World Bulletin of Public Health (WBPH)
Available Online at: https://www.scholarexpress.net
Volume-40, November 2024
ISSN: 2749-3644

ONCO MED-CHEMISTRY

Leader: Yusuphodjayeva Hurshida Sobirovna
Senior Lecturer, Department of Medical Biological Chemistry, TMA
Leader: Islamova Zulfiyahon Saidg`anihojanovna
Associate Professor
Executor: Miraziz Muhammadiev Maksudovich
Student in TMA (faculty 1 120-B)

Article history:

Received: September 14th 2024
Accepted: October 10th 2024

Abstract:

Onco Med-Chemistry focuses on designing and developing cancer therapies by integrating chemistry, biology, and pharmacology. It targets processes similarly carcinogenesis, tumor advancement, and drug resistance to create agents such as kinase inhibitors, immune checkpoint modulators, and antibody-drug conjugates. Tools like structure-based design and high-throughput screening are vital for innovation in this field.

Keywords: oncology, medicinal chemistry, cancer therapy, kinase inhibitors, immune modulators, epigenetics, drug resistance.

INTRODUCTION

Onco Med-Chemistry is a specialized branch of medicinal chemistry dedicated to combating cancer through the rational design and development of therapeutic agents. This interdisciplinary field combines insights from organic chemistry, pharmacology, and oncology to address the complexities of cancer biology. By targeting key pathways involved in tumor initiation, progression, and resistance, Onco Med-Chemistry aims to create innovative treatments with improved efficacy and specificity. Advances in technologies like structure-based drug design, computational chemistry, and high-throughput screening have revolutionized the field, enabling the discovery of small molecules, biologics, and hybrid therapies that modulate specific cancer targets. With a focus on unmet medical needs, Onco Med-Chemistry plays a crucial role in improving patient outcomes and shaping the future of cancer treatment.

DISCUSSION

The field of Onco Med-Chemistry has demonstrated significant advancements in the design and optimization of cancer therapeutics. Through the application of structure-based drug design (SBDD) and high-throughput screening (HTS), researchers have successfully developed novel classes of drugs, including kinase inhibitors, immune checkpoint inhibitors, and epigenetic modulators. The integration of computational methods has enhanced precision in identifying lead compounds, reducing development timelines, and improving the drug-likeness of candidates.

Key challenges remain in overcoming drug resistance mechanisms, optimizing the safety profiles of therapies, and targeting "undruggable" pathways in cancer biology. Innovations such as PROTACs (proteolysis-targeting chimeras) and antibody-drug conjugates (ADCs) have shown promise in addressing these gaps, demonstrating superior selectivity and efficacy in preclinical and clinical studies. Furthermore, an emphasis on biomarker-driven drug development has enabled the creation of personalized therapies, aligning treatment options with specific genetic or molecular tumor profiles.

Despite these advancements, issues such as off-target effects, tumor heterogeneity, and limited therapeutic windows necessitate continued research. Collaboration across disciplines, combined with advances in drug delivery systems and bioinformatics, will further propel the field towards overcoming these limitations and delivering transformative cancer therapies.

RESULTS

1. **Kinase Inhibitors**: Several newly developed kinase inhibitors have demonstrated enhanced selectivity, minimizing off-target toxicity. For example, next-generation inhibitors have shown efficacy in overcoming resistance to earlier-generation drugs like EGFR or BRAF inhibitors.
2. **Immune Checkpoint Inhibitors**: Novel molecules targeting PD-1/PD-L1 and CTLA-4 pathways have exhibited improved response rates in advanced solid tumors, with combinations yielding synergistic effects.
3. **Epigenetic Agents**: Small molecules targeting histone deacetylases (HDACs) and bromodomain-containing proteins (BETs) have entered

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clinical trials, showing potential in cancers resistant to conventional therapies.

4. **Antibody-Drug Conjugates (ADCs)**: Advancements in linker and payload chemistry have led to ADCs with higher efficacy and lower systemic toxicity, broadening their application in both solid and hematologic malignancies.

5. **Targeting Tumor Microenvironment**: Experimental drugs addressing hypoxia, angiogenesis, and immune suppression in the tumor microenvironment have shown promise in preclinical studies, enhancing the efficacy of co-administered therapies.

These results underscore the transformative potential of Onco Med-Chemistry in addressing complex challenges in cancer treatment and underscore the need for sustained innovation in this dynamic field.

CONCLUSION

Onco Med-Chemistry has emerged as a cornerstone in the fight against cancer, offering innovative approaches to design and develop highly targeted and effective therapies. By integrating advancements in medicinal chemistry, computational tools, and an in-depth understanding of cancer biology, the field has delivered significant breakthroughs, including kinase inhibitors, immune checkpoint modulators, and antibody-drug conjugates. While challenges such as drug resistance, tumor heterogeneity, and off-target effects persist, ongoing research and technological progress continue to address these barriers.

The future of Onco Med-Chemistry lies in leveraging novel strategies like PROTACs, epigenetic modulators, and biomarker-driven personalized medicine. Additionally, collaboration across disciplines and incorporation of cutting-edge techniques, such as AI-driven drug discovery and advanced delivery systems, promise to further enhance therapeutic outcomes. By continuing to refine and innovate, Onco Med-Chemistry will play a vital role in transforming cancer treatment and improving the lives of patients worldwide.

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