When information about the external world enters the brain through the sensory receptors, physical properties of the stimulus are encoded into sequences of identical electrical impulses in neural cells (neurons). Deep in the brain, cells and systems responsible for different brain functions – from perception to action – find out what the world is by decoding this massive information incoming through thousands of connections in different patterns of impulses. To understand how the brain works we must crack the neural code and this is the main challenge our research. Deciphering this code is like understanding unknown language.

We attempted to solve this problem combining experimental and modeling approach to test activity of neurons in one of the structures of the subcortical visual system – the superior colliculus. Visual cells do not form a homogeneous population – they elaborate different aspects of the visual image, like color, shape and movement or pattern of surface independently, and this information is sent from the retina to higher visual centers in parallel channels. We showed that cells which belong to different channels and are sensitive to different visual stimuli encode information in different ways. Cells from one class take into account recent history of their activity, while the other class of cells appears to use a more complex code. Our finding confirms that there is no universal code in the visual systems and a proper description of cell activity requires further analysis and subtle models of data.