Saudi Pharmaceutical Journal (2015) **23**, 453–454

King Saud University

**Saudi Pharmaceutical Journal**

www.ksu.edu.sa
www.sciencedirect.com

EDITORIAL

# Cell cultures in drug development: Applications, challenges and limitations

Cell culture is among the most widely used laboratory approaches probably because of the diverse aspects it covers and the relatively short period of time it requires. In pharmacology and therapeutic researches, cell culture represents a largely used basic approach. The aim of the modern pharmacology is to first identify active compounds from natural elements (Larkins and Wynn, 2004; Ghanemi and Boubertakh, 2014; Boubertakh et al., 2013; De Pasquale, 1984) that can constitute a starting point to develop therapeutic drugs. Nowadays, the drug development lies mainly on the identification of compounds that are thought to be active (Ghanemi, 2014a,b; Winquist et al., 2014) based on their chemical structures (Huryn and Wipf, 2014) or based on observation reported by biologists or physiologists for example. Those compounds are then further investigated.

The first step in drug discovery is, in many cases, to test compounds in cell culture to find out how active they are in terms of pharmacological actions. The challenges faced in this step are diverse. Indeed, selecting the cell line is an important issue since the compound activity may be specific. Defining the optimum conditions for both the cell culture media and the drug solvent, in addition to the other reagents that are eventually used, remains important since a variation of each of these factors could affect the robustness of the cell-based assay by influencing the live cells (Ghanemi, 2014a), and therefore the assay's results. Another important element is the choice of the positive control, which is in many cases a commonly used drug that is well studied and well known for the activity we are about to test. Importantly, the use of negative controls assures a better interpretation of the results since it allows us to distinguish the effects of the tested drugs from those due to other elements such as the reagents or the cell culture medium ingredients.

For instance, many pharmacological discoveries related to one of the most important pharmacological targets, G protein coupled receptors (Ghanemi, 2013, 2014c, 2015; Ghanemi et al., 2013), have been made, thanks to cell cultures and the related bio-molecular methods. We expect more advances due to the high diversity of the existent cell strains and the similarities that exist between the pathways within those cells and some human disease mechanisms we want to elucidate in order to treat the underlying causes instead of just managing the symptoms. Yet, an active compound does necessary mean a future drug since toxicological studies (Wang et al., 2014; Abdi, 2013), chemical investigation, clinical trials and legal issues may exclude a compound from further development processes towards a recognized drug. However, cell culture-based assays cannot provide the full pharmacological profile since the data they provided are limited to some molecular and cellular aspects such as pharmacodynamic, biochemical pathways and genetic variations.

Since cell-culture studies focus on isolated cells apart from tissues or organisms, the influence of some elements that can interfere with the pharmacological receptors for example, including some chemical environments (Ghanemi et al., 2013), hormones and fluid pressure cannot be studied. Importantly, some pharmacokinetic parameters cannot be studied by cell cultures, and animal experiments remain required to achieve this purpose. Focusing on the challenges facing the application of cell culture techniques in drug discovery and overcoming them would further exploit this important method for drug discovery and drug development research.

## Acknowledgment

Abdelaziz Ghanemi is the recipient of a 2013 CAS-TWAS President's Postgraduate Fellowship.

### References

Abdi, M.M., 2013. Chapter 9 – best practice in toxicological pathology. In: Faqi, A.S. (Ed.), A Comprehensive Guide to Toxicology in Preclinical Drug Development. Academic Press, pp. 213–236.

Boubertakh, B., Liu, X.-G., Cheng, X.-L., Li, P., 2013. A spotlight on chemical constituents and pharmacological activities of *Nigella glandulifera* Freyn et Sint seeds. J. Chem. 2013, 12.

Peer review under responsibility of King Saud University.

ELSEVIER Production and hosting by Elsevier


http://dx.doi.org/10.1016/j.jsps.2014.04.002

De Pasquale, A., 1984. Pharmacognosy: the oldest modern science. J. Ethnopharmacol. 11 (1), 1–16.
Ghanemi, A., 2013. Schizophrenia and Parkinson's disease: selected therapeutic advances beyond the dopaminergic etiologies. Alexandria J. Med. 49 (4), 287–291.
Ghanemi, A., 2014a. Biological properties and perspective applications of "bio-neuter" chemicals? Saudi Pharm. J. 22 (1), 1–2.
Ghanemi, A., 2014b. Is mapping borders between pharmacology and toxicology a necessity? Saudi Pharm. J. 22 (6), 489–490.
Ghanemi, A., 2014c. Psychiatric neural networks and neuropharmacology: selected advances and novel implications. Saudi Pharm. J. 22 (2), 95–100.
Ghanemi, A., 2015. Targeting G protein coupled receptor-related pathways as emerging molecular therapies. Saudi Pharm. J. 23 (2), 115–129.
Ghanemi, A., Boubertakh, B., 2014. Shorter and sturdier bridges between traditional Chinese medicines and modern pharmacology. Saudi Pharm. J. 49 (1), 1–5, http://dx.doi.org/10.1016/j.jsps.2014.02.010.
Ghanemi, A., He, L., Yan, M., 2013. New factors influencing G protein coupled receptors' system functions. Alexandria J. Med. 49 (1), 1–5.
Huryn, D.M., Wipf, P., 2014. Chapter 3 – natural product chemistry and cancer drug discovery. In: Neidle, S. (Ed.), Cancer Drug Design and Discovery, Second ed. Academic Press, San Diego, pp. 91–120.
Larkins, N., Wynn, S., 2004. Pharmacognosy: phytomedicines and their mechanisms. Vet. Clin. North Am. Small Anim Pract 34 (1), 291–327.
Wang, Y., Borlak, J., Tong, W., 2014. Chapter 6 – toxicogenomics – a drug development perspective. In: Yao, Y., Jallal, B., Ranade, K. (Eds.), Genomic Biomarkers for Pharmaceutical Development. Academic Press, San Diego, pp. 127–155.
Winquist, R.J., Mullane, K., Williams, M., 2014. The fall and rise of pharmacology – (Re-)defining the discipline? Biochem. Pharmacol. 87 (1), 4–24.

Abdelaziz Ghanemi
*Key Laboratory of Animal Models and Human Disease Mechanisms, Kunming Institute of Zoology Chinese Academy of Sciences, Kunming 650223, Yunnan Province, China*

*University of Chinese Academy of Sciences, Beijing 10049, China*
*E-mail address:* ghanemiabdelaziz@hotmail.com

Available online 20 April 2014