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Nature and nurture: Baby's development is affected by genes and conditions in the womb

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A recent study led by A*STAR's Singapore Institute for Clinical Sciences (SICS) found that genetics as well as the environment in the womb play important roles in the development of the baby. The effort by the international team of scientists and clinicians is the world's first attempt to discover how genetic and environmental factors affect the human epigenome . The results have fundamental implications for how epigenetic studies will be conducted in the future and for our understanding of how the mother's nutrition and lifestyle may have long-lasting effects on the health of her children.

In this study, samples of umbilical cord tissue were taken from 237 individuals in the GUSTO Birth Cohort Study and their epigenetic profiles were examined. While genetic differences alone accounted for 25% of epigenetic variation, up to 75% could be attributed to interaction between genetic differences and prenatal environments. This means that both prenatal and genetic factors closely related.

Earlier research has shown that some of prenatal factors such as maternal smoking, maternal depression, maternal weight, infant birth weight, gestational age and birth order affect the development of foetuses. This study shows that the most variable epigenetic marks among new-borns are most likely to be driven by a combination of genetic differences and the environment in which the baby develops before birth. Thus, future studies on human epigenetic variation could include an assessment of how much environmental influences are affected by genetic differences. The findings were published in the

respected genome biology and genomic medical journal *Genome Research*.

Coordinated by Senior Principal Investigator, Dr. Joanna Holbrook at A*STAR's SICS, and in collaboration with the Yong Loo Lin School of Medicine, National University Health System, KK Women's and Children's Hospital, and overseas partners in Canada, U.K., and New Zealand, samples from the GUSTO Birth Cohort Study (detailed in Annex A) were used for this landmark study on Asian epigenetics.

"The GUSTO birth cohort is an extremely powerful dataset to investigate how our experiences at the very beginnings of our lifetimes, in combination with our genes, affect our health throughout our lives. We see those messages transmitted via our DNA. We are asking fundamental questions about how the product of human evolution (our genes) interact with the individual circumstances we are born into, to shape our well-being," remarked Dr Joanna Holbrook.

"These findings are likely to revolutionise our understanding of gene-environment interactions in early life and demonstrates the type of science that can be brought to bear when clinicians, basic scientists, and bio-informaticians work together," said Associate Professor Chong Yap Seng, GUSTO Lead Investigator and Acting Executive Director at SICS.

Professor Keith Godfrey, Professor of Epidemiology and Human development at the Medical Research Council Lifecourse Epidemiology Unit, University of Southampton, iterated, "Epigenetics, and in particular DNA methylation marks, are thought to link a baby's development in the womb with its risk of obesity and heart disease in later life. This research provides important new evidence that fixed changes in a baby's genes have only a modest influence on its epigenetic profile at birth and that most of the variation between babies arises from interactions between the environment experienced in the womb and the

genetic information inherited from the parents."

More information: genome.cshlp.org/content/early … 39.113.full.pdf+html

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