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Challenges of Scientific Research in Molecular Biotechnology in Yemen

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ABSTRACT

Research is achieved for the sake of contribution towards science and getting information systematically, starting from the collection of data, passing through interpretation and final evaluation of these data and all that, in an organized manner which is called scientific research. Biotechnology includes the application both of older biological knowledge, which is based on structures, functioning, and development of animals and plants in their ecological setting, and of newer approaches, which are based on an understanding of genetics and on the cellular and subcellular processes. The development of biotechnology has given society an awesome new power and an equally awesome responsibility to use it wisely. Biotechnology is being applied in different areas of science such as agriculture, health, the environment, and many other aspects of science and industry. Most of these applications and developments are centered in the developed countries and the research is established by these notions. Currently, it has been obvious that biotechnology is crucial for notion's economic growth and sustainable development. Yemen, as one of the most developing countries, is suffering to emerge molecular biotechnology research in universities and research units. This is because of many aspects that affect the soceity, goverment, and ultimatly the entire country, including society, human resources, facilities, infrastructure and environment resources, and stability. To conclude, the researchers in Yemen are surrounding by many challenges, which are starting in society and ending up in the laboratory. The research has very low priority on a long list of priorities such as food, stability, security, and healthcare. All the challenges can be solved, but it will need a more educated society and serious government policy toward research as a tool to build a strong society.

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Introduction

Research is achieved for the sake of contribution towards science and getting information systematically, starting from the collection, passing through interpretation and final evaluation of data and all that, in an organized manner which is called scientific research. The person who is conducting research is called a researcher. The researcher is the one who performs the research according to the field, abilities, and question. The results obtained from a small group through scientific studies are return to the society, and new knowledge is revealed with respect to diagnosis, treatment, and reliability of applications (Çaparlar and Dönmez, 2016). At the beginning of scientific research, researchers already should choose the point of research, plan, and identify the methods and materials. In the coined report of Helsinki, it is stated that 'the primary aim of research in the medical field is to comprehend the reasons, development, and effects of diseases, and to develop a variety of important aspects such as interventions of prevention, diagnosis, and treatment. Furthermore, the best-agreeable interventions should be evaluated consistently by investigations that include reliability, efficacy, accessibility, and quality (Fenstermacher, 1994). Research in biotechnology has started since recombinant DNA technology was developed in the early 1970s (Glick & Patten 2022). Biotechnology includes the application both of older biological knowledge, which is based on structures, functioning, and development of animals and plants in their ecological setting, and of newer approaches, which are based on an understanding of genetics and on the cellular and subcellular processes for example: 1) recombinant DNA, the combination of genes occur in nature, but it is only recently that a technique has been developed for engineering such combination artificially, 2) monoclonal antibodies, 3) vaccines and tissue culture, and 4) protoplast fusion, microbiological fermentation, and enzymatic catalysis (DaSilva et al., 2002). The development of biotechnology has given society an awesome new power

and an equally awesome responsibility to use it wisely. Biotechnology is being applied in different areas of science such as agriculture, health, environment, and many other aspects of science and industry. Most of these applications and developments are centered in the developed countries and the research is established by these notions **(**Vose and Cervellini, 1983; Madan, 2005). Currently, it has been obvious that biotechnology is crucial for notion's economic growth and sustainable development (Acharya, 1996; Mostafa, 2018). Yemen, as one of the most developing countries, is suffering to emerge molecular biotechnology research in universities and research institutes. This is because of many issues that affect the soceity and goverment and ultimatly the entire country. The author will mention some aspects regarding the issues that affect negatively scientific research which include prevailing cultural norms that are often incompatible with the need to control population growth, and to develop labor discipline, and entrepreneurial attitudes involving willingness to sacrifice for the future. Political power, even under popular revolutionary regimes, becomes unaccountable, personal, and ineffective in inducing cooperation and eliciting needed changes. Corruption and over-centralized, over-bureaucratic administration make the introduction of modern technologies difficult, producing disillusionment and economic distortions more often than the pride of accomplishment. The basic task of this paper is to give an opinion on the challenges of scientific research in Yemen in the field of molecular biotechnology.

Challenges of Sceintific Research in Yemen

Yemen, the Republic of Yemen, is located in the east of the Red Sea, north of the Indian Ocean, and southwest of the Arabian Peninsula in western Asia with a population of 26,687,000 on the 555,000 km2 as mentioned in the population projection of 2015. Yemen has many islands in the Red Sea and the Arabian Sea, the largest of which is Socotra Island on the Arabian Sea. Yemen is the least developed country among countries in the Middle East. It is a developing country where illiteracy prevails especially in previous generations and rural areas and has limited economic resources (Al Qaidani, 2020). The Republic of Yemen was born in 1990 by unifying the Yemen Arab Republic in the north and the People's Democratic Republic of Yemen in the south. North Yemen was under the control of the military and later on under the leadership of the General People's Congress Party. South Yemen was under the control of the Yemeni Socialist Party. Yemen was known as Manhattan of the desert, but now Yemen is referred to as only one of the poorest countries on Earth. The name of Yemen has become synonymous with famine and war. Health, education, and research have been among the hardest hit sectors, and the failure to take immediate action to rebuild these sectors threatens the future of the country and the next generations. Continuity of absence of a strong educational system and research that can educate and train the next generation of professionals, teachers, engineers, doctors, leaders, researchers, and scientists (Zakham et al., 2020). Special regional and international scholarships could help by considering the barriers Yemeni students and academics face in accessing education during the war, and offer exceptions that facilitate the training and continuation of research, especially in advanced science in biology such as molecular biotechnology. In the following points, the authors will illustrate the main challenges that face researchers in science search generally and molecular biotechnology in particular.

The Society

Yemeni people, generally, do not care that much on research and higher education. Private section such as companies are rarely suppoting the researchers and research. Moreover, Yemeni families which are fathers, mothers, and siblings of researchers mostly do not even support the researcher morally. The employees in the adminstraion at universitıes and units of research do not realize the process of scientfic research, and the importance of time factor so that they easily delay any documnt which is basically important.

Human Resources

It is obvious to all of us that scientific research is a basic requirement for human and social development, and the correlation between advanced scientific research and well-being life is clear globally. The success or failure of any attempt is based basically on the individuals who are doing that attempt. In Yemen, many of professors and other researchers mainly engage in research for promotion on the employment ladder, and as a result, they are simply a part of the problems of weakening research. Many of researchers in Yemen have difficulty with English skills, the language of today's science community. So, as long as researchers can not communicate verbally or/and in writing effectively. This brings a big barrier, or sometimes limited contact, between them and other individuals in the science community from developed countries or even from other developing countries in a region. Also, many of researchers lack academic skills such as synthesis and paraphrasing which lead reasearches to copypast most of others thoughts. Regarding training and research programs, the government sends some undergraduate students and graduate students abroad to study or to train, and they pay large sums of money. Then, they fail to provide them with adequality paid employment or facilities when they return Yemen. Another aspects that can be included under human resources is that a lot of specialized academic staff migrate to abroad searching for scientfic secure.

Environment Resources and Infrastructure

The infrastructure and environment are other aspects of issues that face Yemeni scientific researchers. As we all know developing countries have problems in every affair, and Yemen as one of the developing countries and is a country where political problems take a lot of time. The motivational environment as a factor to support research is considered completely absent. First, research laboratories at universities and others lack either modern equipment or solutions. Even more, a lot of equipment are existing, but they need maintenance. The high cost of modern equipments and its solutions present a big obstacle in the way of acquiring them. Enough chemicals always are not

available because of their high cost or the high amount of time needed to bring them from abroad, particularly recently when the political situation getting worse. Regarding maintenance, timely servicing of outdated equipment seems an impossible task. All those aspects affect negatively the expense of research progress. Some small research projects require kits or fine chemicals that may not always be available locally, even if they were locally available, it might be out of the ability of the researcher to pay for them Since most search projects are funded by researchers themselves. Additionally, the absence of skillful technicians and recently unpaid jobs for technicians and other staff have caused another big dilemma in the way of search. Indeed, chemical synthesis of genes, PCR, and DNA sequencing, figures 1, 2 and 3, are essential techniqes in molecular biotechnology research. At some Yemeni govermental and private diagnostics labratories PCR is available. However, gene synthesis is abscent. Furthermore, computers are an essential part of any molecular biotechnology research and other research areas. In Yemen, at research laboratories, it is common not to see modern computers. Furthermore, software programs are not available, and most of the advanced research samples are sent to the laboratory abroad in order to get the results and this is successful sometimes, but usually the researchers suffer a lot until their required analysis gets done. The availability of the internet at research laboratories is another matter of issue that faced researchers. We live in the information age, and the internet becomes the place where we can access databases, journals, and books to keep track of the latest development in science around the world, however, most higher education institutes in Yemen do not have high-speed internet services and other laboratories do not have an internet connection. Even more, most professors and academic staff do not have email addresses belonging to their universities or institutes. Researchers simply use their own emails. This, indeed, lead to the lack of a sense of professionalism when they intend to communicate with other researchers outside in the world. Also, funding can be insecure at most times. A number of masteres and Ph.D. researchers depend on their parents or friends financially, which is tremendously worrying and traumatic to secure new funding.

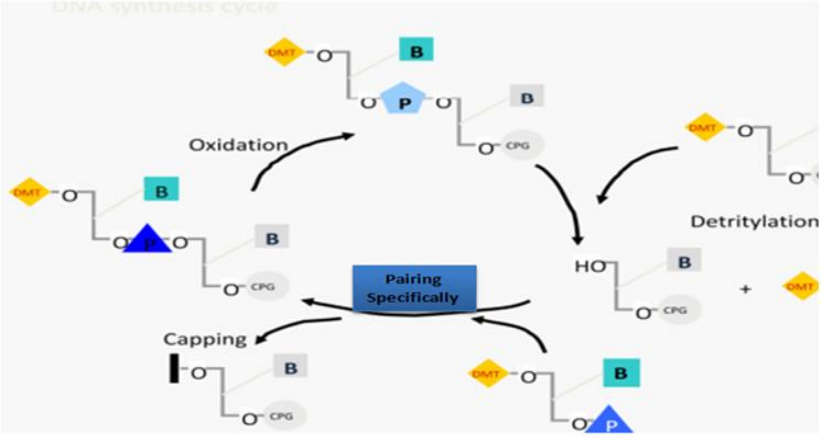

Figure 1. Gene synthsis in vitro: Modified from (Javed et al., 2013).

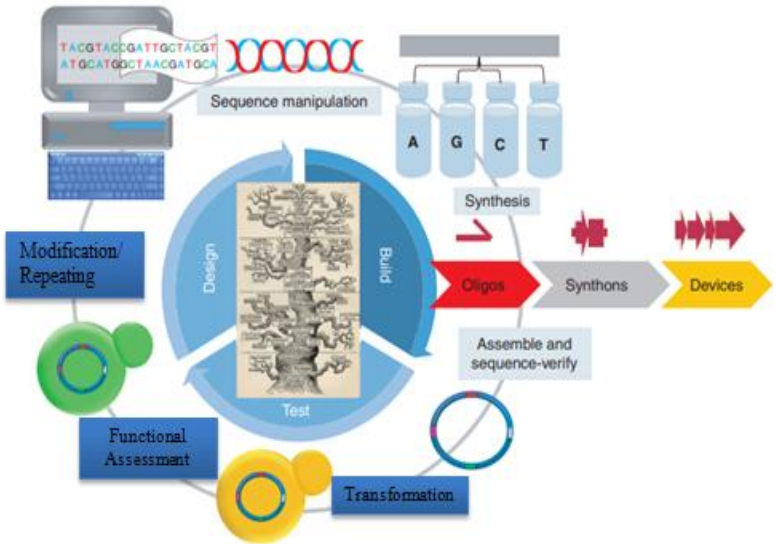

Figure 2. Synthetic DNA constructs are designed and manipulated using computer-aided design software: Modified from (Hughes and Ellington, 2017).

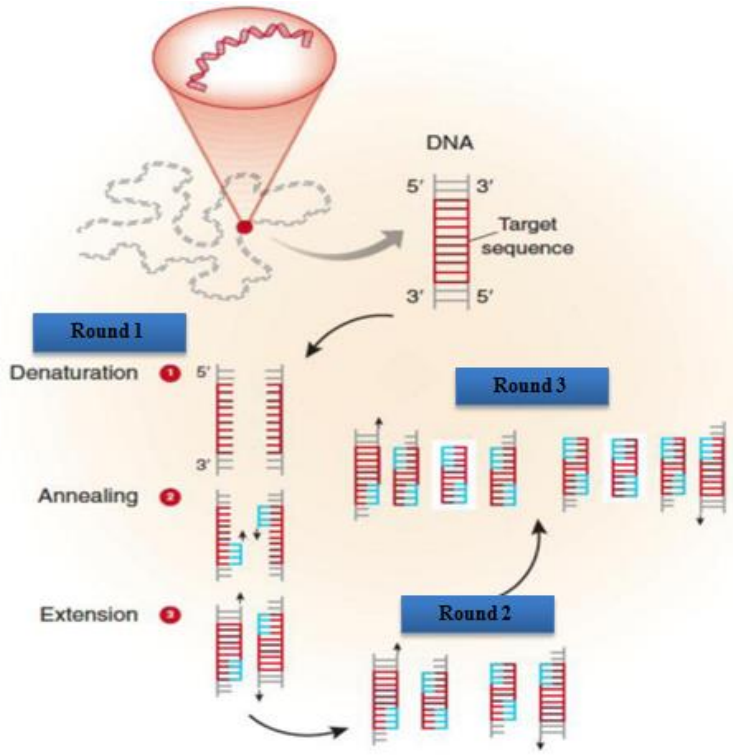

Figure 3. Schematic presentation shows the PCR principle: Modified from (Garibyan and Avashia, 2013).

Facilities

Researchers in Yemen work in lack essential services such as lack of breakrooms, bathrooms, lack office space, and so many other essential supplies. This is in sharply clear contrast to what the researchers should be supplied at sites of research in order to be productive. What's more, researchers may be unable to access to the laboratory to follow experiments because of the policy of security at higher education institutes, which makes another barrier in the way of researchers, and their ongoing research.

Stability

It is not there because of the absence of security. Yemen has been worrisome for more than seven years because of the conflict between Houthi (officially called Ansar Allah) and the government due to different motivations. People in north Yemen live in fear of death from bomb explosions by Saudi military aviation and the military confrontations between Houthi and resistant People in south Yemen are afraid of armed guys who spread in different areas. Some governmental universities are most postponed their work because it is be predicted to explode by Saudi military aviation as places to store weapons. This makes the search so hard. On the whole, Yemen is one of the non-industrial countries, and the science research improvement has started later by creating governmental and private universities, which are located in main cities, with basic facilities and some important infrastructures done with large amounts of money given by Yemen's friends and the international community. All science infrastructures got damaged in research laboratories were also largely affected. Meanwhile, electricity and water supply are vandalized from some universities.

Conclusion

The researchers in developing countries, which Yemen is one of them, are surrounded by many challenges, which are starting in society and ending up in the laboratory potentials. The research has very low priority on a long list of priorities such as food, stability, security, and healthcare. All the challenges can be solved, but it will need a more educated society and serious government policy toward research as a tool to build a wealthy and strong society. It is real and clear that the investment in research is always the key way to resolve chronic dilemmas that are facing the wheel of improvement, unless Yemeni people will stay helplessly watching problems and suffering continuously on a daily basis needs as human beings.

Aknowlogments

Tha article is written by the first author as requirment for Ph. D degree, and the second author is the supervisor of this work. If we should thank someone, it would be TARGİD congress for giving us this opportunity to share this work.

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