MedCrave
Step into the World of Research

Nursing and Care Open Access Journal

Opinion

Open Access

CrossMark

Anticancer drug, development perspectives

Abstract

Anticancer drug development is facing ever-increasing challenge. A huge number of chemicals or bio-agents should be evaluated pharmacologically and clinically. Due to lack of funds and human resources, high-quality and robust drug evaluation needs joint-efforts between chemists and pharmacologists. New generation of drug evaluation and development is undertaken and renewed with high-throughput biotechnology and genomic/molecular mechanistic exploration. This Article provides this area of anticancer drug design, evaluation, discovery and licensing with balanced and careful efforts.

Keywords: Anticancer drug development, neoplasm metastasis, pharmaceutical technology, cancer stem cells

Volume 11 Issue 2 - 2025

Da Yong Lu
School of Life Science, Shanghai University, China

Correspondence: Da Yong Lu, School of Life Sciences, Shanghai University, Shanghai 200444, PRC, China, Tel 718-463-3286

Received: April 12, 2025 | **Published:** June 19, 2025

Introduction

Cancer is a malignant and complex disease that causes approximately 7 to 10 million deaths annually in the past decade. The limitation of cancer therapeutics is lack of high effective anticancer drugs for all categories of cancer subtypes and neoplasm metastasis.[1-5] As a result, the convention of drug evaluation, discovery, licensing, development and manufacture needs quality chemistry and pharmacology studies.[6-12] Over the past two decades, the evaluative systems of drug developments change a lot—generating of miniature and high-throughput techniques for cost reduction and avoidance of repetition and variation between different testing and compound derivatives.[13,14] Correspondingly, the chemical, pharmacological and clinical knowledge should be integrated and mutual-benefits.[6]

Methods

Pharmaceutical significance

To integrate chemistry and pharmacological techniques, new chemicals and bio-agents should be reevaluated and repurposed in the faces and cases of new diseases and pathological discoveries. It needs the joint-efforts between chemists and pharmacologists because past evaluative convention is outdated now. Huge financing and uncertainty of clinical drug evaluation and validity. New ideology and modality should be integrated and classified.

Therapeutic obstacles

Cancer drug resistance, clinical relapse, metastatic spread and high toxicities of drugs are still modern challenge now. [13-19] In order to achieve better drug licensing, robust evaluative strategies should be advanced in the upcoming decades. To overcome therapeutic obstacles and challenges, it should continue to drug or therapeutic advancements step by step in the clinic.

Genomic projects

The funds for anticancer drug discovery and licensing increase continually.[20] Genomic data and studies by modern DNA sequencing and sampling will include in more normal people and cancer patients.[21,22] Therapeutic difference and relation between primary and metastasis tumors should be focused and progressed.[23,24] It needs time to consume and ethical safeguard.[25] These kinds of techniques and studies are fundamental issues for promoting anticancer drug developments and therapeutic promotion in the clinic.

Results

Tumor inoculation and other evaluative factors

Different anticancer drugs are sensitive to different tumor models. Enormous tumor models will drive high costs for every compound evaluation (request of testing's to more tumor molecules and models). Controlling and balancing the ranges and sizes of research projects and funds is constantly facing to us.[20] Of course, relevant technical improvements, like miniature of drug sensitivity testing, genomic sequencing and multi-omits techniques and others are these answers that we can provide nowadays.

Tumor inoculation routes affect drug response data.[20,26,27] Similarly, environmental factors, surroundings and neo-vasculature (tumor microenvironment—TME) lead to therapeutic compromises and drug resistance.[28-31] As a result, anticancer pharmacology and pharmaceutical studies need to revolutionize.[32] The advanced drug research systems and clinical investigations are expecting great progress of clinical cancer treatments and drug development.

Metastatic models

To discover high-effective anti-metastatic drugs, metastatic models, especially animal models, should be improved. [33-35] By large animal studies, more therapeutic data similar and effective to human conditions will be received. Knowledge generation and technical advances will showcase a great progress of patient's survival and overall therapeutic benefits in the future.

Discussion

Phytochemical drugs

Medicinal chemistry studies provide feasibility and speediness of new drug licensing and development. These studies generate the broadness of evaluative systems and drug toxicity discovery, including phytochemical agents and herbal medicine in cancer treatment.[36-42] In the past, chemicals discovered from nature showed higher therapeutic index in clinical trials.[36,37] This phenomenon is well noticed in modern drug development.

Drug targets

Drug development is widely divided by different disciplines (neural, immune, cardiovascular, infection and others). This leads to great repetition and loss of opportunity by single laboratory or

company to finalize comprehensive disease coverage and drug licensing. In order to overcome this low efficiency of drug evaluation and development, breaking barriers and ground of different fields of scientists should be aimed. Global integration of compounds, techniques, evaluative architectures and knowledge will improve the efficacy and reduce costs for drug development. In addition, drug development must well cooperate between chemists, pharmacologists and clinical doctors (Table 1).

Table 1 Future trends of anticancer drug developments

Categories	Current	Future
Animal models	Mice	Large animals
Drug targets	Anti-proliferative	Anti-metastasis
Tumor origin	Primary	Cancer stem cells
Drug efficacy	Single	Drug combination
Mechanisms	Tumor-oriented	Immune-oriented

Artificial intelligence

Computational design, mathematics and analysis of experimental and clinical data help drug discovery in reducing the sizes of experiments.[43-46] It can save times and promote quality in every stage of drug develop by utility of past and other researcher's data. Mathematical or physics-majored researchers with pharmacologists can facilitate mutual knowledge exchanging in drug licensing and marketing.[44,45]

Palliative drugs

Among the past decade, palliative treatments for cancer are gradually accepted in global basis. Palliative medicine treats for patients with pain and symptom alleviation are growing popularity in experiments and clinical trials. It is commonly less cost than conventional targeted therapy. Therefore, it is warmly welcome by oriental countries, such as India,[47] Russia[48] and China.[49] The establishment of pharmacological models for palliative treatments may be also a future trend.

Conclusion

Anticancer drug development has different pharmacological approaches.[50] Owing to the slow progresses of anticancer drug discovery and development, pharmacological updating and clinical modality can be made to facilitate drug development and cost reduction. In the future, more therapeutic efforts and technology may be implemented in drug evaluation and licensing.[51-53]

Acknowledgement

None.

Conflicts of interest

None.

References

1. Lu DY, Lu TR. Antimetastatic drugs, pharmacologic challenge and opportunity. *Curr Drug Ther*. 2025;20(2):169–179.
2. Gerstberger S, Jiang Q, Ganesh K. Metastasis. *Cell*. 2023;186:1564–1579.
3. Lu DY, Lu TR, Xu B, et al. Anticancer drug developments, challenge from historic perspective. *EC Pharmacol Toxicol*. 2018;6(11):922–936.
4. Lu DY, Lu TR, Wu HY, et al. Cancer metastasis treatments. *Curr Drug Ther*. 2013;8(1):24–29.
5. Lu DY, Lu TR. Anti-metastatic drug development, overview and perspectives. *Hosp Palliat Med Int J*. 2023;6(2):45–51.
6. Lu DY, Xu B, Lu TR. Anticancer drug development, evaluative architecture. *Lett Drug Des Discov*. 2024;21(5):836–846.
7. Merris J. Productivity counts—but the definition is key. *Science*. 2005;309(5735):726–727.
8. Ruggeri BA, Camp F, Miknyoczki S. Animal models of disease: preclinical animal models of cancer and their applications and utility in drug discovery. *Biochem Pharmacol*. 2014;87:150–161.
9. Herter-Sprie GS, Kung AL, Wong KK. New cast for a new era: preclinical cancer drug development revisited. *J Clin Invest*. 2013;123(9):3639–3645.
10. Lu DY, Chen EH, Lu TR. Anticancer drug development, a matter of money or a matter of idea? *Metabolomics*. 2015;5(2):e134.
11. Lu DY, Ding J, Chen RT, et al. Antimetastatic activities and mechanisms of action among bisdioxopiperazine compounds. In: Moore B, ed. *Pharmaceutical Formulation and Medicinal Chemistry: Mechanisms, Developments and Treatments*. New York, NY: Nova Science Publishers; 2016:73–106.
12. Lu DY, Lu TR, Zhu H, et al. Anticancer drug development, getting out from bottleneck. *Int J Mol Biol*. 2017;2(1):00010.
13. Lu DY, Lu TR, Yarla NS, et al. Anticancer drug development, breakthroughs are waiting. *Adv Pharmacol Clin Trials*. 2017;2(1):119.
14. Gupta GP, Massague J. Cancer metastasis: building a framework. *Cell*. 2006;127:679–695.
15. Talmadge JE, Fidler IJ. The biology of cancer metastasis: historical perspective. *Cancer Res*. 2010;70(14):5649–5669.
16. Valastyan S, Weinberg RA. Tumor metastasis: molecular insights and evolving paradigms. *Cell*. 2011;147(2):275–292.
17. Nieto MA, Huang RY, Jackson RA, et al. EMT:2016. *Cell*. 2016;166(1):2–45.
18. Lu DY, Lu TR, Xu B, et al. Anti-metastatic drug development, work out towards new direction. *Med Chem*. 2018;8(7):192–196.
19. Lambert AW, Pattabiraman DR, Weinberg RA. Emerging biological principles of metastasis. *Cell*. 2017;168:670–691.
20. Lu DY, Lu TR, Chen EH, et al. Anticancer drug development, system updating and global participation. *Curr Drug Ther*. 2017;12(1):37–45.
21. Lander ES. Initial impact of the sequencing of the human genome. *Nature*. 2011;470:187–197.
22. Wang DF, Liu BL, Zhang ZM. Accelerating the understanding of cancer biology through the lens of genomics. *Cell*. 2023;186:1755–1771.
23. Zhong L, Zhao ZP, Zhang XN. Genetic differences between primary and metastatic cancer, a pan-cancer whole-genomic comparison study. *Signal Transduct Target Ther*. 2023;8:363.
24. Birkbak NJ, McGranahan N. Cancer genome evolutionary trajectories in metastasis. *Cancer Cell*. 2020;37:8–19.
25. Rahimzadeh V, Bartlett G. Policies and practices of data-intensive primary care in the precision-medicine era. *Intern Med Rev*. 2017;3(9):1–14.
26. van de Wetering M, Francies HE, Francis JM, et al. Prospective derivation of a living organoid biobank of colorectal cancer patients. *Cell*. 2015;161:933–945.
27. Sveen A, Bruun J, Eide PW, et al. Colorectal cancer consensus molecular subtypes translated to preclinical models uncover potentially targetable cancer cell dependencies. *Clin Cancer Res*. 2018;24(4):794–806.

28. Lu DY, Chen XL, Huang M, et al. Relationship between blood fibrinogen concentration and pathological features of cancer patients: a 139-case clinical study. *Online J Biol Sci*. 2007;7(1):8–11.

29. Lu DY, Chen XL, Ding J. Treatment of solid tumors and metastases by fibrinogen-targeted anticancer drug therapy. *Med Hypotheses*. 2007;68(1):188–193.

30. Dvorak HF. Tumor stroma, tumor blood vessels, and anti-angiogenesis therapy. *Cancer J*. 2015;21(4):237–243.

31. Dvorak HF, Weanor VM, Tisty TD, et al. Tumor micro-environment and progression. *J Surg Oncol*. 2011;103(6):468–474.

32. Lu DY, Lu TR, Chen EH, et al. Keep up the pace of drug development evolution and expenditure. *Cancer Rep Rev*. 2018;2(5):165.

33. Lu DY, Wu FG, Shen ZM, et al. Different spontaneous pulmonary metastasis inhibitions against Lewis lung carcinoma in mice by bisdioxopiperazine compounds of different treatment schedules. *Sci Pharm*. 2010;78(1):13–20.

34. Ruiz-Espigares J, Nieto D, Moroni L, et al. Evolution of metastasis study models toward metastasis-on-a-chip: the ultimate model? *Small*. 2021;17(14):2006009.

35. Lu DY, Lu TR. Anti-metastatic drug development, utility of more animal models. *Mathews J Pharm Sci*. 2022;6(1):MJPS.10011.

36. Ali I, Saleem K, Uddin R, et al. Natural products: human friendly anti-cancer medications. *Egypt Pharm J (NRC)*. 2010;9(2):133–179.

37. Lu DY, Lu TR, Lu Y, et al. Discover natural chemical drugs in modern medicines. *Metabolomics*. 2016;6(3):181.

38. Pattanayak S. Alternative to antibiotics from herbal origin—outline of a comprehensive research project. *Curr Pharmacogenomics Pers Med*. 2018;16(1):9–62.

39. Hu B, Du Q, Shen KP, et al. Principles and scientific basis of traditional cancer treatments. *J Bioanal Biomed*. 2012;S6:005.

40. Lu DY, Lu TR. Drug discoveries from natural resources. *J Prim Health Care Gen Pract*. 2019;3(1):28.

41. Lu DY, Lu TR, Putta S, et al. Anticancer drug discoveries from herbal medicine. *EC Pharmacol Toxicol*. 2019;7(9):990–994.

42. Lu DY, Lu TR. Herbal medicine in new era. *Hosp Palliat Med Int J*. 2019;3(4):125–130.

43. Franssen LC, Lorenzi T, Burgess AEF, et al. A mathematical framework for modeling the metastatic spread of cancer. *Bull Math Biol*. 2019;81:1965–2011.

44. Lu DY, Lu TR. Mathematics or physics-majored students on the biomedical fields, insiders or outsiders? *Metabolomics*. 2015;5(4):e142.

45. Lu DY, Wu HY, Lu TR, et al. Updating biomedical studies by recruiting more mathematics or physics-majored talents. *Metabolomics*. 2016;6(2):e148.

46. Nguyen MH, Tran ND, Le NQK. Big data and artificial intelligence in drug discovery for gastric cancer: current applications and future perspectives. *Curr Med Chem*. 2025.

47. Kapil M, Verma A, Sareen R, et al. Palliative care—a small step, big result, an effort to achieve. *Hosp Palliat Med Int J*. 2019;3(5):149–150.

48. Prityko DA, Burkov IV, Safonov VV, et al. Palliative care for children, problems and ways to solve them. *EC Clin Exp Anat*. 2019;2(9):23–29.

49. Lu DY, Wu HY, Shen Y, et al. Medical treatments for incurable diseases, palliative therapy. *Hosp Palliat Med Int J*. 2019;3(5):175–176.

50. Lu DY, Lu Y. Several approaches for anticancer drug development progress. *Nurs Care Open Access J*. 2022;8(3):85–86.

51. Lu DY, Lu TR. Antimetastatic drugs, pharmacologic challenge and opportunity. *Curr Drug Ther*. 2025;20(2):169–179.

52. Lu DY, Lu TR. Drug sensitivity testing for cancer therapy, technique analysis and trend. *Curr Rev Clin Exp Pharmacol*. 2023;18(1):3–11.

53. Lu DY, Lu TR. Anticancer drug development, pharmaceutical progress. *Curr Cell Sci.* 2025;1(1):e27726215312620.