Reply to El-Dib and Glass: Neuroplasticity in the auditory cortex in premature newborns exposed to recorded maternal sounds

We appreciate the close reading and thoughtful comments El-Dib and Glass (1) give our report (2). In our study, 40 premature newborns in the neonatal intensive care unit (NICU) were randomly assigned to receive 3 h/d of auditory enrichment in the form of recorded maternal sounds (RMS; intervention group) or to receive standard care (control). The RMS included mother's voice and heartbeat sounds similar to those heard in the womb. Results show that newborns in the intervention group had a significantly larger auditory cortex at 1 mo of age compared with controls, demonstrating structural brain plasticity in response to maternal auditory stimulation.

To what extent could (or should) auditory stimulation for premature newborns precisely mimic the acoustic experience in the womb? This, among others, is one of the important questions remaining for future investigations. The acoustic gap between the NICU and the womb is virtually unavoidable (3). High-quality exposure to rhythmic/language stimulation in the NICU is extremely limited compared with the constant heartbeats and frequent vocalizations heard in the womb. We agree with El-Dib and Glass (1) that multiple repetitions of the same RMS is not considered a natural fetal experience. However, our intervention did not intend to precisely mimic the biological experience in utero, but rather to enrich the incubator's acoustic environment with womb-like sounds. To precisely replicate the fetal experience of nonstop heartbeat sounds and variable maternal vocalizations and test it experimentally, it would be necessary to put unethical restrictions on parental visitations.

It should be emphasized that RMS, as authentic as they might be, will always deviate from the natural prenatal experience where maternal stimulation is presented contingently in a multisensory fashion (4). In the NICU, such maternal multisensory experience is largely inaccessible except for during skin-to-skin care. Parents must understand that RMS can only supplement, but not replace, their physical presence in the NICU. For that reason, and given the evidence-based importance of reading/talking to NICU infants (5), parental visitation was equally encouraged in both of our study groups.

El-Dib and Glass (1) raise the possibility that noise in the NICU environment may have impeded growth in the control group. However, in our study both groups (intervention and control) were equally exposed to NICU noise. If NICU noise had any effect on brain growth, it would have affected both groups in the same way. The only difference between the groups was the 3 h/d exposure to RMS that newborns in the intervention group received. At this premature age, neurodevelopment is still in flux and the brain rapidly changes with every week of gestation. We were therefore puzzled by El-Dib and Glass's idea (1) of using preterm newborns born 30 d later as controls. This would have introduced a bias to our study, forcing an unfair comparison between preterm newborns born, for example, at 26-wk vs. 30-wk gestation. Although El-Dib and Glass's idea could give rise to an interesting follow-up study, it would have prevented us from determining the basic question of whether exposing NICU infants to RMS is better than the standard care.

Finally, whether the accelerated cortical growth in the auditory cortex observed in our study (2) is sufficient to set the brain on the right developmental track is still a matter of speculation. Further studies are needed to determine the functional implications of these results and their predictive value of long-term hearing and language outcomes.

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The author declares no conflict of interest.

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