A Robotist's Perspective on Radiochemistry Laboratory Automation

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How would a robotist approach the automation of a radiochemistry laboratory? Rather than viewing laboratory automation simply as replacing human operators with robots, this talk explores how concepts developed in robotics and artificial intelligence may provide a systematic framework for future radiochemistry laboratories.

Inspired by task representations widely used in robotics, radiochemistry procedures are viewed as hierarchical compositions of reusable tasks that can be planned, monitored, and executed through an appropriate combination of automation technologies. This task-centric perspective provides an intermediate layer between human-readable experimental procedures and executable robotic actions.

Building on this representation, the talk discusses a hybrid automation framework in which deterministic automation is used for highly structured laboratory processes, conventional robot programming for repeatable manipulation, and robot learning for selected tasks involving environmental variability, contact uncertainty, or difficult-to-model expert skills. The roles of task planning, multimodal monitoring, safety constraints, and human-supervised exception handling are also discussed.

Finally, the presentation briefly explores how these concepts may evolve toward AI-assisted laboratories, where AI co-scientists support literature review, experimental design, data interpretation, and scientific decision-making. Particular attention is given to the challenges and opportunities of extending these ideas to remote and hot-cell operations.

Rather than presenting a completed solution, this talk aims to offer a robotics perspective on the future direction of radiochemistry laboratory automation and to stimulate interdisciplinary discussion between the robotics and radiochemistry communities.

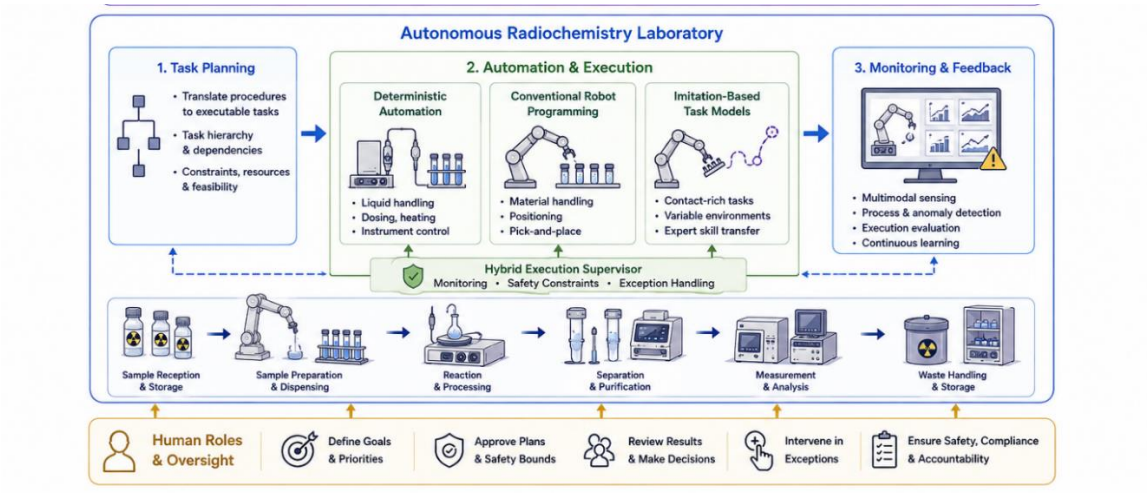

Fig. 1. Autonomous Radiochemistry Laboratory

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