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Press Office
Universitätsstraße 10
D-78464 Konstanz
+49 7531 88-3603
Fax +49 7531 88-3766

kum@uni-konstanz.de
www.uni-konstanz.de

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From grandmother to grandchild:

Professor Thomas Elbert's research team confirms epigenetic effects of having experienced violence.

Violence experienced by expecting mothers detectable in the DNA of their grandchildren. DNA methylation the underlying molecular mechanism. Results published in the Translational Psychiatry journal.

In 1944 and 1945, during the Second World War, the Netherlands experienced a winter famine. Studies have revealed that the children of mothers who were pregnant during this period tended to be overweight and have lifestyle diseases. By contrast, the children of mothers who had been pregnant during the siege of Leningrad in the Second World War displayed none of these tendencies. One of the differences was that, after 1945, Holland developed into an affluent society with an abundance of food, while the Soviet Union did not. These Dutch children had been programmed to survive in a world of famine and few resources but were actually living in abundance.

This coding does not change within a generation. Experiments on animals provide evidence for these effects lasting several generations afterwards. Studies have also drawn the conclusion that epigenetic effects of the experiences of expecting human mothers can be observed in the DNA of their grandchildren. Further confirmation for this hypothesis has now been provided by clinical psychologist Professor Thomas Elbert and his team in Konstanz. Translational Psychiatry published the results of data collected by Dr Fernanda Serpeloni in Rio de Janeiro state, in a region with high levels of domestic and community violence. Dr Serpeloni works in the Clinical Psychology and Neuropsychology research group. The study focuses on finding evidence that experiencing massive violence during pregnancy influences the legibility of genes into the grandchildren's generation.

For her dissertation, Fernanda Serpeloni and specially trained colleagues took saliva samples from 386 people - grandmothers, their daughters and grandchildren. The grandmother and daughter generations were also asked about violence they had experienced in their partnerships and communities in the periods before, during and after their pregnancies.

A fifth of the grandmothers reported having experienced violence by their partners during the pregnancy, another fifth had experienced violence in their extended family and community and

seven percent indicated having experienced both forms of stress during pregnancy. Based on the saliva samples, researchers were able to predict the grandchildren's DNA in five locations within genes involved in circulatory regulation - based on the violence experienced by the grandmothers while they were pregnant with the mothers of these children. "Our studies revealed that especially violence experienced during pregnancy leads to different methylations in children. This is the case, regardless of whether the violence was committed by the partner or in the community", Thomas Elbert concludes.

DNA methylation describes the biological mechanism which connects certain DNA segments to a methyl group. This process is a reaction of the genome to the environment through which genes can be either activated or deactivated. It is an epigenetic mechanism, since the genetic sequence itself is not changed, but only the implementation of the genetic information, its legibility.

The study confirms the role DNA methylation plays in transferring stress from generation to generation. "Methylation patterns are supposed to make it easier to adapt to an environment", says Thomas Elbert. In this case, it suggests: children with the altered DNA methylation patterns might either become more fearful even to the point of depression or act more aggressively and not be very sensitive to others. "It is generally accepted that prenatal stress influences the development of the nervous system, psychological health and risk of psychiatric disorders" Thomas Elbert says. Prenatal DNA methylation patterns could be used as biomarkers in the future.

Original publication:

Serpeloni, F., Radtk,e K., de Assis, S., Henning, F., Nätt, D., Elbert, T. (2017): Grandmaternal stress during pregnancy and DNA methylation of the third generation: an epigenome-wide association study. *Tanslational Psychiatry*, 7 :e1202.
<http://dx.doi.org/10.1038/tp.2017.153>

Facts:

- Study on the epigenetic transfer of violent experiences performed in São Gonçalo, Brazil by the Clinical Psychology and Neuropsychology research group led by Professor Thomas Elbert.
- 386 participants from three generations.
- Support provided by an ERC Advanced Grant MEMO TV (Memories of trauma and violence).

Note to editors:

You can download a photo here:

https://cms.uni-konstanz.de/fileadmin/pi/filesserver/2017/Bilder/Elbert_Sao_Goncalo.jpg

Caption: The Region in Rio de Janeiro state in Brazil, where the data for the study of the University of Konstanz's Clinical Psychology and Neuropsychology research group was collected.

Photo: Dr Fernanda Serpeloni

Contact

University of Konstanz
Communications and Marketing
Phone: + 49 7531 88-3603
E-Mail: kum@uni-konstanz.de

- uni.kn