

# Babies' brains may be tuned to language before birth

Brain imaging shows that premature babies process speech in similar ways to adults.

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Despite having brains that are still largely under construction, babies born up to three months before full term can already distinguish between spoken syllables in much the same way that adults do, an imaging study has shown<sup>1</sup>.

Full-term babies — those born after 37 weeks' gestation — display remarkable linguistic sophistication soon after they are born: they recognize their mother's voice<sup>2</sup>, can tell apart two languages they'd heard before birth<sup>3</sup> and remember short stories read to them while in the womb<sup>4</sup>.

But exactly how these speech-processing abilities develop has been a point of contention. "The question is: what is innate, and what is due to learning immediately after birth?" asks neuroscientist Fabrice Wallois of the University of Picardy Jules Verne in Amiens, France.

To answer that, Wallois and his team needed to peek at neural processes already taking place before birth. It is tough to study fetuses, however, so they turned to their same-age peers: babies born 2–3 months premature. At that point, neurons are still migrating to their final destinations; the first connections between upper brain areas are snapping into place; and links have just been forged between the inner ear and cortex.

## Colourful sounds

To test these neural pathways, the researchers played soft voices to premature babies while they were asleep in their incubators a few days after birth, then monitored their brain activity using a non-invasive optical imaging technique called functional near-infrared spectroscopy. They were looking for the tell-tale signals of surprise that brains display — for example, when they suddenly hear male and female voices intermingled after hearing a long run of simply female voices.

The young brains were able to distinguish between male and female voices, as well as between the trickier sounds 'ga' and 'ba', which demands even faster processing. What is more, the parts of the cortex used were the same as those used by adults for sophisticated understanding of speech and language.

The results show that linguistic connections inside the cortex are already "present and functional" and did not need to be gradually acquired through repeated exposure to sound, Wallois says. This suggests at least part of these speech-processing abilities is innate. The work could also lead to better techniques caring for the most vulnerable brains, Wallois adds, including premature babies. The team's results appear in *Proceedings of the National Academy of Sciences*<sup>1</sup>.

These are "remarkable findings", says Janet Werker, a developmental psychologist at the University of British Columbia in Vancouver, Canada. They are, she says, the first evidence that brains can distinguish between difficult consonants even before a full-term birth, hinting at greater brain sensitivities than previously imagined<sup>5</sup>.

Yet this does not fully answer the innate-versus-learned question, Werker says. "It is possible that the experience of birth triggers a set of processes that prime the brain of a premature infant to respond to language in ways that a same-aged fetus will not."

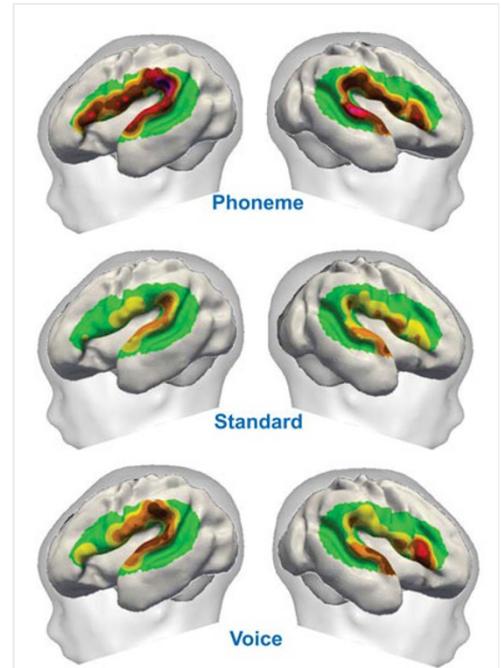


Image courtesy Fabrice Wallois

Changes in blood oxygenation show how brain areas activate while premature babies listen to speech. Monotonous sounds elicit milder responses (middle row) than switching between different syllables (top) or between male and female voices (bottom).

## References

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