

# Applications of Biotechnological Techniques in Healthcare, Current Advancements and Future Directions

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## Abstract

Biotechnology is the emerging field of science that involved for the development of medical products medicines like vaccine based on DNA, recombinant vaccine genomics and proteomics. The purpose of this review included applications of biotechnology in healthcare. Several diseases remain undiagnosed at molecular level. By taken advantage through applications of biotechnology, many advancement has been taken in the in the field of medicine and health sciences. These medicines are alternative of traditional medicines which were used without any diagnosis. In PCR, amplification of gene product visualize in a specific manner. In gene therapy affected cells are replaced with normal cells it can be used for both somatic cells and germ cells. Fluorescence in situ hybridization has important applications to determine that how chromosomes arrangement involved in the behavior of an individual. Biotechnology also has other important applications in healthcare such proteomics, genomics and gene therapy. Several vaccines have been made through using tools of biotechnology. There are some diseases that needed to treat at genetic level though healthcare biotechnology.

**Keywords:** Healthcare biotechnology, Vacancies, Proteomics, PCR, Microarray.

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## INTRODUCTION

Today researchers in the field of medicines are able to determine the radical demonstrations of diseases. From 2001 when human genome was sequenced scientist can detect different genes which are involved in many diseases like cancer cardiovascular respiratory and mental diseases[1]. There are many medicines have been developed which are highly selective by the identification of different genes. A large number of diseases such as cystic fibrosis, Duchene muscular dystrophy, Huntington's disease of nervous system, thalassemia, hemophilia, sickle cell anemia, Lesh Nayan syndrome are treated through by the application of gene therapy it is technique that is developed through biotechnology.

Kary Mullis discovered a technique containing a chain of reactions working through an enzyme called DNA Polymerase Called Polymerase chain reaction re (PCR). Polymerase enzyme move on DNA separated strands through a primer and adds nucleotides basses to synthesize a copy of new strand according to complementary strand. This process takes place in machine that contain all subunits required for the

synthesis of DNA like nucleotides bases DNA polymerase enzyme and primers. In vitro to perform this reaction a high temperature is required for denaturation of DNA strands that cause unwinding of these strands in vivo this naturally controlled through many enzymes. Once denaturation step primers are added this step is known as annealing when the primers are added at the respective ends then in third steps is started that is known as extension in this step DNA polymerase enzyme is added[2]. It gives a copy of DNA this process is repeated again and again and gives large number of copies of DNA. All these steps take place on a specific range of temperature that is increased and according activity of enzyme[3].

Fluorescence in Situ Hybridization is used to determine that how chromosomes arrangement involved in the behavior of an individual. This technique was firstly used in 1969 by Nerve. That used for the specific arrangement of DNA chromosomes. It can be used for the differential of many chromosomes pairs due to its ability to give gives fluoresce by forming hybridization with specific sequence chromosome[4, 5].

Microarray is used for the detection thousands of gene expression containing a chip with small wells having multiple sequences of nucleotides. The improvement of microarray technology is in detail linked with the transition of molecular biology from its classical phase into its submit-genomic technology. Microarray era promises now not only to dramatically accelerate the experimental paintings of molecular biologists but additionally to make feasible an entire new experimental technique in molecular biology[6].

The purpose of this review article focusing on applications of laboratory techniques used in Biotechnology in the field of health sciences for diagnosis of diseases and disease prevention. There are certain advancements have been made in medical sciences by using the laboratory techniques such as polymerase chain reaction, fluorescence in situ hybridization, and microarray.

### Applications of PCR in Healthcare

Another helpful PCR application is the cloning of a specific DNA section, which permits the investigation of quality articulation and has significant potential in criminological drug [7]. The probability of real time PCR checking has upset the measurement procedure of DNA and RNA pieces. This PCR permits the exact evaluation of these nucleic acids with more noteworthy reproducibility. This system gives a delicate strategy to the exact evaluation of singular species, which could be significant to the conclusion of pathogens and hereditary sicknesses. Favorable circumstances of Ongoing PCR incorporate the simplicity of evaluation, more prominent affectability, reproducibility and exactness, quick examination, better control of quality all the while and a lower danger of pollution[8]. Many of disease have been cured through proper prevention such Hepatitis B and C[9].

### Applications of Gene Therapy

In gene therapy affected cells are replaced with normal cells it can be used for both somatic cells and germ cells. By this way accurate genes passed from generation to generation. Generally there are normal genes are used which are synthetic in nature in this technique. Some other important applications of biotechnology involved such as in antisense process nucleic acids fragments of DNA and RNA are used. These are used for the knocking out expression genes[1].

### Applications in Cell Division

In cell division process PCR is applied to prepare the copies of DNA. To give multiple copies of DNA the PCR take place in the forms of cycle s which comprises of three main steps denaturation the steep at which high temperature required for separation of strands second step is annealing in which primers are added the third step is extension in which multiple copies of DNA prepared[10].

### Principle and Applications of Fluorescence in situ hybridization

Fluorescence in situ hybridization (FISH) focusing on ribosomal RNA is a generally utilized atomic device for the development free recognizable proof, perception, and evaluation of microorganisms in ecological and restorative examples. In standard FISH draws near, fluorescently mono-named oligonucleotide tests are hybridized to the rRNA of microbial cells, and the recolored cells are in this manner imagined by wide field epifluorescence or confocal laser checking microscope[11]. HER2 testing which is involved in cancer like breast cancer is usually completed by immunohistochemistry (IHC), chromogenic in situ hybridization (CISH), silver-upgraded in situ hybridization (SISH) or Fluorescence in situ hybridization (FISH).

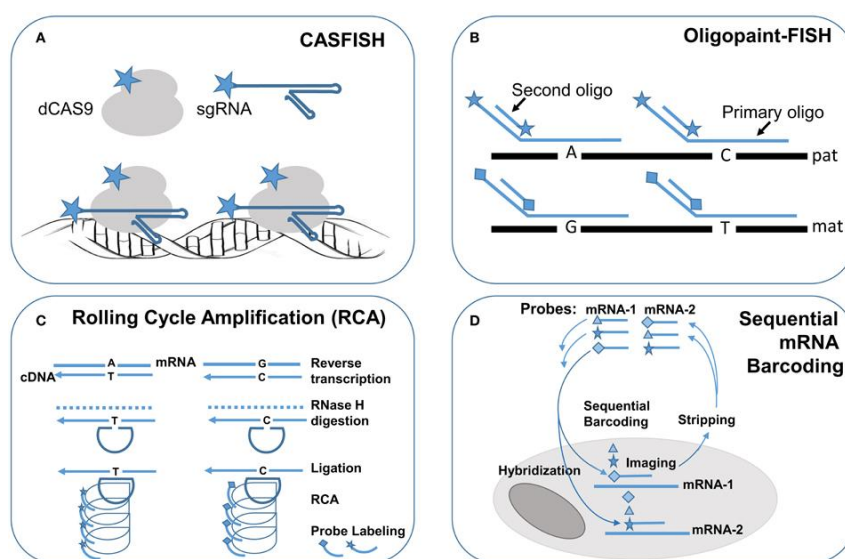


Fig-1: Shows steps involved in Fluorescence in situ hybridization

In interphase cores of examined tumor material, HER2 quality enhancement testing is specially directed by means of FISH[12].The improvement of in situ advances has furnished us with an abundance of data in regards to the areas and articulation examples of qualities in single cells. Progressively complete quality articulation profiles of single cells will give another degree of understanding into the connection of quality articulation designs with specific cell phenotypes. This will be especially significant in investigations of improvement and malady movement, where muddled, finely separated quality articulation programs are in play[13].

### Applications of DNA Sequencing

Sequencing of DNA is the way toward deciding the request for nucleotides inside a DNA atom. Since DNA is the premise of hereditary data, the information on DNA arrangements has become a significant instrument in essential different sectors of research. Such as sequencing of many organisms such as microorganisms viruses bacteria used for the treatment of much disease which are caused by different microbes such as pathogenic bacteria and fungi. First of all sequencing method was discovered by Sanger through Watson and Crick model of DNA [14].The second most significant method sequencing of genome is discovered by Fier in 1972. Which the genome more accurate and affective as compared to Sanger method [15].

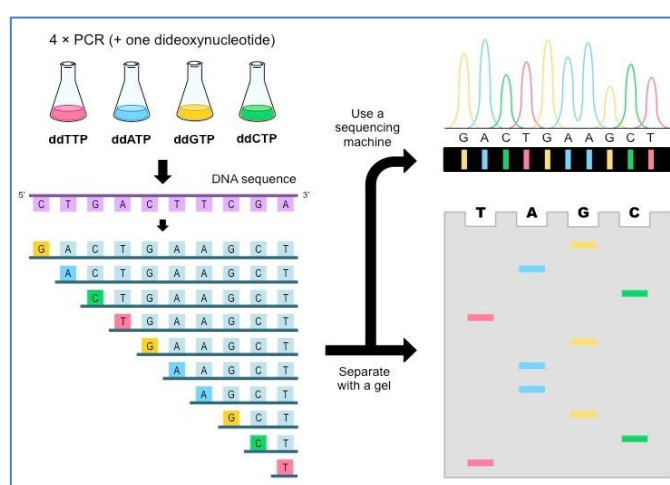


Fig-2: Shows principles steps of Sanger DNA sequencing Method

### Applications of Microarray

There are numerous potential scientific programs have began to become our knowledge of these techniques and the statistics they generate improves. Protein microarrays comprised of antibodies, aptamers, whole mobile or micro dissected cell lysates, recombinant proteins, small-molecule drugs, phage and

antibody-like molecules are being actively explored and used for multiplexed proteomic based totally endpoints33–40.Regardless of the software, the resulting information can incorporate thousands of individual measurements and gives uncomplicated and complex photograph of organic homes of themobile, tissue or organ with profound significance[16].

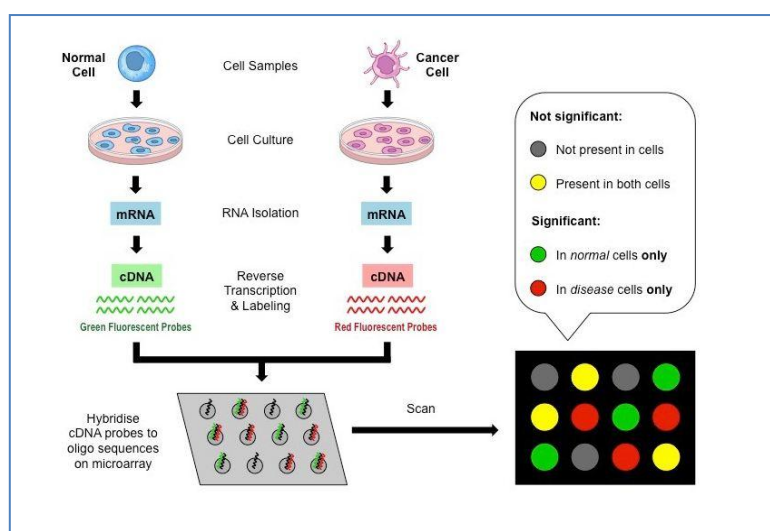


Fig-3: Shows Overview of Microarray

### Applications of Microarray in Diagnosis of Genetic Diseases

After 1990, scientists understand that many diseases are genetic diseases few of them are caused by single gene defect in most multiple genes are involved. By advances in technology scientists start to collect information and also start genome wide scanning. By this way institute of biobank established to store the genotypic data and phenotypic data[17]. United States saved 270 million specimens in biobank in 2008. The rate of new sample collection was 20 million per year[18].

### Applications in Cancer Biology

Cancer is the most vital health issue. According to the survey in 2017 at United States almost 600,920 deaths occur due to cancer. Traditional treatments such as radiotherapy and cancer therapy are less effective treatments due to their less specificity[19]. During the last 10 years a tremendously development has been shown in the field of oncology, now cancer is considered as main cause of death in the whole world. Personalized medicines have been developed through biobanks. These medicines helped to proceed toward the patient of cancer extraordinarily. In biobank there is a schematic program in which information are collected and operated by using bioinformatics, cytomics, genomics, transcriptomics for survey and assuming of cancer and its treatments by using advanced metabolites[20].

### Applications in Clinical Investigation

All running process are systemized between many biobanks they postdate the international protocols

like National cancer institute guideline in the US, confederation of cancer biobanks guideline in UK and international society for biological biospecimen instructions in Europe. There are multiplex systems in cancer biobanks in which standardized collection cancer tissues and their related data is saved. Personalized medicines used for avoidance of cancer and the treatment of cancer. Drug developments and discovery of many biomarkers take place by the application of cancer cell lines, but these are outstanding for the concluded clinical response. These clinical predictive values of cancer cell lines come from the recognition of their shortcomings and less ability to summarize inter and intra tumor heterogeneity. The cancer biology led for the development of targeted therapies. In cancer research the biological specimens of human have been used for many years for the translations, to examine pathogenesis of many diseases for testing of scientific hypothesis and approaches to biomarkers in the experimental studies. There is a systematic process of data collection, processing and functioning of a biobank[20].

### Probiotics in healthcare

Probiotics could deliver a novel flavor, for example, mint or a sharp flavor that could be recognized upon presentation to lethal synthetics or concoction and natural fighting specialists. Comparable impacts could be created by changing the mouth microbiome utilizing gum with a probiotic or an inducer of a hereditarily altered microbiome. Other game changing applications may incorporate the capacity to process grasses or different plants as nourishment sources[1].

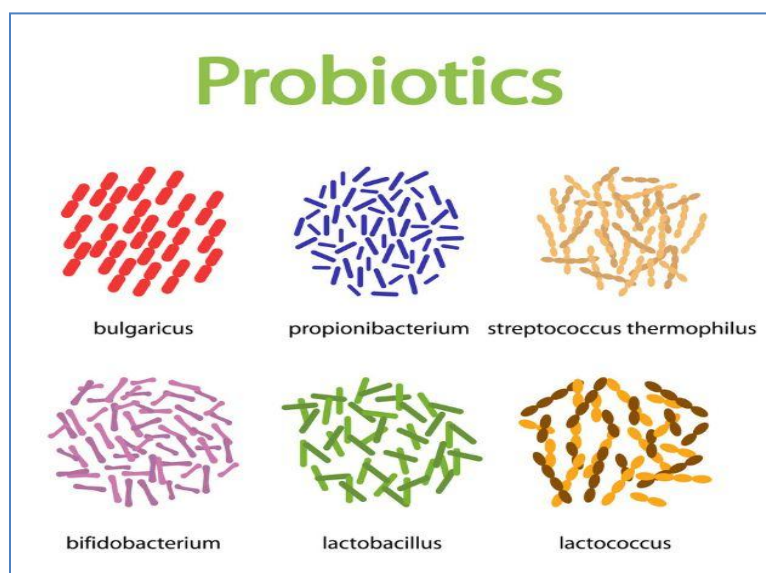


Fig-4: Sources of Probiotics from some bacterial strains

### Future Direction in Healthcare Biotechnology

Biotechnology is the control (as through hereditary designing) of living creatures or their parts to deliver helpful items (as vermin safe harvests, new

bacterial strains, or novel pharmaceuticals); likewise: any of different utilizations of organic science utilized in such control (Merriam-Webster Lexicon). Here we will likewise incorporate innovations dependent on



DNA sequencing, utilization of natural particles, and biomaterials and incorporates organic chemistry, biosynthesis, cell science, physiology, biochemical designing, and understanding the interface among natural and built frameworks.

There is incredible guarantee to comprehend enormous restorative, condition, vitality, rural, and military issues dependent on present and future utilizations of biotechnology. This guarantee is from direct utilization of biotechnology and from the developing territory of multidisciplinary explore that consolidates biotechnology with different sciences like materials science, physical science, science, and designing just to give some examples. Notwithstanding, there is likewise developing worry over potential perils from this zone of science dependent on the potential for disasters from legit researchers and applications intentionally created to cause destructive or in any event, crushing impacts. As uninhibitedly open information, materials, and simplicity of improvement develops, the potential gatherings that can build up these applications has likewise developed from governments and enormous partnerships to ever littler gatherings including non-country state on-screen characters, for example, criminal and fear monger associations and even people[21].

## CONCLUSION

Applications incorporate quicker and increasingly proficient analysis and treatment of illnesses, radiation of hereditary maladies, human quality treatment, biomanufacturing, biofuels, customized drug, ecological remediation, and ailment safe harvests. Nonetheless, other increasingly dubious or even terrible utilizations of this uninhibitedly accessible data could incorporate bioengineering of infections focusing on select gatherings of individuals, plants, or creatures or even the formation of hereditarily improved people that are more grounded, quicker and more fatal than typical. Envision an ailment focused at a provincial staple yield, for example, rice or wheat, and the resulting local destabilization and the world-weight on monetary and farming markets that a debacle, for example, this would make.

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