▶ AMY FELTY, *A formal model of neuronal networks and their properties in Rocq*.
School of Electrical Engineering and Computer Science, University of Ottawa, Canada.
E-mail: afelty@uottawa.ca.

Verification of models of biological and medical systems is a promising application of formal verification. Human neural networks have recently been emulated and studied as a biological system. In this work, we provide a model of some crucial neuronal circuits, called *archetypes*, in the Rocq Prover and prove properties concerning their dynamic behavior. Understanding the behavior of these modules is crucial because they constitute the elementary building blocks of bigger neuronal circuits. We consider a variety of fundamental archetypes and prove an important representative property for most of them. In building up to our model of archetypes, we also provide a general model of neuronal circuits, and prove a variety of general properties about neurons and circuits. The properties we prove have been identified as important in discussions with neurophysiologists. Our most recent work involves a thorough study of the *contralateral inhibition* archetype, which consists of two or more neurons, each one inhibiting the other; in most cases, there is a "winner" which continually fires, while all others become dormant. In addition, we have defined our model with a longer term goal of modeling the composition of basic archetypes into larger networks, and structured our libraries with definitions and lemmas useful for proving the properties in both current and future work. This is joint work with Abdorrahim Bahrami, Samuel Desrochers, Elisabetta De Maria, and Rebecca Zucchini.