

Solving a Puzzle in Brain Development

Scientists may have answered a longstanding question in biophysics: how the brain learns to recognize features in images before a newborn even opens its eyes.

By **Ryan Wilkinson**

In a region of the brain known as the primary visual cortex, each neuron transmits an electrical signal only when an image contains a light or dark edge of a specific orientation. The orientation that triggers the transmission varies between neurons. Such orientation selectivity develops in baby animals before they first open their eyes and, therefore, before they have any visual experience. Francesco Fumarola at the RIKEN Center for Brain Science, Japan, and his colleagues have now devised a model that explains this surprising observation [1].

The orientation selectivity is thought to arise through rules by which “neurons that fire together, wire together.” In other words, if any two neurons are frequently active at the same time, their connections strengthen so that activity in one neuron facilitates activity in the other. Previous work showed that this process could lead to the development of orientation selectivity if, in the absence of vision, input neurons to the primary visual cortex spontaneously fire together in particular

patterns. However, those predicted patterns do not match the ones observed in experiments.

Fumarola and colleagues found a way in which the emergence of orientation selectivity could arise from the firing patterns seen in experiments. In their model, input neurons with stronger connections to the primary visual cortex compete less effectively with other neurons for further connections and vice versa. The firing of these input neurons then instructs the development of orientation selectivity. The researchers say that by addressing this longstanding problem, their study could lead to a better understanding of other aspects of brain development.

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REFERENCES

1. F. Fumarola *et al.*, “Mechanisms for spontaneous symmetry breaking in developing visual cortex,” *Phys. Rev. X* **12**, 031024 (2022).



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