Humanoid Robots in Real-World Laboratories

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The integration of biotechnology and IT has catalyzed significant advancements in life sciences, yet major challenges remain unresolved. For instance, experimental data often lacks reproducibility. Modern technologies have facilitated large-scale and high-throughput experiments, yet they have concurrently escalated the demand for labor-intensive, repetitive tasks, consuming valuable human resources. High biosafety-level experiments necessitate costly preventative measures to protect researchers from hazardous reagents. Furthermore, laboratory resources are rarely fully utilized, leading to daily surpluses of resources, including expensive instruments and laboratory spaces. To address and mitigate these issues, we have developed the humanoid robot Maholo LabDroid [1]. It stands as a prime solution for transitioning towards laboratory automation. Maholo is programmed to perform a variety of life science experiments using standard laboratory instruments, eliminating the need for specialized equipment. The current paradigm of laboratory automation largely involves 'Robotizing,' or simply replacing human tasks with robots. However, our approach, 'Robotalizing,' leverages robots and AI to create new value in life sciences. We have successfully developed several applications in the field of regenerative medicine: an autonomous culture system combining Maholo with AI [2], an autonomous experimentation system integrating Maholo with optimization AI [3], and a robotic cell processing facility for clinical use [4]. These developments have successfully led to the Robotalization of the entire spectrum from basic to clinical research in cell culture. In this presentation, we aim to introduce these initiatives and discuss the future of life sciences driven by robots and AI.

[1] Yachie et al, Robotic crowd biology with Maholo LabDroids. *Nature Biotechnology* (2017)
[2] Ochiai and Motozawa et al, A variable scheduling maintenance culture platform for mammalian cells. *SLAS Technology* (2020)
[3] Kanda and Tsuzuki et al, Robotic search for optimal cell culture in regenerative medicine. *eLife* (2022)
[4] Terada et al, Robotic cell processing facility for clinical research of retinal cell therapy. *SLAS Technology* (2023)