of a large amount of DNA simultaneously.

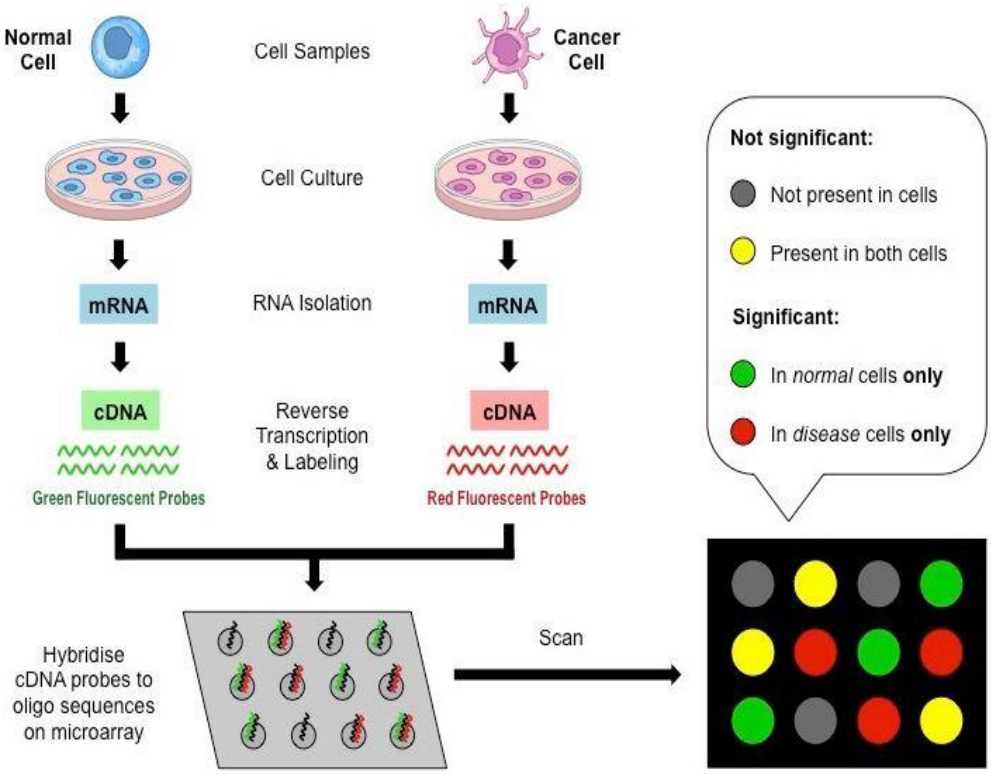

Fig. 2. Shows Gene expression by Microarray technique.

It can identify different strains of bacteria and compare them according to their differentiating genomes and to diagnose the infections caused by certain pathogens in human bloodstream. It can also help to identify the Single nucleotide polymorphism (Sturn *et al.*, 2002).

Microbiome control

A microbiome is the assortment of various microbial populaces that live in a particular specialty, for example, the gut, skin surface, mouth, soil, or water. Probiotics containing the microbes Lactobacillus or Bifidobacterium are at present used to improve assimilation and gastrointestinal issues. Direct, or roundabout, control of the microbiome of Warriors' stomach utilizing custom fitted probiotics, genome designing, engineered science or different methodologies will bring about improved resilience of nourishment and improved protection from ailment. Extra research has ensnared the gut microbiome control of an individual's state of mind, digestion, and physical execution. For instance, the gut microbiome has been shown to have an association with neuro developmental clutters, for example, mental imbalance; proposing a potential probiotic therapy.10Microbiome control is probably going to be utilized in new manners in 2025 to yield probiotics to improve officer execution so preparing could be shorter and progressively serious. This innovation may expand or build learning limit, sharpness,

capacity to act in an upsetting situation, empower coordination of detecting in novel ways. Increasingly unusual yet game changing uses incorporate probiotics that will build up organisms in the gastrointestine (GI) fit for reacting to stressors, occasions, dangers, needs through inception of a course of reactions within the sight of an upgrade, for example, a concoctet (Zand and Narasu, 2013).

Biomanufacturing utilizes biotechnology ways to deal with produce item items, naturally based atoms, or particles that can be utilized in development of materials. Presently, most endeavors are centered around pharmaceutical creation or mass substance generation. New biomanufacturing approaches using microscopic organisms where engineered science has been utilized to make counterfeit pathways for amalgamation of synthetic concoctions that are valuable in vitality (biofuels), in item blend (compound antecedents) or generation of complex biochemicals for anti-toxins (Zand and Narasu, 2013; Zhang *et al.*, 2017).

New Biomanufacturing Approaches

Bioassays incorporated into Bandages like stages have just been created to screen various proteins or synthetic substances in sweat. Later on these stages are probably going to bring about novel, on–request, multiplexed conveyance frameworks for energizers, medications, or other utilitarian particles. On request biomanufacturing coordinated into brief tattoos or bandages will give one of a kind abilities to enlarge trooper detecting, drug, and ID. Detecting dangers may incorporate synthetic compounds (TICS/TIMS), CBRN, temperature and mugginess (Carter *et al.*, 2017).

These tattoos will be engraved on troopers preceding sending and incorporate physiological sensors that don't expect blood to screen metabolic items (to decide vitality levels), hydration level, cortisol level to decide pressure and weakness, and use as input to decide crisis medicinal states. For instance an officer may be encountering a significant level of pressure or fatigue. Sensors will distinguish and process the occasion, at that point engineered science made microorganisms will react with the right treatment by produce and discharge biomolecules, for example, endorphins to ease the pressure. On the off chance that an officer is depleted, the sensors identify a metabolic sign and start, through a manufactured protein (to maintain a strategic distance from bogus commencement occasions), a hereditarily adjusted organism in the Trooper's gastrointestinal framework to discharge a biomolecule, for example, a steroid or other invigorating specialist. In the event that a trooper is presented to a compound specialist, a similar course could discharge a pharmaceutical operator legitimately to the circulation system or produce it through hereditarily changed microorganisms (Silva and Passos, 2002).

Advancements in Healthcare Biotechnology

Albeit Engineered Science has incredible potential for helpful applications, there is likewise a danger of a manufactured creatures getting away and conceivably harming the earth or the deliberate formation of hurtful living beings. As the innovations expected to make these life forms keep on getting more affordable and inescapable, this hazard will increment. A few organizations are advancing improvement of down to earth engineered science items. For instance, DARPA has begun a program considered Organic Heartiness in Complex Settings that supports creating manufactured science moves toward that are increasingly steady and safe to use in complex natural situations. One of the expressed objectives of the DARPA program is wellbeing, characterized as the improvement of strategies to control the development and expansion of designed life forms in complex settings. This zone is probably going to be utilized in new manners in 2025 (Levsky and Singer, 2003).

Improvement in Biongineering Pathways

Innovations dependent on manufactured science rise in 2025 that give new instruments to detecting and reacting to various signs (synthetic, organic, attractive, electric). Crude ultralow force, or vitality creating, manufactured life forms will be utilized to control straightforward gadgets, fig. occasions, and for general checking of the earth. This will empower remarkable

situational mindfulness. Manufactured science will likewise likely give new ways to deal with balancing officers physical reactions to the earth where through control of microbiomes or direct obstruction with natural pathways for therapeutic medications or execution upgrade (Petricoin III *et al*., 2002).

Quality treatment in Healthcare

Quality treatment or the utilization of quality substitution to fix malady has had late accomplishments in treating beforehand uncurable ailments, for example, the metabolic illness metachromatic leukodystrophy. Late advances show that people could be designed utilizing these advances driving some to require a ban on germ line cell (undeveloped organism) editing. This region is probably going to be utilized in new manners in 2025. Increasingly basic maladies, for example, diabetes I could be preventable. Individuals with affectability to specific synthetic substances might be made uncaring. This could lessen hazard to fighters while working in urban theaters where high centralizations of modern synthetics are probably going to be found. This innovation could be a distinct advantage in 2025 if state on-screen characters with access to the innovation can improve fighter execution. The morals and correspondence to people in general in regards to utilization of this innovation will influence the Military's utilization of advances for fighters(Bardhan and Thouin, 2013).

Conclusion

For recombinant vaccines several genes from various organisms responsible for various kind of diseases have been isolated, purified, cloned and expressed to show their vaccination abilities. This CRISPR technology can be used to modify mosquitoes in such a way that they will not be able to transmit malaria. Manufactured science, an order that spotlights on making manufactured natural, living beings or gadgets with properties that don't happen in nature, offers incredible guarantee in controlled plan of new innovations utilizing organic building.

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