Advances in
Biotechnology & Microbiology
ISSN 2474-7637

Juniper Publishers
key to the Researchers

Mini Review
Volume 18 Issue 1 - March 2024
DOI: 10.19080/AIBM.2024.18.555976

Adv Biotechnol Microbiol

A Compenshive Review on Experimentation on Human DNA

Hussain Ahmad[1], Yasir Nawaz[2], Arooj Aslam[2], Ayesha saddiqa[3], Nabila Iqbal[4], Luqman Hakeem[2], Muhammad Kaleem ullah[2]* and Asad Abbas[2]

[1]*Department of Botany, university of Agriculture, Fasialabad, Pakistan*

[2]*Department of Zoology, university of Okara, Pakistan*

[3]*Department of Chemistry, Government college University, Faisalabad, Pakistan*

[4]*Department of Zoology, University of Agriculture, Fasialabad, Pakistan*

Submission: March 01, 2024; **Published:** March 11, 2024

***Corresponding author:** Muhammad Kaleem ullah, Department of Zoology university of Okara, Pakistan

Abstract

To identify genetic disorders, a large amount of good quality DNA is required. The most frequently used method is to obtain genomic DNA from nucleated cells of peripheral blood. In the process of forensic investigation, forensic identification is a universal method. Human DNA experimentation is a complicated and diverse process that needs to be planned carefully. Numerous methods, including the phenol-chloroform process, silica column purification, and magnetic bead-based approaches, can be used. DNA sequencing is the technique used to ascertain the exact nucleotide order within a DNA molecule. Sanger sequencing, next-generation sequencing (NGS), and third-generation sequencing technologies like PacBio are some of the techniques can be used. The creation of targeted medicines based on the genetic profiles of particular patients may be made possible by an understanding of the genetic basis of disease. In forensic science, DNA profiling is frequently used to identify people, determine paternity, and connect suspects to crime sites. To conclude, DNA of good quality is very important for DNA sequencing and gets mutation profiles. This will be helpful in targeting accurate medication for the disease.

Keywords: Peripheral Blood, Phenol -Choloroform, Genetic, Mutation.

Abbreviations: NGS: Next-Generation Sequencing; XP: Xeroderma Pigmentosum; PCR: Polymerase Chain Reaction

Introduction

In genomic disorders, the modern research approach declared that it is compulsory to collect the large amount of good quality DNA that needs to be acquired from various sample resources. DNA typing is the most authenticated way for the distinctive recognition of human bodily fluid stains found at violation scenes. The most frequently used method is to obtain genomic DNA from nucleated cells of peripheral blood. Other various sources of DNA isolation include urine, hair with follicles, and buccal cells that are easy to obtain in a noninvasive way rather than invasive methods like blood collection [1]. In humans, DNA repair reactions play a very crucial role in intercepting the development of cancer growth. The incident rate of internal cancer is very high in those individuals with defects in mismatch repair [2]. Some individuals are distressed from (XP) Xeroderma pigmentosum with non-functioning nucleotide excision repair specific for bulky DNA lesions which demonstrates itself by the high prevalence of actinic cancer and increased occurrence of cancer of internal organs and mental and neurological abnormalities [3].

In the process of forensic investigation, forensic identification is a universal method. Through the process of forensic identification, one can compare traces of saliva, blood, or any other various types of biological specimen left at the crime location with those found on conjecture clothes and with models from the victim. In forensic genetics (PCR) polymerase chain reaction technique is widely used for DNA identification. This procedure produces genetic fingerprints [4].

We are continually revealed to foreign DNA from various types of sources like malicious or benign microbes, pollens are present in inhaled air. The molecules of DNA are pervasive in huge numbers in unprocessed food or also present in various kinds of raw materials. In consumed products various fractions of DNA

molecules of varying size may be present depending on the extent of processing even in processed food like chocolate or corn chips [5].

Discussion

Human DNA experimentation is a complicated and diverse process that needs to be planned carefully; ethical issues must be considered; and tight rules must be followed. These studies might have a broad range of goals, from comprehending basic biological processes to creating remedies for hereditary illnesses. In this talk, we will explore the many facets of working with human DNA in studies, including the techniques employed, moral issues, possible uses, and the field's future. Extracting DNA from cells is the first step in many investigations utilizing human DNA [6]. Numerous methods, including the phenol-chloroform process, silica column purification, and magnetic bead-based approaches, can be used to accomplish [7]. The type of sample, the required purity, and the experiment's size all influence the method selection. A basic method for amplifying particular DNA sections is PCR. It makes it possible for scientists to replicate a certain DNA sequence millions of times, even from tiny or damaged materials [8]. Applications for PCR are numerous and include molecular biology research, forensics, and genetic testing. DNA sequencing is the technique used to ascertain the exact nucleotide order within a DNA molecule. Sanger sequencing, next-generation sequencing (NGS), and third-generation sequencing technologies like PacBio are some of the techniques for sequencing DNA. Because genome editing tools like CRISPR-Cas9 allow for precise change of DNA sequences, they have transformed the area of molecular biology [9]. Researchers can study gene function, disease models, and possible therapeutic treatments by using genome editing to add, remove, or modify particular genetic sequences in human cells.

Informed consent is a requirement set forth by ethical principles for participants in DNA research. This includes outlining the goals of the study, any possible dangers or advantages, and the intended use of their genetic data. Participants' liberty to deny participation or give their agreement must be respected, and researchers must make sure they are aware of the nature of the study [10]. It is critical to safeguard the confidentiality and privacy of participants' genetic information. Strict data security procedures must be put in place by researchers to guard against illegal access to or disclosure of private genetic data. This entails getting ethical clearance for data exchange and cooperation, as well as de-identifying data whenever practicable [11]. It is the responsibility of researchers to optimize study benefits while reducing participant harm. This entails carrying out in-depth risk assessments, putting safety measures in place to reduce any dangers, and placing participant wellbeing first throughout the whole study process. Fair access to the advantages of genetic research should take into account racial, ethnic, and socioeconomic status, among other things. It is important to make sure that everyone can benefit from genetic research, even underrepresented communities that might not receive enough attention in studies [12].

The creation of targeted medicines based on the genetic profiles of patients may be made possible by an understanding of the genetic basis of disease. Through the examination of genetic variants linked to medication metabolism, treatment response, and illness risk, researchers can determine customized treatment plans that maximize effectiveness while minimizing side effects. Genetic counseling services can be guided by genetic information gleaned from human DNA experimentation, which can assist individuals and families in understanding their risk of inherited illnesses, making educated decisions about reproduction, and gaining access to the right medical care and support systems. By using human DNA experiments, scientists can build cellular or animal models of hereditary illnesses, which offers important insights into the workings of the disease and possible targets for treatment [13]. These models can be used to evaluate potential medications, track the course of diseases, and create novel treatment strategies. In forensic science, DNA profiling is frequently used to identify people, determine paternity, and connect suspects to crime sites. The sensitivity and specificity of forensic DNA testing have been significantly increased by technological advancements in DNA sequencing and analysis, which has increased its usefulness in criminal investigations and the exoneration of falsely condemned people [14].

Conclusion

It provides a comprehensive overview of various aspects of DNA research, including genomic disorders, forensic investigations, exposure to foreign DNA, and human DNA experimentation. Importance of collecting high-quality DNA for genomic disorders and forensic identification, the role of DNA repair in preventing cancer, the widespread use of PCR in forensic genetics, and the continual exposure to foreign DNA from various sources. The complexity and diversity of human DNA experimentation, emphasizing the need for careful planning, ethical considerations, and adherence to rules. The discussion on extracting DNA from cells using various methods, including PCR, suggests ongoing advancements in techniques and technology. The mention of genome editing tools like CRISPR-Cas9 points towards the transformative potential of these technologies in molecular biology. The importance of informed consent, privacy protection, and fair access to genetic research benefits underscores the evolving ethical landscape in DNA research. The potential creation of targeted medicines based on genetic profiles and the use of genetic information in counseling and disease modeling hint at the promising future applications of DNA research in personalized medicine and therapeutic strategies. Advances in DNA sequencing and analysis in forensic science suggest continued improvements in the sensitivity and specificity of DNA testing for criminal investigations. The future of DNA research appears promising, with ongoing advancements shaping its applications and ethical considerations.

How to cite this article: Hussain A, Yasir N, Arooj A, Ayesha s, Nabila I. A Comprenshive Review on Experimentation on Human DNA. Adv Biotech & Micro. 2024; 18(1): 555976. DOI: 10.19080/AIBM.2024.18.555976

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DOI: 10.19080/AIBM.2024.17.555976

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