University of Reading

Human Resources

Job Description

Title	Details
Job title	Postdoctoral Research Associate in Embodied Intelligence and Soft Matter Robotics
Department/Unit	Biomedical Sciences and Biomedical Engineering, School of Biological Sciences
Job Type	Fixed-term, full-time, 3 years (36 months) Project start: 1 March 2027
Grade	Grade 6
Accountable to	Dr Yoshikatsu Hayashi, Associate Professor / Principal Investigator
Accountable for	No formal line-management responsibility anticipated
Vacancy reference	SRF54793

Purpose

To undertake interdisciplinary research on the emergence of embodied intelligence through bioelectrical learning in self-oscillating hydrogels coupled to soft robotic bodies. The postholder will deliver experimental and computational research across the Leverhulme-funded project, investigate how the goal-oriented motion can be trained in soft brain through sensorimotor feedback, and contribute to peer-reviewed publications and research dissemination.

How can intelligence emerge when a brain and body interact, rather than being designed separately?

A new Leverhulme Trust-funded project at the University of Reading, led by Dr Yoshikatsu Hayashi, will explore how intelligence could emerge from interactions between soft materials, a robotic body and its environment. Engineers usually design a robot's controller and body separately, then connect them, i.e., brain controls body. Living organisms develop from a single cell. As an animal grows, without 'watch maker', its nervous system and body continually influence each other to adapt to changing environments. Body movement generates sensory feedback, which shapes the neural networks controlling future actions. Through this ongoing signalling, behaviours such as crawling, walking, and a goal-oriented behaviour can emerge.

Neural communication fundamentally relies on the movement of charged particles called ions. Interestingly, ions also flow through water-rich hydrogels, where polymer networks can guide their movement. Could this provide a primitive form of electrical communication without neurons? Previous research demonstrated that electroactive gels could improve their performance in the

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computer game Pong through feedback, suggesting that soft matter can exhibit adaptive behaviour without living neurons.

By exploring how brain-like control and body movement might emerge together from physical matter, the research aims to uncover fundamental principles of Physical AI and inspire future generations of intelligent soft robots.

Curious about the science? Read about the fascinating 'Gel Brain' research in Nature: https://www.nature.com/articles/d41586-024-02704-y

The Postdoctoral Research Associate will join the School of Biological Sciences at the University of Reading, contributing to a Leverhulme Trust-funded interdisciplinary research project led by Dr Yoshikatsu Hayashi. The post will play a key role in investigating the emergence of embodied intelligence through interactions between electroactive soft materials, robotic bodies and their environments. The successful candidate will conduct experimental and computational research, develop innovative soft matter robotic systems, and collaborate with researchers across biomedical engineering, physics, and artificial intelligence. The role will contribute to high-quality scientific publications, international research collaborations and the development of new approaches to intelligent soft materials and robotics.

Team Structure

The postholder will report to Dr Yoshikatsu Hayashi (Principal Investigator) and work within his interdisciplinary research environment at the University of Reading, collaborating with researchers and students in soft matter, bioelectricity, machine learning and soft robotics. External collaboration will be undertaken as appropriate to project objectives.

Main duties and responsibilities

1. Design experiments on electrical stimulation and spatiotemporal chemomechanical oscillations in Belousov–Zhabotinsky hydrogels.
2. Develop measurement, stimulation and analysis methods, including multi-electrode approaches to redox and electrical signals.
3. Develop and integrate a soft robotic body with hydrogel-based control and force/haptic sensor feedback.
4. Quantify emergent locomotion, coordination and adaptation in closed-loop brain–body experiments.
5. Implement computational analyses and learning approaches, including reservoir computing and, where suitable, reinforcement learning and optimisation.
6. Prepare publications, presentations, reports and contributions to future funding applications.
7. Collaborate with the PI, students and partners and contribute to day-to-day project planning.

Supervision received

The PDRA reports to Dr Yoshikatsu Hayashi, who will provide scientific direction and regular research meetings. The PDRA is expected to exercise substantial independence in experimental design, analysis and delivery based on one’s ideas.

Supervision given

No formal line-management duties are anticipated. The PDRA may provide day-to-day technical guidance and mentoring to undergraduate and postgraduate students or project collaborators, as agreed with the PI. International collaboration is encouraged for networking and expanding scientific ideas.

The PDRA will also contribute to public engagement and outreach activities, promoting the project's research in embodied intelligence, soft robotics, and bioelectrical learning. These activities may include interactive demonstrations, workshops, and educational events for local communities, schools, and the wider public, as well as participation in University Open Days and public engagement events at museums in London and elsewhere in the UK.

The PDRA will help communicate complex scientific concepts to non-specialist audiences, encouraging public interest in interdisciplinary science, engineering, and emerging technologies.

Contact

Yoshikatsu Hayashi, Associate Professor

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Website (Lab): https://www.sites.google.com/site/complexlivingmachineslab/

Terms and conditions

Fixed-term, full-time for 3 years (36 months);

The role is primarily based at the University of Reading; occasional travel to research meetings or collaborators may be required, subject to approval.

Project start: 1 March 2027; proposed employment period: 1 March 2027 to 28 February 2030,

Date assessed: 29 October 2026

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Person Specification

Job Title	School/Department
Postdoctoral Research Associate in Embodied Intelligence and Soft Matter Robotics	School of Biological Sciences

Which stage these Criteria be assessed
A = Application
I = Interview

Criteria	Essential	Desirable
Skills Required	• Performing physical chemical experiments (A, I) • Programming and quantitative data-analysis skills. (A, I) • Ability to design, document and interpret reproducible research experiments. (A, I) • Evidence of scientific communication, including papers, presentations or equivalent research outputs. (A, I) • Ability to work independently and collaboratively across disciplines. (A, I)	• Experience with instrumentation, embedded systems or real-time closed-loop control. (A, I) • Experience with interdisciplinary experimental/computational research. (A, I)
Attainment	• A PhD (awarded or near completion) in a relevant discipline. (A)	• PhD research in physics, engineering, soft matter, robotics, materials science or computational science. (A)
Knowledge	• Knowledge of experimental (Physical Chemistry) and/or computational research methods relevant to nonlinear dynamics, active soft matter, soft robotics or machine learning. (A, I)	• Knowledge of BZ reaction systems, electroactive hydrogels, sensorimotor loops, reinforcement learning or reservoir computing. (A, I)
Relevant Experience	• Research experience in nonlinear dynamics, active soft matter, soft robotics, experimental control or machine learning. (A, I)	• Experience of electrical stimulation, multi-electrode arrays, mechanical characterisation or soft robotic fabrication. (A, I)
Other	• Commitment to safe, ethical and reproducible research practice. (I) • Ability to manage research priorities and meet agreed milestones. (I)	• Experience of international research collaboration. (A, I)

Completed By: Dr Yoshikatsu Hayashi

Date: 29 October 2026

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