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# Brains That Are Still Getting Wired In Babyhood

Cells migrate long after birth and affect development, new research shows



*ILLUSTRATION: TOMASZ WALENTA**

By **MELVIN KONNER**
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**We humans** are born in a feeble state, very much needing our parents to help us survive. They also play a role in shaping our unripe brains for social life. A major new discovery offers insight into these remarkable neural developments in the first few months of life—and highlights the peculiar evolutionary strategy that allows us to have such big brains.

Scientists have a clear sense of how the brain grows in the womb. A deep "progenitor" zone creates new cells, called neurons, which are guided by molecular signals to various specialized regions. We have long thought that this differentiation in the brain was largely complete before birth.

The new study—published in October in the journal Science and led by Mercedes Paredes of the University of California, San Francisco—changes this thinking. In fact, new neurons fan out all over the frontal lobes *after* birth. The frontal lobes carry out our most distinctively human functions—speech, reason, planning, the regulation of emotions.

## *Markers of migrating cells lit up an arc of red and green.*

Neurons formed in the progenitor zone must migrate across the brain to the spots where they are needed to form connections. This happens with help from proteins on the cell's outer walls. The proteins allow a neuron to recognize the surfaces and cells that it needs to slink over—and where it must stop to connect. This circuit formation is key to brain development.

Why are these new cells needed? The scientists identified the presence of gamma-aminobutyric acid (GABA), which suggests one of the roles of this cell migration. In the brain, GABA functions chemically to inhibit a cell from its activities—acting as a kind of "off" switch.

The researchers do not speculate about the purpose of this cell migration, but the fact that the cells are wired to inhibit suggests to me that they might help in one of the frontal lobe's major roles: curbing impulses from deeper, older parts of the brain. If this is so, why would this development happen after birth, without the protection of the womb? The past few decades of anthropological research offer an answer, and it has to do with our unusual evolutionary strategy as a species.

Our ape relatives enjoy easy births, but the sturdy pelvises that allowed humans to stand upright six million years ago made the birth of large babies difficult. A few million years later our heads began to swell to accommodate our increasingly powerful brains. All of this made it necessary for women to give birth earlier in gestation.

Eventually, anthropology tells us, humans needed so much development that it could not all happen inside the womb. We came to need a "fourth trimester"—external gestation. Remarkably, the imaging studies done for the new paper suggest that the migration of brain cells over the frontal lobes goes on until 5 or 6 months of age.

Compared with humans, an ape mom's newborn is advanced: perkier, abler and cuter in every way. But humans' external gestation means that our cuddling, rocking, cooing, singing and smiling—as well as our nonresponse to a cry or a dirty diaper—affect our babies at a time when their brains are far from complete, when some cells are being wired up from scratch.

This suggests to me how our early interactions with babies might establish lasting behavior patterns, for better or worse, even before they get to the "three-months revolution," when their behavior includes social smiles, eye contact and less crying, all of which get the baby ready for relationships.

Our grandnephew visited recently after five great months on the outside—most of his brain-cell migration presumably done, but the wiring-up still going on. He was all eyes, smiling and laughing at everyone—a step toward the trust at the heart of society. But those inhibiting circuits are at work too. Soon he will focus more on his ardent parents, selectively creating the relationships that are the building blocks of our social life.

**Just a note to say that when Tomasz Walenta made this graphic, he was working from a version of the column that described the pattern of migrating brain cells as an arc or rainbow, with cells stained red and green by the scientists. As usual, a brilliant Walenta drawing, but unfortunately the reference that would have made it clear was cut from the text for space reasons. — Mel Konner*