

# UCL Undergraduate Mathematics Colloquium

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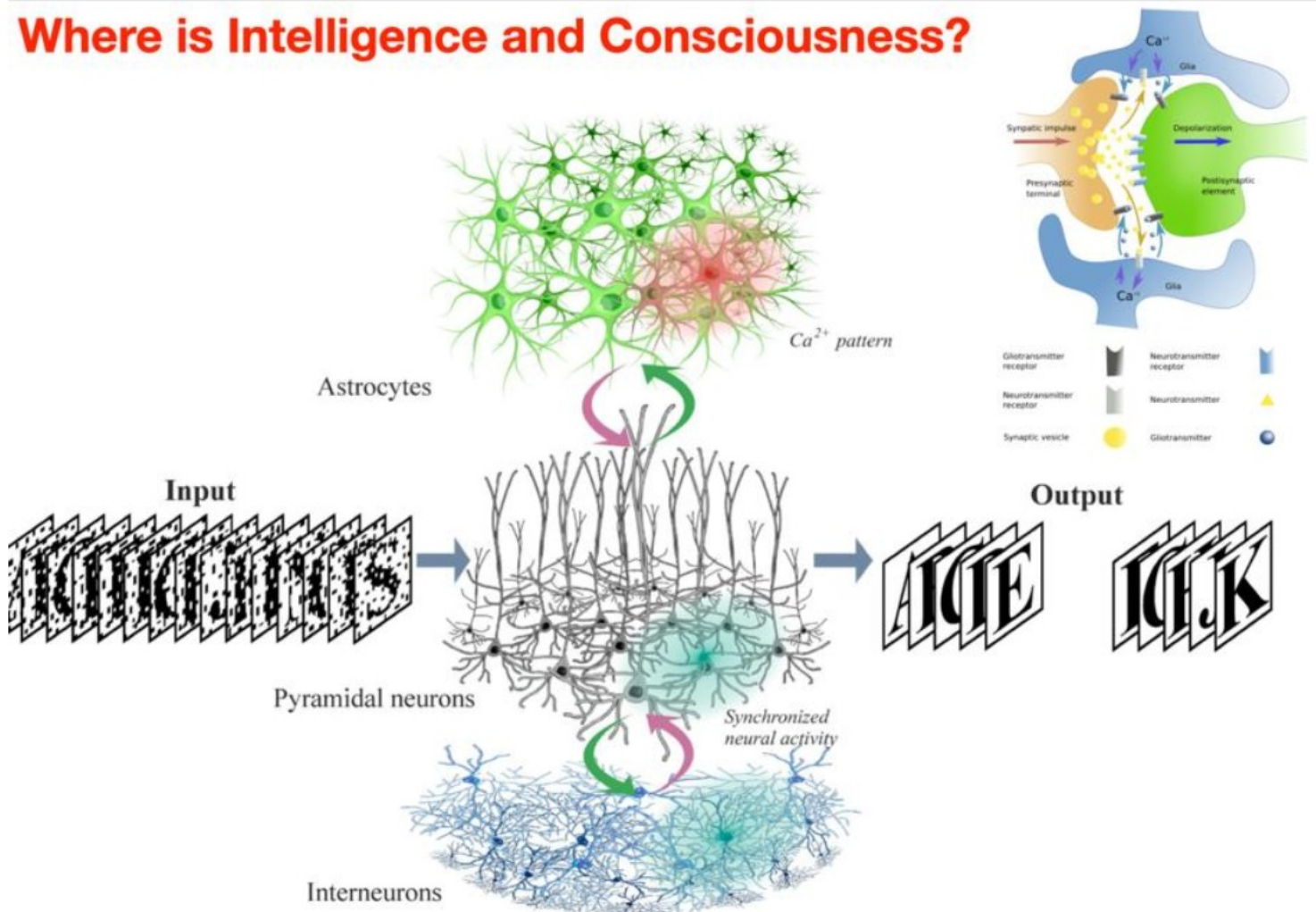
Date: 9<sup>th</sup> June 2026, Time: 4-5pm

Location: Seminar Room G20, Bentham House

## Emergence of Intelligence in Complex Physiological Networks

Speaker: Professor Alexey Zaikin (UCL)

### Where is Intelligence and Consciousness?



**Abstract:** A human body is a supernetwork because this a network of networks, where each network has enough complexity to generate a property of intelligence, and these networks are communicating in an intelligent way. Hence, natural questions arise; what are the principles of intelligence emergence in complex physiological networks, how can we measure it, and what is an interaction of intelligence with other properties of complex networks, such as multiplexing or even a consciousness?

Alone in the human brain we have 86 billion neurons, each having up to 10k varying synapses overlapped with a network of astrocytes and other glial cells. Calcium events in astrocytes can be excited by neural activity and then mediate neurotransmitters of synapses, providing local and tentative synchronization. Recently we have shown that because of this local integration, astrocytes can organise associative working memory [1,2] and even be responsible for situation-based neuromorphic memory in spiking neuron-astrocyte networks [3].

Moreover, we have shown that, in a simple but realistic model of neuro-glial network, the presence of astrocyte could contribute to the generation of positive Integrated Information and, hence, its evolutionary appearance was important to develop consciousness. Hence, astrocytes and genetic networks may contribute not only to the appearance of intelligence, but also consciousness [4, 5]. On the other hand, inside each cell we have many complex and interacting networks, and a complexity of a genome alone is enough to have perceptron features [6]. There are many ways to organise intelligence in genetic networks [7] and even consciousness [8]. But how is learning organised in genetic neuron astrocyte networks?

Another interesting result is that AI itself can be induced by stochasticity because noise can change the effective phase space of the system. In particular, noise can induce excitability, needed by AI properties of the neuron-astrocyte systems, by means of the noise-induced phase transition [9]. How can we measure an ability of a dynamical network to contribute to the Intellectome of a physiological system - this is another interesting question discussed in this talk. And even more interesting what is a relation between intellectome of the physiological system and its ability to generate consciousness? To answer the question of how to quantify level of consciousness, recently the Integrated Information Theory of Consciousness has been developed, controversially claimed not only as a way to measure the complexity of brain but also its level of consciousness.

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