Neuroscience data talk

Instinctive behavior circuit development is shaped by sensory input, sex, and function

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Host: Sweeney Group

How does animal behavior emerge developmentally? This question, and particularly the underlying contributions of genetic versus environmental information, has been fiercely debated by generations of scientists, leading Nikolaas Tinbergen to codify developmental issues as one of his Four Questions in the study of animal behavior. Despite this historical spotlight, modern studies of neuronal circuit development have largely focused on sensory systems or prenatal stages. To gain insight into behavior development, we focused on the preoptic area (POA) of the hypothalamus. Recent work has identified molecularly defined neuronal types in the POA that appear dedicated to specific social behaviors (e.g. mating or parenting) or homeostatic functions (e.g. sleep or thirst). However, this work has been carried out exclusively in adults; how these cell types emerge developmentally remains unknown. We molecularly profiled POA cell types in mice using single-nucleus RNA-sequencing and paired ATAC-sequencing at eight ages from late embryo to adult. We identified key stages of POA development, including the perinatal emergence of sex differences, postnatal maturation of signaling networks, and nonlinear transcriptional changes accelerating at the time of weaning and puberty. We next asked how POA development is affected by environmental inputs by examining five mutant lines, each impaired in a specific sensory modality crucial for POA function. This uncovered a major role for vomeronasal input in POA cell type maturation, while other sensory inputs have little to no effect. Altogether, our work paints a picture of POA development as surprisingly sensitive to extrinsic factors, and lays the foundation for future work addressing the origin of instinctive behaviors and their control at various life stages.

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Mondi 2, Central Building

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