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Applications of Big Data in Laboratory Diagnostics and Research

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Recent advancements in high-throughput omics technologies have led to an exponential accumulation of data, revolutionizing laboratory diagnostics and research. This presentation examines the integration of big data analytics into the discovery and validation of candidate biomarkers—an essential pathway toward realizing precision health and personalized medicine. Our breakthroughs in multi-omics integration have enabled the identification of clinically relevant molecules that inform early disease detection, predict therapeutic responses, and guide clinical decision-making. Despite these successes, challenges persist, including data heterogeneity and the obscuration of biologically meaningful signals by noise, thereby underscoring the need for innovative analytical strategies and advanced methods for integrating interdisciplinary domain knowledge. This talk critically evaluates emerging solutions to these obstacles, emphasizing how refined data integration methodologies are converting laboratory discoveries into robust clinical applications.