MEDIA RELEASE

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Deakin University researcher unveils pregnancy mystery

A Deakin University study has unlocked one of the many mysteries of pregnancy—how the trace element copper is transported across the placenta. The findings provide a lead to the possible cause, treatment and prevention of a number of potentially fatal conditions.

Belinda Hardman completed the study for her PhD with Deakin's Centre for Cellular and Molecular Biology under the supervision of Dr Leigh Ackland.

Ms Hardman is the first to find that copper is delivered to the developing foetus via specific transporters in the placenta that are regulated by the mother's oestrogen and insulin levels. These findings have implications for better understanding preeclampsia, intrauterine growth retardation, the development of babies born to mothers with gestational diabetes and some genetic disorders.

"This is a very exciting finding because until now nobody understood how copper moved across the placenta from the mother to the foetus," Ms Hardman said.

"The results provide a target for further research into a range of conditions that are believed to be related to copper metabolism such as preeclampsia and intrauterine growth retardation (a condition where the foetus doesn't receive enough nutrition to grow properly).

"The study has implications for understanding genetic diseases such as Wilsons Disease—a copper toxicity disorder that affects the liver—and Menkes Disease—a copper deficiency disease that is fatal. It also provides a point of reference for looking at the development of babies born to mothers who had gestational diabetes because of the impact this illness has on maternal insulin levels."

Using placental cells grown in culture to form a layer of what the placenta is like in the body, Ms Hardman was able to follow the flow of copper across the placenta and see the effect of hormones.

"Through studying the cell model I identified two transporters involved in the regulation of copper: one transporter took copper across the placenta to the foetus and a different transporter took any excess copper back to the mother. This system would ensure that there was never too much copper in the foetus," she explained.

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"As pregnancy progresses and the nutritional needs of the foetus increase there is also a naturally occurring increase insulin and oestrogen in the mother. I was able to emulate this in the cell model and found that with the increase in hormones there was an increase in the copper going across the placenta and a decrease in the amount coming back, again ensuring adequate levels of copper available for the foetus."

Despite being essential for life, not a lot is known about the metabolism of copper generally, let alone during pregnancy.

"Not many people know that without copper the human body cannot survive," Dr Ackland explained.

"Copper is particularly necessary for brain and skin development. And while it is essential for life, too much can be deadly.

"For the most part people get enough copper in their diet so we do not believe that severe copper deficiency is a problem in the general population. However in pregnancy, when the needs of the mother change and there are the demands of the foetus, this is a critical time to understand copper metabolism.

"The foetus can face a range of problems without enough copper such as aneurysms, connective tissue disorders and mental retardation."

While her study does not provide all the answers, Ms Hardman said it was an important step in better understanding copper metabolism and opened up opportunities for further research.

"My research does not go all the way to explaining the impact of copper metabolism in certain diseases. However, it is important because we need to understand the normal state before we can look further at the implications in copper-related diseases," she said.

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Belinda Hardman and Leigh Ackland are available for interview.

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