Study shows human brain able to discriminate syllables three months prior to birth

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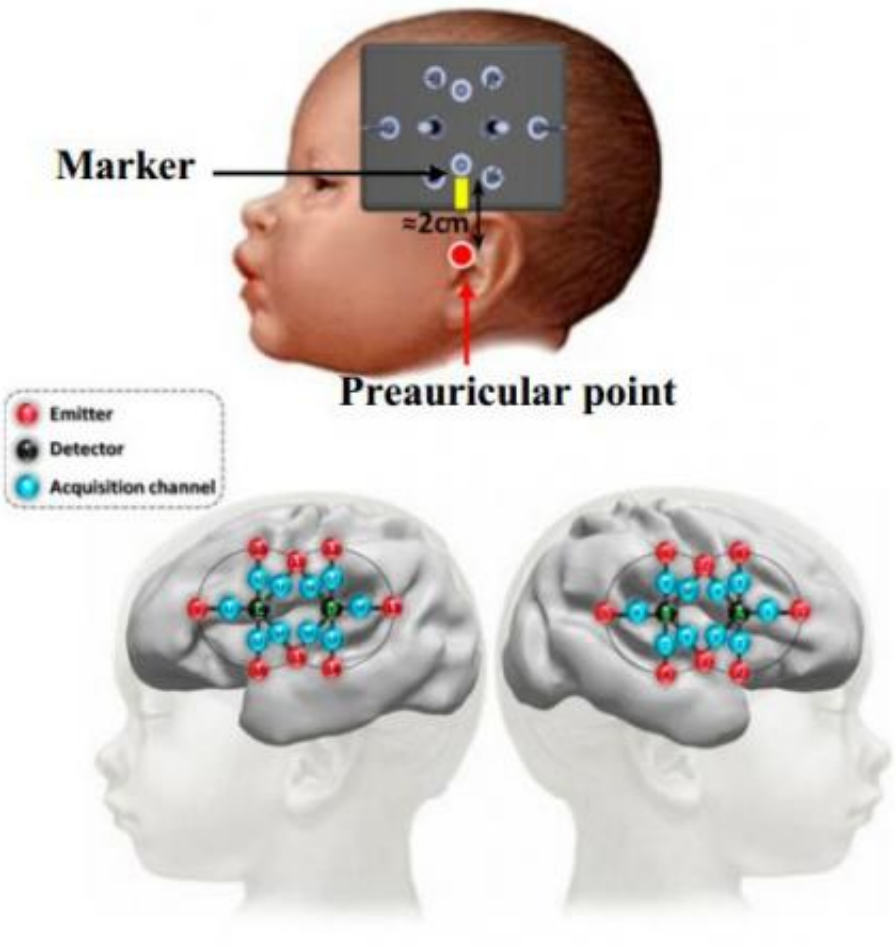

(Upper) Schematic representation of the location of the optical probe on an infant's head relatively to anatomical landmarks. (Lower) Estimated projection of the optodes on the brain of a 30 wGA preterm infant [courtesy of Petra Huppi and Jessica Dubois]. The eight emitters (red circles) are arranged on two 1.5-cm-diameter circles centered by the two detectors (black circles), creating 10 points

of measure (channels) over each hemisphere (blue circles). Credit: *PNAS*, doi: 10.1073/pnas.1212220110

(Medical Xpress)—A team of French researchers has discovered that the human brain is capable of distinguishing between different types of syllables as early as three months prior to full term birth. As they describe in their paper published in the *Proceedings of the National Academy of Sciences*, the team found via brain scans that babies born up to three months premature are capable of some language processing.

Many studies have been conducted on full term babies to try to understand the degree of mental capabilities at birth. Results from such studies have shown that babies are able to distinguish their mother's voice from others, for example, and can even recognize the elements of short stories. Still puzzling however, is whether some of what newborns are able to demonstrate is innate, or learned immediately after birth. To learn more, the researchers enlisted the assistance of several parents of premature babies and their offspring. Babies born as early as 28 weeks (full term is 37 weeks) had their brains scanned using bedside functional optical imaging, while sounds (soft voices) were played for them.

Three months prior to full term, the team notes, neurons in the brain are still migrating to what will be their final destination locations and initial connections between the upper brain regions are still forming—also neural linkages between the ears and brain are still being created. All of this indicates a brain that is still very much in flux and in the process of becoming the phenomenally complicated mass that humans are known for, which would seem to suggest that very limited if any communication skills would have developed.

The researchers found, however, that even at a time when the brain

hasn't fully developed, the premature infants were able to tell the difference between female versus male voices, and to distinguish between the syllables "ba" and "ga". They noted also that the same parts of the brain were used by the infants to process sounds as adults. This, the researchers conclude, shows that linguistic connections in the brain develop before birth and because of that do not need to be acquired afterwards, suggesting that at least some abilities are innate.

More information: Syllabic discrimination in premature human infants prior to complete formation of cortical layers, *PNAS*, Published online before print February 25, 2013, doi: 10.1073/pnas.1212220110

Abstract

The ontogeny of linguistic functions in the human brain remains elusive. Although some auditory capacities are described before term, whether and how such immature cortical circuits might process speech are unknown. Here we used functional optical imaging to evaluate the cerebral responses to syllables at the earliest age at which cortical responses to external stimuli can be recorded in humans (28- to 32-wk gestational age). At this age, the cortical organization in layers is not completed. Many neurons are still located in the subplate and in the process of migrating to their final location. Nevertheless, we observed several points of similarity with the adult linguistic network. First, whereas syllables elicited larger right than left responses, the posterior temporal region escaped this general pattern, showing faster and more sustained responses over the left than over the right hemisphere. Second, discrimination responses to a change of phoneme (ba vs. ga) and a change of human voice (male vs. female) were already present and involved inferior frontal areas, even in the youngest infants (29-wk gestational age). Third, whereas both types of changes elicited responses in the right frontal region, the left frontal region only reacted to a change of phoneme. These results demonstrate a sophisticated organization of perisylvian areas at the very onset of cortical circuitry, 3 mo before

term. They emphasize the influence of innate factors on regions involved in linguistic processing and social communication in humans.

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