Egyptian Journal of Basic and Clinical Pharmacology
vol. 8 (2018), Article ID 101388, 2 pages
doi:10.11131/2018/101388

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Opinion

Challenges Facing Scientific Research in Developing Countries: 2. Environment and Resources

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In a previous "Opinion", I attempted to define problems facing scientific research in developing countries related to the "Human Factor"; scientists who are entrusted with the effort of propelling the research forward, intellectually and physically [1]. I referred to the lack of proficiency in the English language by many scientists resulting in a limited *effective* contact with scientists from the developed world, problems with plagiarism and career stagnation issues.

In this "Opinion", I will attempt to dissect potential problems related to the physical environment surrounding scientific research in developing countries, including resources necessary for its success. Research laboratories in developing countries lack not only modern equipment, but may even lack functional equipment. While the high cost of modern equipment presents an obstacle in the way to acquire these equipment in developing countries, timely and professional servicing of mostly outdated equipment seems to be an impossible task. In this regards, awaiting a spare part from a foreign manufacturer or source may take months, which comes at the expense of research progress. Absence of skilled technicians is another dilemma that is frequently encountered in developing countries.

Some research projects require kits, isotopes and/or fine chemicals; costly supplies that may not always be available locally. Although it may sometimes be possible to schedule one's research to accommodate lengthy purchasing and shipping procedures as well as possible custom delays, short half-lives of some isotopes and instability of other products at ambient temperature make them absolutely out of reach of researchers in developing countries. This may very likely limit the scope and direction, and possibly success of certain research projects.

As computers have become an integral part of any research laboratory in the developed countries, and as advances in computer technology makes it a necessity to upgrade existing computers every few years, it becomes difficult to see modern computers in laboratories in developing countries. The same applies to specialized software programs necessary for some research projects. Another dimension to the technology gap scientists in developing countries suffer from is the lack of availability of high-speed internet, assuming that dependable internet services are available at all. It is now paramount to have electronic access to databases, journals and books, to keep up with the latest developments in research around the world. Unreliable internet services obviously hinders one's ability to keep up with such developments. Most scientists in the developing countries with whom I communicate do not have email addresses affiliated with their place of work; they simply have public domain emails, sometimes with unprofessional users' names. This confers a sense of a lack of professionalism in their communications with the outside world.

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Dates
Received 13 August 2018
Accepted 13 August 2018

Of equally high importance is the fact that scientists in developing countries work in crowded and debilitated, facilities lacking essential amenities, such as clean bathrooms and breakrooms, as well as air-conditioned space. Indeed, sometimes they may totally lack office space and supplies. This is in a stark contrast to what one would usually find at sites where scientific research is performed in developed countries (academic, industrial, private or governmental), where clean bathrooms, fully staffed cafeterias and adequate office supplies are the norm. This is in addition to a comfortable ambient temperature, summer and winter, necessary for a productive research environment.

At the other end of the spectrum, research environment, facilities and resources in developing countries with enough wealth accumulated from natural resources may be state-of-the-art where equipment, computers and internet connections are modern. However, availability of research supplies and equipment maintenance remain a problem and a significant part of the *brain power* is transiently imported from the developed world. It is puzzling as to why these countries have not developed national cadres of skilled scientists after many decades of affluence and contact with scientists from developed countries.

In terms of policies and practices, I am reminded of the story of a young enthusiastic postgraduate student in a developing country who went to his laboratory on the morning of a weekend day to complete an experiment that he had started the day before. That student was denied access to the laboratory, by security personnel, on the account that "his major Professor was not in the laboratory that weekend day". A few years later, in the USA, the same student was given keys and free unhindered access not only to his laboratory, but also to the door to the entire college. Fear of accidents as well as lack of trust are another impediment to research in the developing countries.

In conclusion, scientific research is relegated to a very low priority in developing countries on a long list of seemingly more pressing priorities, such as food, shelter and healthcare. Ironically, an investment in scientific research may prove to be the key to resolve many of these other daunting chronic problems. Only innovative societies develop solutions to emerging problems through research, while others stand helplessly watching problems and decay mount.

Competing Interests

The author declares no competing interests.

References

[1] Mostafa Z. Badr, "Challenges Facing Scientific Research in Developing Countries: 1. The Human Factor," *Egyptian Journal of Basic and Clinical Pharmacology*, vol. 8, Article ID 101378, 2018.