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## REVIEWER'S REPORT

**Manuscript No.: IJAR-56152**

**Title: The Augmented Biochemist: Artificial Intelligence as a Transformative Force in the Medical Biochemistry Laboratory.**

**Recommendation:**

Accept as it is .....

Accept after minor revision.....

Accept after major revision .....

Do not accept (*Reasons below*) .....

| Rating | Excel. | Good | Fair | Poor |
|---|---|---|---|---|
| Originality | | ✓ | | |
| Techn. Quality | | ✓ | | |
| Clarity | ✓ | | | |
| Significance | ✓ | | | |

**Reviewer Name: Dr. AMINA**

## Reviewer's Comment for Publication.

### Overall Evaluation

This manuscript presents a comprehensive and well-structured narrative review on the transformative impact of Artificial Intelligence (AI) across the pre-analytical, analytical, and post-analytical phases of the medical biochemistry laboratory. The topic is highly relevant and timely, considering the rapid integration of AI and machine learning tools into laboratory medicine. The concept of the "Augmented Biochemist" is compelling and provides a forward-looking perspective on professional evolution within the discipline.

The manuscript is clearly written, logically organized, and accessible to both laboratory professionals and clinicians. The discussion of workflow-based AI integration is particularly strong and enhances the practical relevance of the review.

### Major Strengths

1. Comprehensive Workflow Coverage:

   The structured approach—pre-analytical, analytical, post-analytical, and laboratory management—provides clarity and systematic coverage.

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2. Balanced Perspective:
   The manuscript appropriately discusses both opportunities and challenges, including regulatory, ethical, and explainability concerns.
3. Clinical Relevance:
   Practical examples such as sepsis detection, metabolic syndrome profiling, predictive maintenance, and patient-based real-time QC add applied value.
4. Future-Oriented Vision:
   The concept of the "Augmented Scientist" is well-articulated and reinforces the collaborative human-AI paradigm rather than a replacement narrative.

## Minor Revisions Suggested

1. Depth of Critical Appraisal:
   While the manuscript summarizes applications effectively, it would benefit from deeper critical evaluation of:
   - Current limitations in model generalizability across institutions.
   - Real-world implementation barriers (cost, interoperability, workforce training).
   - Evidence level (e.g., validation vs. routine clinical adoption).
2. Reference Alignment:
   Some cited studies (e.g., reference 8 on diabetic retinopathy) are illustrative but not directly within medical biochemistry. A brief clarification explaining their relevance to laboratory diagnostics would improve coherence.
3. Regulatory Section Expansion:
   The regulatory discussion could briefly mention adaptive/continuously learning algorithms and post-market surveillance challenges.
4. Quantitative Evidence:
   Inclusion of selected performance metrics (e.g., sensitivity, specificity, AUC improvements reported in studies) would strengthen the technical rigor.
5. Formatting Adjustments:
   - Minor grammatical smoothing in certain sections (e.g., repetition in AI definition).
   - Ensure consistent formatting of subheadings.

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## Conclusion

This manuscript addresses a critical and evolving area in laboratory medicine. With minor revisions to enhance critical depth and specificity, it will make a valuable contribution to the literature. The paper is suitable for publication after minor revision.