The Future of Pharmacology: Towards More Personalized Pharmacotherapy and Reverse Translational Research

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“Significant advances in pharmacotherapy have been made in the recent years, and it is an honour to take on the tasks and responsibilities of an editor in chief for the journal Pharmacology in this exciting, yet critical, moment in time. There has been a tremendous increase of therapeutics that were designed and developed based on biological insights. One prime example is the revolutionary progress made in cancer immunotherapy, hailed as a Breakthrough of the Year 2013 by the journal Science [1], and acknowledged with the Nobel Prize in Physiology or Medicine 2018, jointly awarded to James P. Allison and Tasuku Honjo (https://www.nobelprize.org/prizes/medicine/2018/summary/). On the other hand, there is a significant gap between the number of proposed drug targets based on current research approaches and new therapies on the market, which has also been referred to as the “valley of death” [2]. Despite reasons for optimism, further development is urgently required in light of interindividual differences in the treatment response and safety concerns, which demands a better understanding of biological processes and the underlying mechanisms of action [3, 4].

Clinical pharmacology, in particular in terms of pharmacogenomics and therapeutic drug monitoring, has played a pioneering role in precision medicine [5]. Insights on pharmacokinetic parameters, such as organ functions, or genetic variations in proteins such as CYP enzymes, drug transporters or HLA gene variants, have improved the individual efficacy and safety of drugs [5]. Reverse translational research approaches, from bedside to bench, are expected to reveal novel drug targets or to identify clinical subtypes of disease for more informed and individualized drug treatment [2, 6]. The increasing availability of biobanks and databanks, high-throughput methods, and computational tools may prove invaluable in facilitating precision medicine and reverse translational research [2, 7–10]. Both clinical and experimental pharmacologists are likely to be exposed not only to a significant body of new scientific evidence and increased

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The Future depends on what you do today.”
– Mahatma Gandhi.
complexity but also to novel opportunities for individualized drug treatment. Historically, many important drug discoveries were made upon induction on the basis of empirical observations, eventually transforming plant- or microorganism-derived substances into a therapeutic compound. Typically, this aspect is favourably perceived in public opinion, eventually exploited for marketing purposes, and often expressed in normative, sometimes emotional, statements. But these “gifts” from nature come at the cost of off-target effects, as co-evolutionary pressure for organ-specific effects, such as of cardiac glycosides in *Digitalis purpurea* on mammalian heart function, appears rather unlikely. While anecdotal and accidental observations may have their value, there is a need to explore molecular mechanisms and biological processes for improved opportunity recognition and a more rational design of drugs and clinical trials [11]. Challenges remain for the pharmacologist to better understand the mechanisms of certain established drugs, such as the pluripotent anti-inflammatory effects of steroids or high-dose intravenous immunoglobulin preparations [12, 13]. Thus, there is a call for the modern pharmacologist to actively engage in basic and translational research and for the field to adopt new domains that were not traditionally linked to pharmacology.

In the years to come, the field of pharmacology will be expected to respond to the increasing demand for improved and individualized approaches to drug safety and efficacy. The journal *Pharmacology* shall provide a platform that fosters communication between clinical and experimental pharmacologists, toxicologists and researchers in all areas of Biomedical Sciences. Such interdisciplinary exchange will be required to shape pharmacology in a way that addresses current shortcomings and prepares for the welfare of future generations.

**Disclosure Statement**

The author declares no conflicts of interest.

**References**