University of Lethbridge News Release

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Researchers show prenatal stress influences new behavioural traits, including handedness

A new study by researchers at the Canadian Centre for Behavioural Neuroscience at the University of Lethbridge, recently published in Cerebral Cortex, shows the effects of prenatal stress accumulate across generations and can affect behavioural traits, such as right- and left-handedness.

Mirela Ambeskovic, a PhD candidate working in the laboratory of Dr. Gerlinde Metz, was the lead author in a study that examined the effects of prenatal stress over four generations of rats.

“Our original idea was just to test the effects of prenatal stress on motor development to see if it affects males and females differently and whether one generation of stress would have a different effect than four generations of stress,” says Ambeskovic. “But while I was testing my animals’ fine motor skills in a reaching task, I noticed something interesting.”

Ambeskovic found that males who were in the multigenerational stress group were predominantly left-pawed, while females in the same group were both left- and right-pawed. In comparison, males whose ancestors were only exposed to stress once, either in their mothers or their great-great-grandmothers, did not show a significant increase in being left-pawed.

She and Metz, a neuroscience professor, went through previous research and found no conclusive evidence of a genetic link to handedness.

“We thought maybe it’s an epigenetic effect because these animals have been stressed and epigenetically programmed across generations,” says Ambeskovic. “We did see a difference in behaviour so the stress had negative effects on fine motor skills in males and it actually had positive effects in females. Our females were better at the reaching task than the control group which had experienced no stress.”

With the help of Dr. Bryan Kolb, also a neuroscience professor, they examined the neural structure of the brains of these male rats. The researchers found their right hemispheres — which are linked to the left paw — showed increased complexity and spine density, or more connections, in their neurons.

“Ancestral stress often affects males more than females,” says Ambeskovic. “It affects their behaviour and it also changes their brain organization, so we see the structural changes in the neurons and their spine density.”

Researchers don’t know what comes first, paw preference or a dominant right brain hemisphere but even so, such changes should be adaptive. Ambeskovic says ancestral stress may have a protective effect for females.

“It could be that, through epigenetics, our moms prepare us for a stressful environment that might be coming down the road and it’s more important for females to know how to cope with it as they will be the bearers of the future generation,” says Ambeskovic.

In the same way, males affected by ancestral stress might be better prepared to defend their territory because they are more adaptable, perhaps because they could be more prone to using both paws if needed, Metz adds.

“There have been studies, that for programming across generations, there’s an increase in behavioural flexibility, especially in the males. That’s what we’re seeing here. There’s more flexibility to do more tasks,” says Metz.

Ambeskovic is also looking at the effects of multigenerational stress and aging. She has found that males exposed to multigenerational stress are more susceptible to chronic diseases as they age. This study, and others, show the brain can be changed by experience and this could help pave the way to developing interventions that could change the brain in beneficial ways earlier in life.

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Contact:
Caroline Zentner
403-394-3975 or 403-795-5403
caroline.zentner@lethbridgeherald.com