DEVELOPMENTAL MEDICO-LIFE-SCIENCES

ISSN (P): 3007-2786, (E): 3007-2794 DOI: https://doi.org/10.69750/dmls.03.01.0182

EDITORIAL Open Access

Integrating Genetics and Molecular Biology into Routine Clinical Care

Arslan Shuja[1*]

1- Institute of Molecular biology and biotechnology (IMBB), CRIMM, The University of Lahore, Lahore, Pakistan.

Corresponding Author: Arslan Shuja, **Email**: arslanshuja1@gmail.com, **Cell:** +92-3354568416

Keywords: Genomics, Molecular Biology, Precision Medicine, Genetic Testing, Clinical Decision-Making.

Received: 05/09/2025
Revised: 17/10/2025
Accepted: 25/12/2025
Published: 30/01/2026

A Turning Point in Modern Medicine:

Clinical medicine is in a new era where genetics and molecular biology are becoming more than a reserve of the research laboratory but they are on the verge of becoming part of the normal healthcare procedure. The shift to mechanism-based precision care using symptoms as a guiding factor is an unprecedented occasion to redefine the way diseases are identified, categorized, and treated. However, even with astounding scientific progress, molecular tools are still not consistent in the health systems of the world, indicating the continued inadequacy in the infrastructure, training, and policy [1,2].

Redefining Diagnosis Through Molecular Insight:

Clinicians can now use genetic and molecular technologies to discover the underlying causes of disease at the molecular level of DNA mutations, pathway perturbations, and cellular signalling defects. The tools provide a sense of clarity in areas that the conventional diagnostics fail to do so [3]. One such area is how cancers are now classified based on biomarkers instead of tissue, which is now possible to allow specific treatment which is dramatically effective. Genetic variations that influence lipid metabolism, arrhythmia predisposition as well as cardiomyopathies are clarifying the risk evaluation, and personalized therapy in cardiology. Likewise, fast PCR-based technologies and genomic surveillance of infectious disease diagnostics have transformed the field of antimicrobial stewardship and outbreak control [4].

The Gap Between Innovation and Implementation:

Although this is the promise, molecular diagnostics remains not incorporated into the clinical practice of most hospitals especially in the developing world. The reasons are high cost of equipment, limited laboratory capacity, and scarcity of trained personnel to adopt [5]. The clinicians are yet to be convinced of how to interpret genetic findings or how to incorporate the molecular findings to make decisions. Moreover, health systems do not have structures of genetic counselling, ethics, and safeguarding of patient-related data [6].

The consequence is a growing gap: as the high resource centres develop at an impressive pace, in most healthcare settings the only available mode of operation is still a traditional one and this may slow down the process of correct diagnosis and consequently limit the chance of an early intervention [7].

Education as the Foundation of Integration:

Change in clinical practice will demand change in education in medicine. Genetics and molecular biology should cease being part of the peripheral modules of undergraduate, postgraduate, and continuing medical training and be part of core competencies. Not just to request tests, but also to diagnose molecular profiles, discuss biomarker-based treatments and share the outcomes effectively with the patients [8].

Case-based genomics, simulations of clinical decision-making, and interdisciplinary instructional three components will be necessary to inspire confidence in

practitioners. In the absence of such an educational reform, the most developed technologies will not be used [9].

Building Scalable Molecular Infrastructure:

Laboratory platforms with the capacity to conduct regular molecular testing such as next-generation sequencing, quantitative PCR, digital PCR, and point-of-care assays need to be invested in by the health systems. Notably, the infrastructure should be supported by strong quality assurance mechanisms, bioinformatics capability, and easy connectivity of the infrastructure with the electronic health records [10].

Equitable access is central. Molecular means should not be limited to major metropolitan areas; it is essential to decentralize and incorporate levels of laboratory networks, so that even patients in rural and underserved localities will have access to precision diagnostics [11].

Ethical, Social, and Policy Considerations:

Genomic testing raises some urgent ethical concerns. Preservation of genetic information as confidential information, non-discrimination and setting up of incidental-findings guidelines are principal policy agendas. Counselling of patients should be done in a clear and culturally relevant manner that will encourage a process of informed decision making. The regulatory frameworks of the nations should also change to regulate genetic testing, data storage and clinical application [5,9].

Towards a Future of Predictive and Preventive Care:

The use of genetics and molecular biology in the everyday work of clinicians will change the current medicine as a responsive treatment to proactive prevention. The identification of genetic disorders at an early stage, the use of pharmacogenomic to optimize treatment, and the molecular characterization of conditions associated with chronic illnesses can significantly decrease morbidity, mortality, and the overall healthcare expenditure.

It is the capability to analyze the disease based on molecular signatures that will characterize the future of medicine. To achieve this vision, both the advances of science and the investments of healthcare infrastructure, education of clinicians, policy-making, and equal access should be in balance [8-11].

CONCLUSION

Combination of genetics and molecular biology with everyday clinical practice is no longer a choice it is a necessity of providing the degree of accuracy, effectiveness, and patient-focused care that current health systems require. Through science and innovation, clinical implementation allows the healthcare sector to transition to a future where diagnoses are earlier, treatments more targeted and outcomes are significantly better. The issue is no longer a question of scientific discovery, but the general desire to integrate these tools into the daily routine of medicine.

REFERENCES

1. Lakshmi C, Parameshwari S. Integrating nutrigenomics into clinical practice and public health. In: Arackal JJ, Joshi TJ, editors. *Nutrigenomics and Food Science: Revolutionizing Personalized Nutrition*. Cham: Springer; 2026. doi:10.1007/978-3-032-12415-9_10
2. Chen YM, Hsiao TH, Lin CH, et al. Unlocking precision medicine: clinical applications of integrating health records, genetics, and immunology through artificial intelligence. *J Biomed Sci*. 2025;32:16. doi:10.1186/s12929-024-01110-w
3. Méndez-Vidal C, Bravo-Gil N, Pérez-Florido J, et al. A genomic strategy for precision medicine in rare diseases: integrating customized algorithms into clinical practice. *J Transl Med*. 2025;23:86. doi:10.1186/s12967-025-06069-2
4. Lin M, Guo J, Gu Z, et al. Machine learning and multi-omics integration: advancing cardiovascular translational research and clinical practice. *J Transl Med*. 2025;23:388. doi:10.1186/s12967-025-06425-2
5. Khan A, Barapatre AR, Babar NM, Doshi J, Ghaly M, Patel KG, Nawaz S, Hasana U, Khatri SP, Pathange S, Pesaru AR, Puvvada CS, Billoo M, Jamil U. Genomic medicine and personalized treatment: a narrative review. *Ann Med Surg*. 2025;87(3):1406-1414. doi:10.1097/MS9.0000000000002965
6. Martinelli C, Ercoli A, Vizzielli G, et al. Liquid biopsy in gynecological cancers: a translational framework from molecular insights to precision oncology and clinical practice. *J Exp Clin Cancer Res*. 2025;44:140. doi:10.1186/s13046-025-03371-1
7. Jamalinia M, Weiskirchen R. Advances in personalized medicine: translating genomic insights into targeted therapies for cancer treatment. *Ann Transl Med*. 2025;13(2):18. doi:10.21037/atm-25-34
8. Ghoreyshi N, Heidari R, Farhadi A, et al. Next-generation sequencing in cancer diagnosis and treatment: clinical applications and future directions. *Discov Onc*. 2025;16:578. doi:10.1007/s12672-025-01816-9
9. Frangoul H, Altshuler D, Cappellini MD, Chen YS, Domm J, Eustace BK, et al. CRISPR-Cas9 gene editing for sickle cell disease and β-thalassemia. *N Engl J Med*. 2021;384:252-260. doi:10.1056/NEJMoa2031054
10. National Research Council (US) Committee on a Framework for Developing a New Taxonomy of Disease. *Toward Precision Medicine: Building a Knowledge Network for Biomedical Research and a New Taxonomy of Disease*. Washington (DC): National Academies Press (US); 2011.
11. Bowdin S, Gilbert A, Bedoukian E, Carew C, Adam MP, Belmont J, et al. Recommendations for the integration of genomics into clinical practice. *Genet Med*. 2016;18(11):1075-1084. doi:10.1038/gim.2016.17

This article may be cited as: Shuja A. Integrating genetics and molecular biology into routine clinical care: advancing precision medicine in everyday practice. *Dev Med Life Sci*. 2024;3(1):1-2. doi:10.69750/dmls.03.01.0182