## Building Functional Sensory Circuits: Unraveling the Role of Spontaneous Activity in modality-specificity

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Spontaneous thalamic waves of activity propagate to the cortex during normal embryonic development, influencing the organization of cortical structures. Our group has pioneered the study of the role of these thalamic waves in the development of sensory maps and cortical columns, the functional unit of the cortex. These studies have revealed that structured patterns of neuronal activity in the thalamus of mouse embryos sculpt the functional columns in the cortex and the concomitant functional somatotopic map, a process that occurs during immature cortical stages. Using in vivo calcium imaging in intact mouse embryos, we identified that the fundamental columnar organization of the thalamocortical somatotopic map already exists before birth. Our laboratory provided the first causal link between intrinsic thalamic activity in the embryo and cortical map formation. Recently, our lab has demonstrated that sensory circuits emerge as nonsegregated modules and that at birth these circuits became segregated and sensory modalities specified. By doing sensory circuit stimulation in mouse embryos in vivo, we found, unexpectedly, that this segregation takes place in an evolutionary ancient subcortical structure, the superior colliculus, in a process that depends on the earliest activity from the retina. This work has now changed the way we understand the development of sensory circuits and has opened several lines of research in the frontier of knowledge. In my talk I will show these relevant data and discuss new unpublished results on the existence of patterns of spontaneous activity in sensory stations and how these patterns might be used as a tool to predict circuit development and early sensory plasticity.