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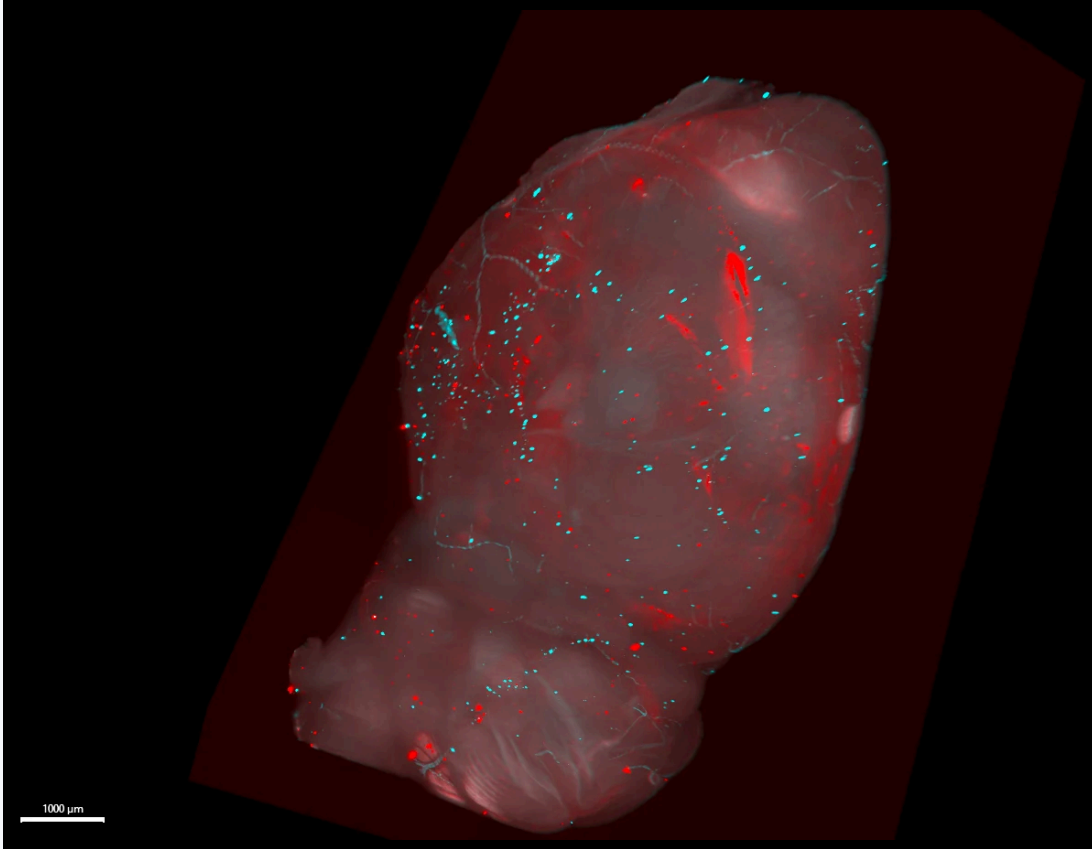
Okun Lab

Inside Our Research



3D view of a maternal mouse brain after pregnancy with a Down-syndrome fetus, captured with an advanced “light sheet” microscope that allows for visualization deep inside the still-intact brain.

The **red** spots are cells that arrived from the fetus, crossed the placenta and settled in the mother’s brain. The **cyan** signal, marks a protein called Amyloid-beta, which is correlated with Alzheimer’s disease. By simply observing where the fetal cells and Alzheimer’s-related proteins are appearing side-by-side, we can begin to understand how pregnancy leaves a long-lasting biological “footprint” in a mother’s brain.

Image credit: Tamir Hirsh. 3D reconstruction of a mouse brain captured using light-sheet microscopy. The Paul Feder Okun Laboratory for Alzheimer’s Disease

Is Feto-maternal Transfer in Down Syndrome Pregnancies Quietly Reshaping Maternal Brain Health?

During every pregnancy, a significant number of fetal cells naturally cross into the mother's body. This is a normal biological process that has been known for quite some time. In pregnancies involving a fetus with Down syndrome, however, this transfer occurs much more intensely and the fetal cells carry higher levels of a protein that causes Alzheimer's disease.

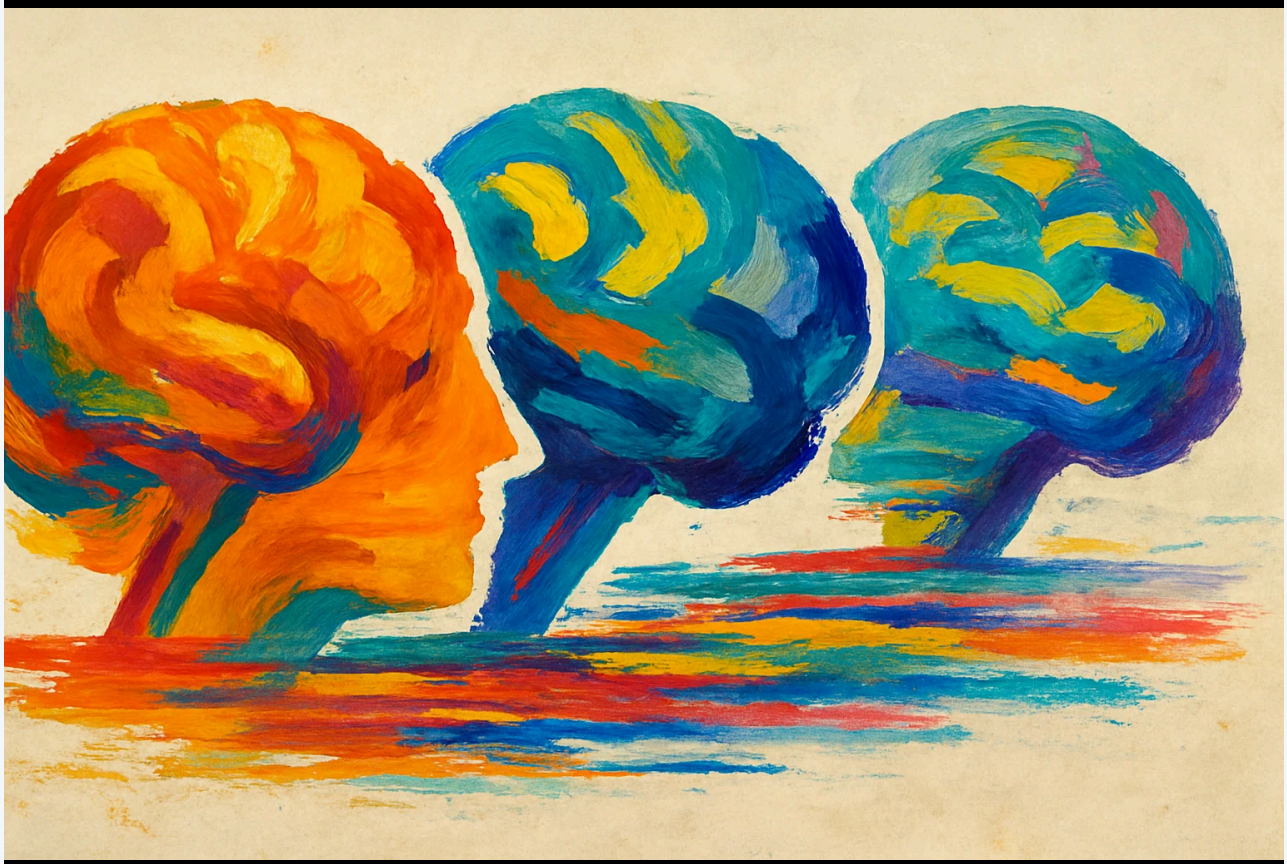
Our lab is studying a simple but profound question: **What happens to a mother's brain whose carrying a fetus with a neuro-developmental disorder, such as Down syndrome?**

We have discovered that fetal cells can travel into the mother's bloodstream, reach her organs, and even enter her brain! Some of these cells may remain in the mother's body for years or even decades after the pregnancy ends. This transfer leads to measurable changes in memory, neuro-inflammation, and the brain's ability to clear harmful proteins. Similarly, these changes are equivalent to what occurs during the early stages in Alzheimer's disease.

Importantly, our work does not suggest that all mothers of children with Down syndrome will develop memory problems. Rather, we are uncovering a new biological pathway that may help explain why women that had pregnancies with Down syndrome babies are at higher risk of developing Alzheimer's disease.

As seen in the image above, understanding how fetal cells interact with the maternal brain, we hope to identify new ways to protect mothers' long-term cognitive function. This research revolutionizes our understanding of the maternal brain during aging, which has been overlooked for decades.

Highlights From The Field



Speaking More Languages, Aging More Slowly

Researchers analyzed data from more than 86,000 adults across 27 European countries to test whether living in more or less multilingual environments relates to how quickly people age. Using a wide range of health and lifestyle indicators, they built a “bio-behavioral age gap” score, which reflects whether someone appears to be aging faster or slower than expected for their chronological age.

The key finding was that country-level multilingualism acted as a protective factor: in countries where larger proportions of people speak additional languages, individuals were less likely to show accelerated aging, whereas those in more monolingual contexts faced higher odds of accelerated aging. This pattern appeared in both cross-sectional and longitudinal analyses and remained robust after adjusting for many national-level influences such as air quality, economic conditions, social inequality, and political context.

Importantly, the protective association showed a dose response pattern: higher national rates of people speaking one, two, or more foreign languages were linked to progressively lower risk of accelerated aging, although some specific contrasts weakened under certain adjustments. These results suggest that greater multilingualism at the population level may support the maintenance of cognitive and functional capacities into older age and could be a useful, though not yet proven causal, lever for public health strategies.

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