

Roundtable Session 2 – Table 5 – Brainstorming on Applications of AI for Bioassays

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Abstract:

Artificial intelligence (AI) is emerging as a transformative enabler with strong potential to improve the design, optimization, and lifecycle management of bioassays. AI can support more efficient, data-driven method development by helping generate experimental designs, identify critical parameters, assist with troubleshooting, and accelerate data analysis. It may also reduce effort in historically manual, high-volume work such as data review and verification. However, to realize these benefits responsibly, AI outputs must be validated through appropriate human oversight and implemented within a framework that balances innovation with control.

Discussion Questions:

Q: How are you using AI in your laboratory for bioassay development?

Q: Have you explored use of AI to assist with method development activities such as probing different optimization strategies?

Q: Have you used AI to assist in providing a more comprehensive view during troubleshooting an unusual assay result or trend?

Q: How are you leveraging AI for data analysis, visualization, or interpretation of bioassay results?

Q: What challenges or limitations have you encountered when integrating AI into your workflows?

Q: How do you ensure appropriate validation and governance when using AI-generated outputs in regulated environments?

Notes:

1. Introduction

This second roundtable discussion continued the exploration of artificial intelligence (AI) applications in scientific workflows, with a noticeably larger group of participants. A key observation was the significant expansion of AI usage compared to the previous year, when adoption was still at an early stage. The conversation reflected a growing maturity in both tools and user experience, particularly in bioassay and analytical environments.

2. Current Applications of AI

AI is now widely used as a productivity and knowledge-generation tool, enabling rapid creation of scientific diagrams, summary tables, literature reviews, and presentation materials. These capabilities are helping scientists streamline communication and reduce time spent on routine documentation tasks.

Participants also highlighted AI's role in technical problem-solving, such as debugging automation code without relying on vendor support, as well as assisting with general computational tasks. However, concerns were raised regarding the accuracy of mathematical calculations, indicating that results still require careful verification.

In laboratory and process development contexts, AI is increasingly applied to optimize workflows and experimental design, including support for cell line development, cleaning procedures, and assay optimization. One participant described the use of a specialized AI tool for bioassay development that can recommend parameters such as dose ranges, dilution schemes, and cell seeding densities, significantly shortening development timelines.

AI also demonstrates strong capability in data retrieval and analysis, for example by rapidly extracting long-term historical datasets (e.g., stability data spanning multiple years). While this improves efficiency, participants consistently emphasized the need for human validation of outputs.

More advanced implementations were discussed by participant from an AI-focused organization, who described the use of professional AI agents integrated through a “tool-calling” framework and “context engineering”. This approach extends beyond basic prompt-based interaction, enabling AI systems to perform complex tasks—such as large-scale data analysis, document review, and drafting in a more structured and reliable manner.

3. Limitations and Considerations

Despite the rapid progress, several limitations remain. AI systems may exhibit hallucinations or overly agreeable responses, reflecting their tendency to provide user-

pleasing answers rather than strictly accurate ones. This reinforces the importance of human oversight in all applications.

Another practical challenge discussed was the time investment required for prompt development, which can sometimes conflict with project timelines and deadlines. This highlights the need to balance upfront effort with long-term efficiency gains.

4. Key Insights

The discussion underscored that AI is becoming smarter, faster, and more embedded in daily workflows, particularly in bioassay-related activities. Its ability to accelerate data access, support decision-making, and automate routine tasks is transforming how work is conducted.

At the same time, the group reached strong alignment that AI should be used as an assistive tool under human guidance, rather than an independent decision-maker.

5. Conclusion

This session highlighted the rapid and widespread adoption of AI across bioassay development and analysis. AI is already delivering tangible benefits in efficiency, insight generation, and workflow optimization. However, its effective use depends on thoughtful implementation, validation, and human supervision.

Overall, AI is making scientific work more efficient and accessible, and its role is expected to continue expanding as tools and methodologies evolve.