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Recent Advances in Anticancer Drug Development: A Medicinal Chemistry Perspective

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Abstract:

The development of anticancer drugs over the past few years has been heavily influenced by developments in the field of medicinal chemistry, especially due to the convergence of rational drug design, Structure-Activity Relationship (SAR) studies and novel drug delivery systems. The current review highlights animal-based preclinical trials that show the efficacy of a variety of therapeutic strategies such as targeted small molecules, natural product-derived molecules, prodrug delivery, nanomedicine, and combination therapies. Murine tumor models have shown evidence of significant improvement in the therapeutic outcomes, including reduction in tumor mass, apoptosis induced through mitochondrial and caspase pathways, angiogenesis inhibition, and pharmacokinetic and bioavailability. The use of the sophisticated animal models, which include xenograft, syngeneic, orthotopic and the genetically engineered mouse models, have offered in-depth information about tumor biology, drug mechanism and response to therapy under controlled conditions. Also, there is a promising prospect of nanotechnology-based delivery systems and prodrug strategies to enhance tumor-specific targeting and reduce systemic toxicity. Although these results are promising, a number of issues remain, such as translational differences between the animal model and clinical response, heterogeneity in the tumor, and the safety of highly potent compounds. In sum, this review in conjunction shows the central role of medicinal chemistry in the development of next-generation anticancer therapies and the significance of balancing the application of chemical innovation with biological validation to realize more effective and safer cancer therapies.

Keywords: Anticancer drug development, Medicinal chemistry, Animal models, Structure–Activity Relationship (SAR), Targeted therapy, Nanomedicine, Prodrugs, Combination therapy.

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1. INTRODUCTION

Cancer has been a big worldwide health problem with uncontrolled tumor growth, invasion, and metastasis, and new therapeutic approaches have to be designed continuously to be more effective. The field of medicinal chemistry has greatly changed the approach to developing anticancer drugs in the last several decades because it has become possible to design and optimize the compounds that are more specific and less toxic. Although proven to be effective in animal models by inhibiting tumor growth, traditional chemotherapeutic agents are not selective and have severe systemic side effects[1]. Modern methods, on the contrary, are concerned with specific therapy, prodrug delivery, and drug delivery using nanotechnology, which are aimed at increasing the concentration of drugs at the tumor foci and reducing their toxicity to normal tissues. To a large extent, these innovations have been influenced by a better understanding of the molecular mechanisms behind cancer progression, such as dysregulated signaling pathways, apoptotic resistance, and dysregulated cell cycle control.

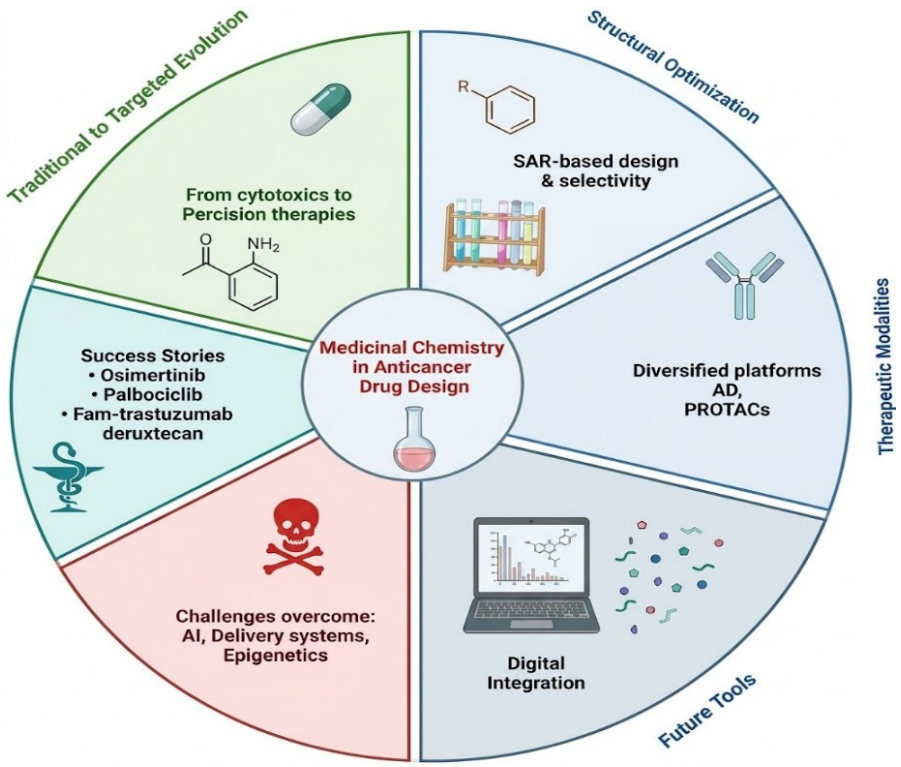

Figure 1: Medicinal Chemistry Perspective[2]

In the medicinal chemistry viewpoint, more recent developments focus on the combination of structure-activity relationship (SAR) studies and rational drug design to generate very potent and selective anticancer agents. Preclinical animal experiments have a significant part to play in the process as they give important information on drug efficacy, pharmacokinetics and safety profiles under controlled conditions. Targeted small molecule, derivatives of natural products, and combination therapies are some of the strategies that have shown promising outcomes of reducing tumor burden, angiogenic inhibition, and drug resistance in vivo. Accordingly, the ongoing revolution in medicinal chemistry not only increases the efficiency of drug discoveries but also develops subsequent generation anti-cancer agents, making it a crucial research field in coping with the increasing cancer burden[3].

1.1 Background and Context

Cancer is among the most prevalent causes of death on the planet and is marked by the unregulated growth, invasion and spreading of cells. The molecular and genetic basis of cancer has been studied and developed over the years and has thus led to the formation of more specific and efficient therapeutic interventions[4]. Medicinal chemistry has been instrumental in this development through facilitation of rational design, synthesis and optimization of anticancer therapeutics. The lack of specificity of traditional chemotherapeutic drugs, though promising in terms of reducing tumor burden in animal models, is often related to severe side effects. Recent advances, in turn, concentrate on targeted therapies, prodrug systems, and nanotechnology-based drug delivery, which strive to achieve specificity, decreased toxicity, and improved therapeutic results in preclinical models.

1.2 Objectives of the Review

This review will focus on the following main objective:

- To conduct the analysis of the current progress in developing anticancer drugs through animal-based preclinical research, pay attention to the medicinal chemistry methods targeted therapy, prodrugs, and nanomedicine.
- To aim is to determine the contribution of Structure-Activity Relationship (SAR) and rational drug design to the optimal anticancer drug efficacy, selectivity and pharmacokinetic properties.
- To determine the usefulness of different animal models and techniques in tumor progression, drug response, and therapeutic outcomes.
- To analyze the biological effects of novel anticancer agents, such as the reduction of tumor, apoptosis and angiogenesis inhibition in animal systems.
- To determine the existing constraints, translation issues and future research prospects in anticancer drug development driven by medicinal chemistry.

1.3 Importance of the Topic

The significance of this subject is that it can fill the gap between chemical innovation and its implementation in cancer therapy biologically. As cancer becomes more complex and conventional therapies have their drawbacks, more specific, effective and less-toxic therapies are increasingly required. Preclinical studies are important to ensure the safety and effectiveness of the newly developed compounds before being used clinically using animals[5]. Knowledge of new developments in medicinal chemistry can not only improve the process of drug discovery but also help in the creation of new generation anticancer drugs. The review can thus play a critical role in shedding light on the current developments, and outlining the current challenges and future research directions in the area of anticancer drug development.

2. PRECLINICAL ANTICANCER DRUG DEVELOPMENT: ANIMAL STUDIES AND KEY INSIGHTS

Recent animal-based preclinical research has shown considerable advancements in the development of anticancer drugs using rational design, targeted therapy and advanced delivery systems and have demonstrated tumor reduction, induction of apoptosis and angiogenesis inhibition[6].

2.1 Overview of Recent Research Studies

Recent preclinical trials have shown that there is considerable development of anticancer agents by:

- Rational drug design of a particular oncogenic pathway.
- Kinase inhibitors and enzyme-specific molecules.
- Application of hybrid molecules that comprise several pharmacophores.
- Exploration of natural product derivatives.

Recently, a series of these synthesized compounds have been demonstrated to exhibit tumor growth inhibition, angiogenesis, and apoptosis induction in tumor models in mice, and have been shown to have therapeutic potential[7]. These researches are now more directed towards targeting molecular pathways that contribute to cancer progression, including dysregulated cell signaling pathways, aberrant control of the cell cycle and resistance to apoptosis. As an example, heterocyclic compounds, e.g., quinazolines and pyrimidines, have been shown to be highly effective anticancer agents because of their ability to inhibit important signaling pathways, e.g., epidermal growth factor receptor (EGFR) and other tyrosine kinases. Also, hybrids of molecules that combine several pharmacophores have proven to be more effective since they can be used to target numerous biological targets at the same time, decreasing drug resistance. Natural product derivatives and, especially, those of plant and microbial origin remain an important aspect, offering structurally diverse and biologically active scaffolds[8].

2.2 Methodologies Used in Animal Studies

The potential therapeutic agents are also tested in preclinical anticancer research using a variety of well-established animal models and approaches to analysis, which research can use to assess the safety, efficacy, and the biological behavior of promising therapeutic agents in controlled conditions. Such models play a vital role in understanding tumor biology, drug mechanisms as well as treatment responses prior to the clinical trials[9].

- **Xenograft tumor models:** These are the implantation of the animal tumor cells in the immunocompromised mice (including nude or SCID mice). It is a common model of testing the antitumor effect of novel drugs because animal cancer cells can be cultivated in a living host. It is a tool that is useful in screening anticancer compounds as researchers can monitor tumor size, progression, and response to treatment. Nevertheless, it might not completely recreate immune-related interactions because the host does not have a functional immune system.

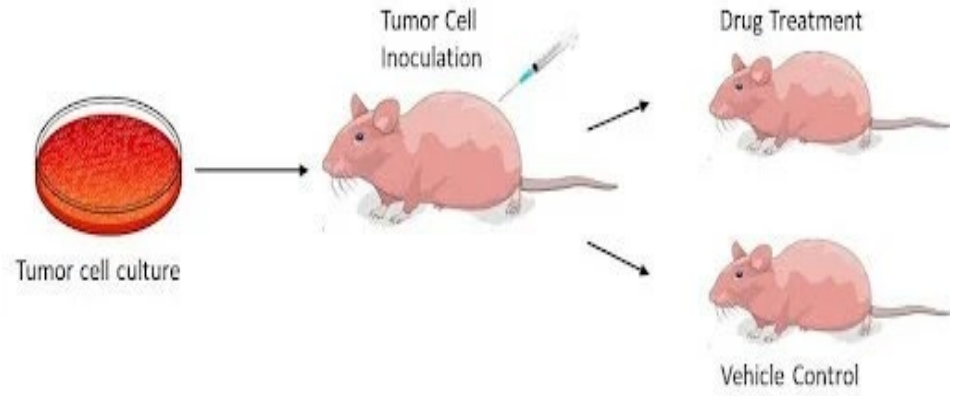

Figure 2: Xenograft Tumor Models[10]

- **Syngeneic models:** In this method tumor cells of the same genetic origin as that of the host animal are placed in immunocompromised mice. Such models especially come in handy during the study of the role of the immune system in cancer progression and treatment especially in the development of immunotherapies. As they do not destroy the immune system, they offer more physiologically relevant information on tumor-immune interactions[11].
- **Orthotopic models:** These models include implanting tumor cells into the natural location of the tumor (e.g., the pancreatic cancer cells into the pancreas). This is a more realistic imitation of the natural tumor microenvironment, such as local tissue architecture, blood supply, and metastatic behavior. Orthotopic models are very useful in the study of tumor invasion, metastasis and organ specific response to drugs.
- **Genetically engineered mouse models (GEMMs):** GEMMs are engineered by inducing targeted genetic mutations leading to cancer development, which is quite similar to the genetic and molecular characteristics of animal cancers. These models can allow researchers to investigate the initiation and progression of cancer, as well as its response to therapies, in a more biologically relevant environment. They are especially relevant in studying targeted therapies and the oncogenic pathways.

Pharmacodynamic (PD) and pharmacokinetic (PK) analyses are common to determine the behavior of a drug in the body. Pharmacokinetics measures drug absorption, distribution, metabolism, and excretion (ADME) and pharmacodynamics measures the biochemical and physiological action of the drug and its mechanism of action. Combined, PK/PD studies can be used to identify the most effective dosage regimens and therapeutic windows[12].

2.3 Findings and Outcomes

Preclinical anticancer research involving animal models has provided great information on the therapeutic capability and biological impact of recently discovered compounds. These studies offer important information about drug efficacy, mechanisms of action, and enhances drug delivery systems, thus informing future clinical development[13].

- **Significant tumor volume reduction:** A significant reduction in tumor size after exposure to investigational drugs is one of the major effects to be realized in the animal

studies. Measurement of tumor volumes over time is a direct measure of therapeutic effectiveness.

- **Induction of apoptosis via mitochondrial and caspase pathways:** One of the essential processes that are involved in the action of most drugs against cancer is programmed cell death (apoptosis). It has been reported that a number of the compounds induce intrinsic apoptotic pathways including mitochondrial dysfunction resulting in the release of cytochrome c and subsequent caspase (like caspase-3 and caspase-9) activation in animal models[14].
- **Inhibition of angiogenesis and metastasis:** The other finding is that some anticancer agents can prevent angiogenesis- the development of new blood vessels which feed tumors. These medications can effectively starve tumors and restrict their growth because angiogenic factors like vascular endothelial growth factor (VEGF) are targeted by the medications.
- **Improved bioavailability with novel drug formulations:** Poor solubility and bioavailability is an issue with many traditional anticancer drugs. Preclinical research has demonstrated that Nano formulations and systems that involve the use of carriers can substantially improve absorption and systemic availability of these drugs[15].

Moreover, liposomes and polymeric nanoparticles are the nanoparticle-based drug delivery systems that have become promising in animal models. These systems are useful in the targeted delivery of drugs by accumulating preferentially in tumor tissues in processes such as the enhanced permeability and retention (EPR) effect[16].

2.4 Critical Evaluation

Strengths

Preclinical studies with animals have various significant benefits that render them essential in the development of anticancer drugs. The availability of controlled experimental conditions is one of the major strengths, since dosage, environmental and genetic background could be well controlled to ensure consistency and reliability of results. Another function of these models is studying the drug mechanisms in vivo, whereby the researcher can observe the interaction of a drug in a living system, including its impact on tumor growth, immune response and molecular pathways. Also, these studies are usually reproducible and cost-efficient relative to animal clinical trials, which allows conducting a large-scale screening of potential therapeutic agents[17].

Weakness

Even though animal studies are important, they also have significant limitations which should not be overlooked. The first one is the fact that animal and human physiology can vary greatly, causing a mismatch in the effects of drugs among species and thus translational accuracy. Consequently, clinical outcomes have little predictive value most of the time; in other words, even successful results in animals do not necessarily translate to the same efficacy and safety in animals. Ethical factors are also a key aspect since animal research practices are questioned based on the welfare issues, thus requiring stringent regulatory measures and ethical standards. In addition, the tumor models are variable since two different models might not be able to reproduce the complexity and heterogeneity of animal cancers, which might limit the generalizability of results[18].

3. ADVANCED THERAPEUTIC STRATEGIES IN ANTICANCER DRUG DEVELOPMENT

Derivatives of natural products, prodrugs, nanomedicine and small molecules targeted have demonstrated considerable anticancer efficacy in animal models by increasing selectivity, efficacy and drug delivery and reducing toxicity. All these strategies enhance tumor inhibition, resistance to drugs, and pharmacokinetics, indicating their significance in contemporary medicinal chemistry-based anticancer development[19].

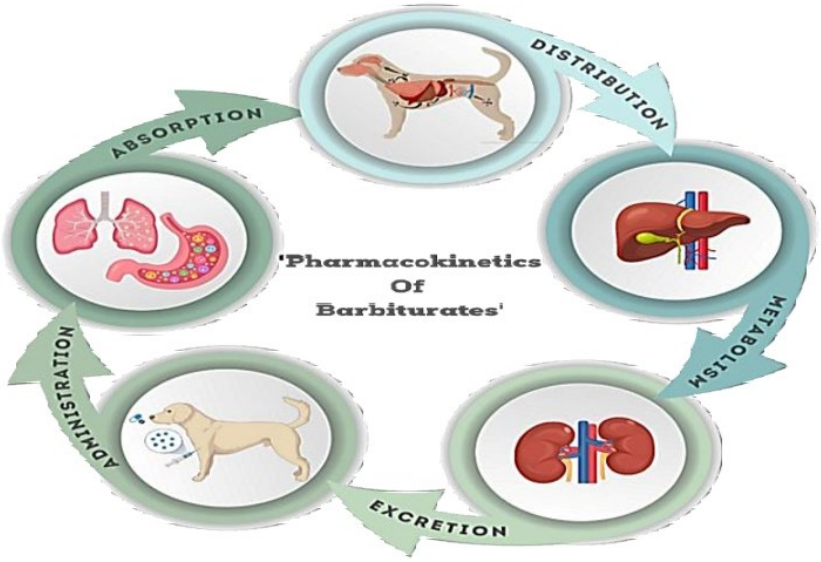

Figure 3: Pharmacokinetics of Barbiturates[20]

3.1 Targeted Small Molecules

Medicinal chemistry has greatly contributed to the creation of targeted small molecules that specifically bind to cancer-associated proteins including kinases, transcription factors and signaling enzymes. These compounds have shown high binding affinity and selectivity to molecular targets in animal models leading to effective tumor growth inhibition with minimum harm to normal tissues. These agents minimize off-target effects that are common with traditional chemotherapy since they target certain oncogenic pathways, including tyrosine kinase signaling. The research in structure-activity relationship (SAR) has been instrumental in the refinement of these molecules, to understand important functional groups that confer biological activity, which allows optimization of potency, selectivity, and pharmacokinetic properties with minimum toxicity[21].

3.2 Natural Product-Derived Anticancer Agent

Natural products remain a valuable source of anticancer agent because of their structural diversity and biological activity[21]. Alkaloids, flavonoids, and terpenoids are also compounds that have been widely tested on animal models and show a high level of antioxidant, antiprolliferative, and cytotoxic properties. Such agents are capable of regulating important signaling pathways implicated in cancer development such as cell cycle and apoptosis. Moreover, numerous natural products bring about programmed cell death via mitochondrial and caspase-mediated pathways. The pharmacological properties of natural scaffolds have also

been improved through chemical modification of natural scaffold to increase stability, solubility, and bioavailability which are usually the drawback of natural compounds[22].

3.3 Prodrug Strategies

Prodrug strategies are a promising technique in medicinal chemistry to address shortcomings of traditional anticancer drugs, including low solubility, limited bioavailability, and systemic toxicity. Prodrugs are non-active (or less active) forms which are changed into active forms in the biological system, usually in response to a particular tumor-associated condition. Prodrug formulations have shown decreased systemic toxicity in animal models by decreasing the exposure of normal tissues to active drug species, and increasing drug delivery to tumors. Mechanisms of controlled and targeted drug release include activation of enzymes or pH-sensitive cleavage, which are typical of tumor microenvironment. These are some of the strategies that enhance the therapeutic efficacy and safety profiles making prodrugs an exciting field in the development of anti-cancer drugs[23].

3.4 Nanomedicine and Drug Delivery Systems

Anticancer therapy has been transformed by nanotechnology-based drug delivery systems, which have improved the problems of drug solubility, stability, and targeted delivery. In animal models, nanocarriers like liposomes, dendrimers and polymeric nanoparticles have been shown to have better drug targeting by the enhanced permeability and retention (EPR) effect, where nanoparticles target certain tissues in the tumor preferentially. Such systems not only minimize the toxicity of normal cells due to non-specific distribution but also allow the targeted drug to be released in a sustained or controlled manner. Moreover, nanomedicine improves therapeutic performance by boosting drug concentration in the tumor location and improving pharmacokinetics. This method also facilitates co-delivery of various therapeutic agents, and it further increases its possibilities in treating cancer[24].

3.5 Combination Therapy Approaches

Combination therapy has become an effective approach in the development of anticancer drugs and this is especially in the development of drugs to overcome drug resistance and enhance response to treatment. Multiple drugs or therapeutic modalities have demonstrated synergistic effects in animal-based studies resulting in increased tumor suppression with multiple drugs or modalities as opposed to monotherapy. Such combinations are frequently aimed at multiple molecular pathways, thus decreasing the risk of resistance emergence and enhancing the overall effectiveness[25]. Moreover, the mixture methods may enable decreasing the dosage of individual medications, reducing the toxicity and preserving the therapeutic effect. This approach has been especially useful in complex cancers in which various signaling pathways play roles in disease progression, and is of current interest in preclinical studies.

4. STRUCTURE–ACTIVITY RELATIONSHIP (SAR) AND RATIONAL DRUG DESIGN IN ANTICANCER DEVELOPMENT

Structure Activity Relationship (SAR) A basic method in medicinal chemistry, Structure Activity Relationship (SAR) is a systematic method of correlating the chemical structure of a compound with its biological activity in animal models. With controlled changes introduced, including functional group, ring, stereochemistry, and electronic distribution, researchers can

learn which structural features are pivotal to anticancer activity. SAR studies of murine tumor models have shown that even small structural changes can dramatically affect target binding affinity, metabolic stability and general pharmacokinetic behavior. Such insights can be used to optimize lead compounds to become more potent, selective against cancer-specific targets, and less off-target, which will improve therapeutic performance[26].

Rational drug design is used in conjunction with SAR and its components are computational models, molecular docking, quantitative structure activity relationship (QSAR) modeling and virtual screening to determine the interaction of drug candidates with certain cancer-related protein. The best binding conformations can be identified and the molecules can be designed to fit in with the active sites of enzymes or receptors that are known to cause tumor progression. Such rationally designed compounds have shown better tumor inhibition, enhanced bioavailability, and good safety profiles in animal-based preclinical studies than the traditional agents. Also, the method has enabled the creation of multi-target-directed ligands capable of simultaneous regulation of multiple signaling pathways, which is required to deal with the complexity and heterogeneity of cancer[27].

Although this has been achieved, there are still learning curves in the translation of SAR findings to consistently safe and effective therapeutic agents[28]. Higher target specificity does not necessarily result in lesser toxicity because complicated biological systems in animal models will react to highly potent compounds in an unpredictable manner. Moreover, improving a balance between efficacy, stability, and safety is also a crucial challenge. However, the drug discovery pipeline is becoming stronger as continuous drug discovery incorporates SAR with sophisticated computational technologies and in vivo validation plans[29]. Altogether, SAR-directed rational drug design continues to be one of the pillars of current anticancer research and plays an important role in the design of more effective and specific therapeutic agents in preclinical research.

Table 1: Summary of Selected Literature on Anticancer Drug Development and Medicinal Chemistry[30]

Author(s) & Year	Study Focus	Methodology/Approach	Key Findings
Soukarieh et al. (2018)[31]	Quorum sensing in Pseudomonas aeruginosa as drug targets	Review of small molecule inhibitors targeting signaling pathways	Inhibition of quorum sensing reduced virulence and biofilm formation; potential alternative therapeutic strategy
Skok et al. (2019)[32]	Dual inhibitors of DNA topoisomerase II and other cancer targets	Structure-based drug design and biochemical assays	Dual-targeting compounds improved anticancer efficacy and reduced drug resistance

Gezici & Şekeroğlu (2019)[33]	Medicinal plants as anticancer agents	Review of plant-derived bioactive compounds	Alkaloids, flavonoids, and phenolics showed antioxidant, antiproliferative, and apoptosis-inducing effects
Finkbeiner et al. (2020)[34]	Role of phosphine oxides in drug discovery	Physicochemical and in vitro analysis	Improved solubility, metabolic stability, and binding affinity; useful in anticancer drug design
Dalvit & Vulpetti (2018)[35]	Fluorine NMR screening in drug discovery	Ligand-based fluorine NMR technique	Efficient identification of ligand–target interactions; rapid screening of compounds

5. DISCUSSION

The development of medicinal chemistry such as targeted therapy, nanomedicine, and SAR-guided design has greatly enhanced the efficacy of anticancer in animal models with respect to better selectivity, drug delivery, and multi-pathway targeting[36]. Nevertheless, issues of translational gaps, model constraints, and safety issues underscore the necessity of better preclinical models and incorporation of advanced computation methods to develop future drugs[37].

5.1 Interpretation and Analysis of Findings

The findings of animal-based preclinical researches show that current improvement in medicinal chemistry has greatly improved the design of anticancer agents. Targeted small molecules, prodrug systems, natural product derivatives, nanomedicine, and combination therapies are among approaches that have been shown to be very effective in minimizing tumor growth, causing apoptosis and preventing angiogenesis[38]. The combination of Structure-Activity Relationship (SAR) studies with rational drug design has also allowed the optimization of molecular structures and has enhanced the selectivity, binding affinity, and pharmacokinetic characteristics[39]. The results of these studies indicate that the current approaches to drug development are more precise in targeting and multi-pathway modulation, resulting in more effective anticancer therapy in animal models[40].

5.2 Implications and Significance

These findings have implications that are very important to the future of anticancer drug discovery. The shift towards targeted and mechanism-based therapy is a significant step towards creating treatments that are more specific and that have less systemic toxicity[41]. Nanomedicine and prodrug approaches offer novel approaches to drug delivery and bioavailability improvements, whereas combination therapies are the way to deal with the complexity of cancer by tackling multiple biological pathways at once. These advancements bring to the fore the importance of medicinal chemistry in the development of safer and more effective therapeutic agents to enhance the basis of future clinical translation[42].

5.3 Research Gaps and Future Directions

Although progressive developments have been seen in animal research, there are still a number of obstacles and gaps. One of the limitations is the translational distance between animal models and clinical outcomes because variations in physiology and tumor microenvironment may undermine predictive accuracy. Also, current models might not be able to fully model tumor heterogeneity, which restricts the generalizability of findings[43]. Research is further complicated by ethical issues and heterogeneity of experimental systems. Future research must aim to find more predictive and standardized animal models, the combination of more sophisticated computational methods like artificial intelligence to design medicines, and personalized and multi-targeted therapy. Another focus area should be on the efficacy-safety balance to enhance the rate of successful translation of preclinical results into effective clinical treatments.

6. CONCLUSION

The recent developments in the field of anticancer drug development on a medicinal chemistry background has shown significant improvement in the levels of therapeutic efficacy, selectivity as well as safety, especially in animal-based preclinical trials. Targeted small molecule integration, derivatives of natural products, prodrug, nanomedicine and combination therapies have greatly increased cell tumor suppression, apoptosis, and angiogenicity inhibition and have advanced pharmacokinetic and bioavailability characteristics. Structure-Activity Relationship (SAR) studies and rational drug design has also added to optimization of drug candidates and facilitated the creation of more specific and multi-targeted therapeutic agents. Irrespective of these developments, issues like translational gaps, tumor heterogeneity and safety issues remain and this underscores the importance of further predictive animal models and improved computation methods. On the whole, medicinal chemistry remains central towards developing the next generation anticancer therapies, and future studies ought to involve combining new design strategies with more effective preclinical validation to guarantee successful transfer to effective clinical treatments.

REFERENCES

1. Al-Karmalawy, A. A., Eissa, M. E., Ashour, N. A., Yousef, T. A., Al Khatib, A. O., & Hawas, S. S. (2025). Medicinal chemistry perspectives on anticancer drug design based on clinical applications (2015–2025). RSC advances, 15(43), 36441-36471.
2. Kumar, A., Singh, A. K., Singh, H., Vijayan, V., Kumar, D., Naik, J., ... & Kumar, P. (2023). Nitrogen containing heterocycles as anticancer agents: a medicinal chemistry perspective. Pharmaceuticals, 16(2), 299.
3. Gach-Janczak, K., Drogosz-Stachowicz, J., Janecka, A., Wtorek, K., & Mirowski, M. (2024). Historical perspective and current trends in anticancer drug development. Cancers, 16(10), 1878.
4. Olgen, S. (2018). Overview on anticancer drug design and development. Current medicinal chemistry, 25(15), 1704-1719.
5. Lu, D. Y., Lu, T. R., Xu, B., & Yarla, N. S. (2018). Anticancer drug developments, challenge from historic perspective. EC Pharmacology and Toxicology, 6, 922-936.

6. Magalhaes, L. G., Ferreira, L. L., & Andricopulo, A. D. (2018). Recent advances and perspectives in cancer drug design. Anais da Academia Brasileira de Ciências, 90(1 Suppl 2), 1233-1250.
7. Carugo, A., & Draetta, G. F. (2019). Academic discovery of anticancer drugs: Historic and future perspectives. Annual Review of Cancer Biology, 3, 385-408.
8. Thurston, D. E., & Pysz, I. (2021). Chemistry and pharmacology of anticancer drugs. CRC press.
9. Wu, G., Zhao, T., Kang, D., Zhang, J., Song, Y., Namasivayam, V., ... & Zhan, P. (2019). Overview of recent strategic advances in medicinal chemistry. Journal of medicinal chemistry, 62(21), 9375-9414.
10. Kumar, A., Bhagat, K. K., Singh, A. K., Singh, H., Angre, T., Verma, A., ... & Kumar, P. (2023). Medicinal chemistry perspective of pyrido [2, 3-d] pyrimidines as anticancer agents. RSC advances, 13(10), 6872-6908.
11. Li, X., Li, X., Liu, F., Li, S., & Shi, D. (2021). Rational multitargeted drug design strategy from the perspective of a medicinal chemist. Journal of Medicinal Chemistry, 64(15), 10581-10605.
12. Mäder, P., & Kattner, L. (2020). Sulfoximines as rising stars in modern drug discovery? Current status and perspective on an emerging functional group in medicinal chemistry. Journal of Medicinal Chemistry, 63(23), 14243-14275.
13. Jampilek, J. (2019). Heterocycles in medicinal chemistry. Molecules, 24(21), 3839.
14. Yet, L. (2018). Privileged structures in drug discovery: medicinal chemistry and synthesis. John Wiley & Sons.
15. Ghosh, A. K., & Brindisi, M. (2019). Urea derivatives in modern drug discovery and medicinal chemistry. Journal of medicinal chemistry, 63(6), 2751-2788.
16. Sutanto, F., Konstantinidou, M., & Dömling, A. (2020). Covalent inhibitors: a rational approach to drug discovery. RSC medicinal chemistry, 11(8), 876-884.
17. Brogi, S., Ramalho, T. C., Kuca, K., Medina-Franco, J. L., & Valko, M. (2020). In silico methods for drug design and discovery. Frontiers in chemistry, 8, 612.
18. Bakchi, B., Krishna, A. D., Sreecharan, E., Ganesh, V. B. J., Niharika, M., Maharshi, S., ... & Shaik, A. B. (2022). An overview on applications of SwissADME web tool in the design and development of anticancer, antitubercular and antimicrobial agents: a medicinal chemist's perspective. Journal of Molecular Structure, 1259, 132712.
19. Proschak, E., Stark, H., & Merk, D. (2018). Polypharmacology by design: a medicinal chemist's perspective on multitargeting compounds. Journal of medicinal chemistry, 62(2), 420-444.
20. Patrick, G. L. (2023). An introduction to medicinal chemistry. Oxford university press.
21. Modi, S. J., & Kulkarni, V. M. (2019). Vascular endothelial growth factor receptor (VEGFR-2)/KDR inhibitors: medicinal chemistry perspective. Medicine in Drug Discovery, 2, 100009.
22. Zhu, J., Mo, J., Lin, H. Z., Chen, Y., & Sun, H. P. (2018). The recent progress of isoxazole in medicinal chemistry. Bioorganic & Medicinal Chemistry, 26(12), 3065-3075.
23. Chunarkar-Patil, P., Kaleem, M., Mishra, R., Ray, S., Ahmad, A., Verma, D., ... & Kumar, S. (2024). Anticancer drug discovery based on natural products: from computational approaches to clinical studies. Biomedicines, 12(1), 201.

24. Akins, N. S., Nielson, T. C., & Le, H. V. (2018). Inhibition of glycolysis and glutaminolysis: an emerging drug discovery approach to combat cancer. Current topics in medicinal chemistry, 18(6), 494-504.

25. Ramsay, R. R., Popovic-Nikolic, M. R., Nikolic, K., Uliassi, E., & Bolognesi, M. L. (2018). A perspective on multi-target drug discovery and design for complex diseases. Clinical and translational medicine, 7(1), 3.

26. Jiménez, C. (2018). Marine natural products in medicinal chemistry. ACS medicinal chemistry letters, 9(10), 959-961.

27. Toenjes, S. T., & Gustafson, J. L. (2018). Atropisomerism in medicinal chemistry: challenges and opportunities. Future medicinal chemistry, 10(4), 409-422.

28. Mustafa, M., & Winum, J. Y. (2022). The importance of sulfur-containing motifs in drug design and discovery. Expert opinion on drug discovery, 17(5), 501-512.

29. Bhutani, P., Joshi, G., Raja, N., Bachhav, N., Rajanna, P. K., Bhutani, H., ... & Kumar, R. (2021). US FDA approved drugs from 2015–June 2020: a perspective. Journal of Medicinal Chemistry, 64(5), 2339-2381.

30. Boström, J., Brown, D. G., Young, R. J., & Keserü, G. M. (2018). Expanding the medicinal chemistry synthetic toolbox. Nature Reviews Drug Discovery, 17(10), 709-727.

31. Soukarieh, F., Williams, P., Stocks, M. J., & Camara, M. (2018). Pseudomonas aeruginosa quorum sensing systems as drug discovery targets: current position and future perspectives. Journal of medicinal chemistry, 61(23), 10385-10402.

32. Skok, Z., Zidar, N., Kikelj, D., & Ilaš, J. (2019). Dual inhibitors of human DNA topoisomerase II and other cancer-related targets. Journal of medicinal chemistry, 63(3), 884-904.

33. Gezici, S., & Şekeroğlu, N. (2019). Current perspectives in the application of medicinal plants against cancer: novel therapeutic agents. Anti-Cancer Agents in Medicinal Chemistry (Formerly Current Medicinal Chemistry-Anti-Cancer Agents), 19(1), 101-111.

34. Finkbeiner, P., Hehn, J. P., & Gnamm, C. (2020). Phosphine oxides from a medicinal chemist's perspective: physicochemical and in vitro parameters relevant for drug discovery. Journal of Medicinal Chemistry, 63(13), 7081-7107.

35. Dalvit, C., & Vulpetti, A. (2018). Ligand-based fluorine NMR screening: principles and applications in drug discovery projects. Journal of medicinal chemistry, 62(5), 2218-2244.

36. Tanwar DS, Kashyap G, Pandey A, Mahant H, Verma VS. Structure-Based Drug Design of Kinase Inhibitors for Targeted Cancer Therapy. Indian Journal of Pharmaceutical Chemistry and Analytical Techniques. Published online 2025:136-148. doi:10.64062/IJPCAT.VOL1.ISSUE4.11

37. Yu, C., Wang, Z., Sun, Z., Zhang, L., Zhang, W., Xu, Y., & Zhang, J. J. (2020). Platinum-based combination therapy: molecular rationale, current clinical uses, and future perspectives. Journal of medicinal chemistry, 63(22), 13397-13412.

38. Kashyap G, Pandey AP, Tiwari NT, Sahu MK, Verma VS. Meta-Analysis of Multi-Omics and Nanoparticle-Enhanced Therapeutics in Solid Tumors: Advancing Precision Oncology. Journal of Pharmaceutical Research and Integrated Medical Sciences. Published online February 18, 2026:63-76.

39. Dewangan G, Kumar N, Sahu VS, Kashyap G, Verma VSV. Realizing the Promise of Cancer Nanotechnology: From Therapeutic Platforms to Omics-Driven Precision Oncology and Clinical Translation. Journal of Pharmaceutical Research and Integrated Medical Sciences. Published online February 18, 2026:1-12.

40. Bian, M., Fan, R., Zhao, S., & Liu, W. (2019). Targeting the thioredoxin system as a strategy for cancer therapy: Miniperspective. Journal of medicinal chemistry, 62(16), 7309-7321.

41. Han, R., Yoon, H., Kim, G., Lee, H., & Lee, Y. (2023). Revolutionizing medicinal chemistry: the application of artificial intelligence (AI) in early drug discovery. Pharmaceuticals, 16(9), 1259.

42. Raimondi, M. V., Randazzo, O., La Franca, M., Barone, G., Vignoni, E., Rossi, D., & Collina, S. (2019). DHFR inhibitors: reading the past for discovering novel anticancer agents. Molecules, 24(6), 1140.

43. Wu, T., Qin, Z., Tian, Y., Wang, J., Xu, C., Li, Z., & Bian, J. (2020). Recent developments in the biology and medicinal chemistry of CDK9 inhibitors: an update. Journal of medicinal chemistry, 63(22), 13228-13257.