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From basic research to clinical diagnosis

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Editorial

The progression from basic research to clinical diagnosis remains one of the most important challenges in biomedical science. Over the past decades, laboratories have generated a vast body of mechanistic knowledge concerning disease biology, yet only a small proportion of this knowledge has been incorporated into routine clinical practice. The central problem is not a lack of discovery but the difficulty of translating discoveries into tools that are reliable, practical, and meaningful in real-world clinical settings. A biomarker may appear promising in an experimental study yet fail when evaluated in larger and more diverse patient populations. This gap between scientific insight and clinical application remains a major barrier to improved diagnosis (1). Within contemporary clinical practice and the prevailing paradigm of personalized medicine, the need to translate basic science findings into clinical diagnostic and therapeutic applications is particularly pressing. There is a growing clinical need for more accurate and sensitive diagnostic tests, together with a societal demand for efficient healthcare at minimized cost. These needs have significantly shaped the modern understanding of the value of basic science research and its role in contemporary medical practice. Translational research has therefore become a priority for the scientific community, accompanied by a clear recognition that the value of basic research findings ultimately depends on their successful implementation in clinical practice.

Biomarker discovery remains central to this process. Biomarkers have a particularly prominent role in this context as key molecular indicators that can be used for diagnostic, prognostic, and therapeutic purposes. Specifically, disease-associated transcripts, noncoding RNAs, other genetic determinants, proteins, and metabolites can serve as valuable sources of diagnostic and mechanistic information. However, the concept of a biomarker extends beyond a mere association with disease, because successful biomarkers must also demonstrate analytical validity and clinical utility (2). Recent research has demonstrated, in particular, the value of multi-marker approaches as promising disease classifiers. The capacity of biomarkers to serve as important diagnostic and mechanistic tools has the potential to fundamentally transform how diseases are diagnosed and managed while advancing the overall understanding of disease biology.

Basic science is not merely a preliminary stage that ends once a mechanism has been described. Rather, it is the primary source of the data, concepts, and molecular signals from which diagnostic methods are developed. Well-designed experimental studies provide the foundation for assay design, target selection, refinement of detection strategies, and the development of more accurate laboratory tests. In this regard, the Journal of Clinical and Basic Research (JCBR) aims to facilitate the integration of basic research findings on molecular mechanisms and novel therapeutic approaches into the clinical domain. The journal encompasses a broad spectrum of work, ranging from experimental research to applied investigations of basic scientific discoveries relevant to diagnosis and treatment. Consequently, advances in diagnostic medicine depend on findings from both clinical and basic research, and these two forms of inquiry are inextricably linked.

Nevertheless, focused research efforts are required to bridge the gap between biomarker identification and diagnostic application. One such effort involves assay development and validation, including optimization, assessment of analytical performance, cut-off selection, and evaluation of reproducibility. Many promising findings fail at this stage because they are not evaluated under conditions that reflect real-world practice. For this reason, translational success depends on rigorous standardization and careful validation (3). A diagnostic tool must demonstrate robustness across platforms, populations, and settings if it is to progress from the bench to the bedside. New technologies are now reshaping this field. Multi-omics integration, medical imaging, machine learning, and artificial intelligence are enabling the detection of increasingly complex disease patterns. The integration of multi-omics data with state-of-the-art bioinformatics approaches can facilitate the identification of key molecular drivers of disease (4). Thus, these novel opportunities can undoubtedly play an instrumental role in biomarker discovery. At the same time, every new technology should be evaluated for its applicability to clinical settings to optimize assay performance. In this regard, multi-omics and artificial intelligence can become powerful tools for discovering novel disease-specific patterns, but their performance must always be rigorously validated and scrutinized. The most powerful systems of the future will integrate biological insight, computational power, and clinical relevance within a single framework.

The future of clinical diagnosis will depend on stronger collaboration among basic scientists, clinicians, bioinformaticians, and diagnostic developers. No single discipline can bridge this gap independently. A translational ecosystem is needed in which discovery, validation, and implementation advance in parallel. If this connection is effectively established, basic research will do more than expand our knowledge of disease; it will generate better diagnostic tools, support earlier intervention, and improve patient outcomes. This is where the true value of science is ultimately realized. Equally importantly, the translation of laboratory findings into clinical diagnosis must remain guided by rigor, humility, and relevance. Not every molecular signal warrants development into a test, and not every technically impressive method has clinical utility. The challenge lies in distinguishing biological interest from diagnostic value. This distinction requires careful study design, independent validation, and attention to the practical realities of laboratory medicine. When these principles are respected, basic science becomes more than an academic exercise; it becomes a direct contributor to precise, timely, and meaningful healthcare.

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Conflicts of Interest

The authors declare that the work was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Author Contributions

NH contributed to the writing, review, and editing of the manuscript. AR contributed to the review and editing of the manuscript. Both authors approved the final version for publication.

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