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Editorial Recent Advances and Novel Strategies for the Development of Biomedical Therapeutics: State-of-the-art and Future Perspectives

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Abstract

This special issue is published in International Journal of Pharmacology (Vol. 13, Issue 7) with twenty peer-reviewed articles on recent advances and novel strategies for the development of biomedical therapeutics, immunomodulatory agents, delivery of drugs, and vaccines for safeguarding various health issues. The topics/themes covered include: Advances and progress in developing vaccines to counter the threats of Zika virus; Quinazolinone derivatives as a potential class of compounds in Malaria drug discovery; Innovations in the treatment options towards drug-resistant tuberculosis; The role of antioxidants in designing effective drugs for life threatening ailments; Promising anti-diabetic drugs, medicines and herbs; Medicinal values and beneficial applications of Psyllium husk (Plantago ovata), Green tea (Camellia sinensis); Medicinal applications of Stevia rebaudiana, a potential zero calorie sweetener, steviol glycosides; Anticancer and nutraceutical potentialities of phytase/phytate; Cell penetrating peptides as therapeutic vehicles and their use as anticancer peptide; Biomedical applications of pentatricopeptide repeat directed RNA editing with regards to diseases, cancers, and drugs; Next-generation sequencing for drug designing and cancer treatment; Progress towards various approaches from drug discovery to drug targeting; Advantages of selective drug distribution in cancer treatment with special reference to Brentuximab vedotin; G-protein coupled receptors in revolutionizing drug discovery and pharma based research; Bio-inspired synthesis of silver nanoparticles to combat antimicrobial resistance and other pharmacological potentialities; Usage of biomaterials-based hydrogels in biomedical sectors and drug delivery potentialities; Biomedical applications and utilization of diverse nanomaterials; Role of nanotechnology in animal and poultry nutrition; Applications of chromium in poultry nutrition and health, and the toxic effects. The articles published would be useful for medical and veterinary professionals, clinicians, researchers, students/scholars, animal producers, the pharmaceutical industry and biomedicine experts.

Key words: Biomedicine, therapeutics, drugs, medicines, herbs, drug delivery, immunomodulation, vaccine, nanotechnology, disease, health

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The living beings including humans and animals heavily rely on the medicinal arena for any or many reasons throughout their life span. This dependence is even more during various types of illnesses or unhealthy/unwell circumstances. Therefore, the current research in biomedical at large and pharmaceutical, in particular, is aiming to design novel strategies to develop products with ensured quality and efficacy at a higher level. Moreover, the implementation of such unique strategies has been increasingly exploited than ever before to help for an enhanced/better guality of patient lives securely by avoiding and/or limiting drug abuse, or severe adverse effects of in practice traditional therapies. Such practices are also important to improve and/or enhance the progression rate from the traditional biological assays to more advanced studies using animal models. The biomedical sector of the modern world has become a Trojan horse; so far, various methodological approaches including in vitro, in vivo and ex vivo techniques have been exploited and the future seems to be even brighter with a plethora of potential biomedical therapeutics waiting to be realized.

Following a careful consideration of the points mentioned above, this special issue was designed to provide a platform to share comprehensive information on recent trends and in various therapeutic advances regimens, immunomodulatory agents, vaccines to effectively combat important diseases and other health problems, both infectious and non-infectious, posing a challenge to the humans and animals. A special focus was given to the development and applications of emerging and valuable alternate/complementary frontier therapeutic and immune enhancing options especially in the era of emerging drug resistance in microbial pathogens and emerging and re-emerging pathogens.

This special issue is published with review articles on demanding topics and themes as per the above mentioned vision and aims/ scope and researchers from eight countries including Mexico, Australia, India, China, Pakistan, Egypt, Ethiopia and Turkey contributed their valuable review compilations. A brief overview of the review articles published is presented below.

The first review article by Munjal *et al.*, has specifically targeted diverse vaccines available or in clinical trials or under development for ZIKV prophylaxis. The recent outbreaks of Zika virus infections have threaten the mankind because of its reformed status from a very mild self-limiting febrile virus to a highly pathogenic virus; resulted in causing congenital brain abnormalities including microcephaly and Guillain-Barre' Syndrome (GBS)-a neurological disorder. The virus is now

fetching the attraction of researchers throughout the globe to come up with an effective vaccine and drug repurposing against Zika virus. The next review by Khandia *et al.*, is on Cell Penetrating Peptides (CPP) as therapeutic vehicle molecules, encompass their use as anti-cancer peptide and provides glimpse of its site-specific targeting in achieving several goals viz. enhancement in protein expression, gene silencing, formation of pleuripotent cells, reduction in inflammation and apoptosis, trans-epithelial transport, neuroprotection, ischemia treatment, treating insulin disorders, delivery of nucleic acids and agricultural pest control.

The 3rd review article by Li Chang *et al.*, describes the medicinal plant Psyllium husk (*Plantago ovata*) as a potent hypocholesterolemic agent in animal, human and poultry and especially its application as a safe feed additive in poultry farming for the production of organic and low cholesterol designer egg and meat. Saeed *et al.*, published the 4th review article on Green tea as an important herb, describing its phytochemistry, modes of action and beneficial applications in humans and animals for safeguarding different health issues (antioxidant, antimicrobial, anticarcinogenic, anti-stressor, medicinal properties).

Next-Generation Sequencing (NGS) is an emerging field for drug designing and development as well as an omics approach for cancer treatment. Kumar *et al.*, compiled a critical review of multiple approaches of NGS in development of anti-cancer drug including biomarkers based diagnosis and recent trends of targeted capture technology based personalised medicine in cancer therapy (Article 5). Nanotechnology is the promising and emerging technology that has tremendous potential to revolutionize agriculture and livestock sectors globally. Gopi *et al.*, presented the role of nanoparticles in animal and poultry nutrition, as 6th review article, covering the production of nanoparticles, modes of action and applications of nanotechnology in formulating feed additives and food processing and future prospective.

Diabetes is an important disease with global prevalence and rising incidence, representing a major health issue owing to its multisystem involvement and serious complications. Successful treatment of diabetes still remains a challenge and worldwide research is focused on these aspects. Yatoo *et al.*, presented the 7th review article on promising anti-diabetic drugs, medicinal plants and herbs, highlighting the conventional and new classes of drugs as well as advances in drugs and medicine for treatment of diabetes.

Bule *et al.*, provide an overview of the recent advances in the treatment options towards drug-resistant Tuberculosis (TB). They discussed that the number of TB deaths has been unacceptably increased to a large extent and most cases are preventable if people get in time access to health care for a diagnosis and the right treatment (Review Article 8). Hassani and co-workers presented an overview of the biomedical applications of pentatricopeptide repeat (PPR) directed RNA editing, evolution and application of PPR proteins and RNA editing on gene expression, diseases, cancers and drugs. According to the authors, it is worth to mention that correct RNA editing maintains the cell functionality and organism development and any imbalance in RNA editing machinery may provoke diseases and cancers (Review Article 9). Magbool et al., describe various approaches from drug discovery processes to drug targeting mechanisms. Recent advancement in the drug design and development process are discussed with particular reference to bioinformatics-a potent tool for the pharmaceutical sector (Review Article 10).

A review from Villela-Martinez and colleagues presents advantages of selective drug distribution in cancer treatment with special reference to Brentuximab Vedotin. They have discussed the problem of selectivity of the current antineoplastic treatments and how advances in biological drugs have led to improving its selective toxicity (Review Article 11). Irshad et al., discuss the anticancer and nutraceutical potentialities of phytase/phytate. According to the authors, considering all the normal physiological facts present in our body, the phytase/phytate supplementation strongly argue in favour of its inclusion as an essential nutrient. Phytase/phytate-containing natural products have some inherent characteristics that make them a potent candidate for biomedical and pharmaceutical applications (Review Article 12). Bule and co-workers stressed on quinazolinone derivatives as a potential class of compounds in Malaria drug discovery. With the advent of recent technologies, quinazolinone-based pharmaceuticals can be synthesized with higher efficacy. Owing to their inherent bioactive functionalities, guinazolinone derivatives have been extensively exploited in various biomedical sectors with a particular reference to Malaria (Review Article 13). Bilal et al., focus on the utilization of vast diversity of plants in the bio-inspired synthesis of silver nanoparticles to combat antimicrobial resistance (AMR) and also to present other pharmacological potentialities. According to the authors, nanoparticles engineered via Green routes offer important antibacterial activities against a wider spectrum of pathogenic microbes (Article 14 in this issue).

A review by Pranveer Singh reports the significance of protein interactions to understand the physiological processes. Interactions involving G-protein coupled receptors (GPCRs) are crucial as these are target for several marketed drugs and drug candidates in clinical trials. However, these are difficult to purify and study in their native form thus hampering their study. Advent of Surface Plasmon Resonance (SPR) coupled with the advantage of requiring minimal protein, facility to re-create membrane mimetic environment provides excellent opportunity to study GPCRs, revolutionizing the drug discovery and pharma based research (Review Article 15).

In recent years, biomaterials-based hydrogels are gaining high attention owing to their beneficial applications in various biomedical sectors and offer unique dimensions in changing the dynamics of 21st-century drug delivery applications. Villalba-Rodríguez and colleagues reviewed biomaterials [chitosan, poly(lactic-co-glycolic acid) (PLGA) and bacterial cellulose] based hydrogels and their drug delivery potentialities along with presenting future directions as well as addressing the research gaps and outstanding questions for further explorative research to be performed (Review article 16).

Antioxidants prevent oxidative damage by free-radical scavenging; a review by Baunthiyal et al., is highlighting the role of antioxidants in prevention as well as treatment of disorders which occur due to free radicals. The authors have included various antioxidant molecules of different origin which can be considered as effective drug contenders for life threatening ailments (Review Article 17). Nanotechnology is the latest intruder in the medical arena. Diverse nanomaterials viz. carbon nanotube, nanocrystals, nanoparticles, inorganic nanoparticles, metal-based nanoparticles and polymeric nanoparticles etc. are being used for biomedical applications. The review by Raghav et al., have facilitated the audience to know about the various nanomaterials and their utilization in severe diseases (for instance, cancer etc.) at length. This review also focuses on the most relevant and popular nanomaterials and explores the biomedical applications of nanomaterials (Review Article 18).

Farag *et al.*, described the role of chromium in poultry nutrition and health, highlighting its beneficial applications and toxic effects. Chromium is one of the essential minerals which is required for improving productive performance and health issues. This article illustrates the positive and negative impacts of chromium, physical and chemical proprieties, practical applications in poultry nutrition, production, enhancing immunity and health and a special reference to its toxic effects.

Approximately 9% population of the world is diabetic and scientific community is searching potential artificial sweetener;

which has little or no health hazards. Review by Mathur *et al.*, on *Stevia rebaudiana*, a potential zero calorie sweetener, is immensely sweet in taste due to the presence of steviol glycosides in the leaves of the plant. Ascribed to the sweet property, it has high commercial value especially for diabetic patients. Its marketing is in log phase of its growth in present epoch. The review focuses on photochemistry, medicinal applications, pharmacokinetics and safety evaluations of stevia products and its future prospects (Review Article 20).

We believe that owing to the broader medical coverage with high-quality contributions the present special issue will represent an excellent source of information for the readers of the prestigious journal International Journal of Pharmacology. In summary, this special issue was closed with twenty (20) review articles which could be useful for medical and veterinary professionals, clinicians, researchers, students/ scholars, animal producers, the pharmaceutical industry and biomedicine experts. By this means, we, the whole guest editorial team, would like to express our gratitude to all the contributors for their support and hard work to make this special issue compilation a reality.

The guest editors are grateful to Mr. M. Sarwar, Executive Editor of the journal for providing opportunity to publish this special issue as well as Academic Editors for processing all the articles.



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Dr. Kuldeep Dhama, is working as Principal Scientist in the field of diagnosis, vaccine development, prevention and control of important livestock and poultry diseases including zoonosis; especially in the areas of microbiology, immunology, virology, biotechnology and molecular biology. Handled 16 Research Projects, Guided 16 M.V.Sc./P.D. scholars. He has to his credit 500 publications in various National and International journals, books, magazines. Member of 17 Professional/Scientific Societies and honored with 45 Best Paper Awards. Organized 10 Conferences/Symposium/Workshops/Training programmes in various capacities. Worked as Nodal Officer, WTO; Member, Wildlife Health Specialist Group (IUCN). Awarded NAAS (National Academy of Agricultural Science, India) Associateship (Young Scientist Recognition). Working as Editor and Referee of several scientific Journals/Magazines of repute. h-index = 27, 3356 citations.



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Dr. Hafiz M. N. Iqbal is a full-time Research Professor at Tec de Monterrey, Mexico. He completed his PhD in Biomedical Sciences with specialization in Applied Biotechnology & Materials Science at the University of Westminster, London, UK. His PhD thesis is centered on the development of bio-composites with novel characteristics through enzymatic grafting. Dr. Iqbal has guest edited couple of special issues and served as an Editorial Board member for several peer-reviewed journals. He is also a member of Reviewer Panel for Research Proposals for The Research Council of Oman and Ministry of Education and Science, Almaty, Republic of Kazakhstan. Dr. Iqbal has published more than 100 scientific contributions in the form of Research, Reviews, Book Chapters and Editorials. Dr. Iqbal has an H-index = 19 along with more than 1000 citations. Dr. Iqbal has a collaborative network with national and international institutes/universities across the globe. His research interests include biomaterials with novel characteristics for biomedical and pharmaceutical applications, antimicrobial, biocompatible and biodegradable bio-composites for bio-sectors, enzymatic grafting: composites development and characterization, biomedical applications of pristine and grafted materials, particularly infection-free wound healing, bio-catalysis: enzyme kinetics, purification, characterization, immobilization, and industrial applications of enzymes, biomaterials for bioenergy, fermentation process development, production of enzymes, and other industrial products using agro-industrial wastes and by-products, liquid and solid waste management – (re)-valorization of agro-industrial wastes and by-products, and bioremediation of textile dyes and effluents and other hazardous pollutants.