

## OPEN SEMINAR SERIES

**Tuesday 9 June 2015**

**13:00 – 14:00**

**MP Room 5<sup>th</sup> floor,  
L. Sofou Bldg**

### **“Emergence of connectivity motifs via the interaction of long-term and short-term plasticity”**

**By**

**Dr. Eleni Vasilaki,  
Dept. of Computer Science,  
University of Sheffield**

#### **ABSTRACT**

The identification of synaptic mechanisms that underlie learning and memory is a key challenge for neuroscience. These mechanisms are currently assumed to be captured by persistent modifications to the synaptic connections among neurons.

Synaptic connections in microcircuits and networks are not random; experimental observations indicate the existence of specific microscopic patterns (or connectivity motifs), with non-random features. However, it is unclear how plasticity of individual synaptic connections contributes to the formation of the observed motifs. In particular, for cortical pyramidal neurons, the degree of bidirectional connectivity varies significantly between the visual and somatosensory cortex areas (Song et al, 2005, Lefort et al, 2009). Recent evidence in prefrontal cortex (Wang et al, 2006) and in the olfactory bulb (Pignatelli, 2009) suggest that some other features of synaptic physiology, such as the short-term dynamical nature of the synapse, may be correlated to specific connectivity motifs. The causes for these structural differences are still unknown.

I will present a theory based on a phenomenological, long-term synaptic plasticity "learning rule" (Pfister et al 2006, Clopath et al, 2010), that is able to accurately reproduce a vast corpus of experimental data. The rule captures dependencies on both the timing and frequency of neuronal signals, providing a very simple mechanistic explanation for the emergence of connectivity motifs (Clopath et al, 2010, Vasilaki & Giugliano, 2012, 2014, Esposito et al, 2004,2015), while shedding light on the long debate about the nature of the neuronal code.

**The seminar series is open to all members of *staff* and *students* of CITY and to any *externals* that wish to attend.**



The  
University  
Of  
Sheffield.



**CITY College**  
An International  
Faculty Of  
The University.