

## **Assessing whether autonomous labs can increase reproducibility in the sciences**

### **Abstract:**

Reproducibility remains a persistent challenge in scientific research, with substantial economic and scientific costs. While policy interventions such as pre-registration and data-sharing incentives aim to mitigate irreproducibility, automation offers a complementary solution. Autonomous labs, which integrate robotics and AI, have been hypothesized to improve reproducibility by codifying experimental protocols and reducing human error. However, empirical evidence on their effectiveness remains limited.

This study evaluates whether autonomous labs enhance reproducibility compared to traditional human-led experiments. Leveraging real-world deployments at the University of Toronto's Acceleration Consortium, we conduct controlled comparisons across multiple domains, including materials science, polymers, medicinal chemistry, and human organ mimicry. We systematically assess accuracy, consistency, and efficiency across experimental tasks performed by both automated systems and human researchers.

Our findings will provide new insights into the role of automation in scientific discovery, with implications for policymakers, funding agencies, and research institutions seeking to integrate AI-driven methodologies. We discuss the potential benefits and limitations of autonomous labs, including their impact on knowledge transfer between academia and industry.