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'Experiment of nature' examines how mother's diet may impact on child's health

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Could our mother's diet at the time we are conceived set the course for our future health? This intriguing question is at the heart of a new study based on an "experiment of nature" being conducted by Wellcome Trust-funded researchers.

We inherit our DNA - the genetic blueprint that determines our make-up - from our parents: 50% of our DNA from our mothers and 50% from our fathers. Apart from the occasional mutation, deletion or duplication of information, this DNA remains unchanged between generations.

The environment, for example our diet, whether we smoke, and the toxins that we encounter in our daily life, can cause changes in how our genes are expressed - in other words, how they function - and these changes can be inherited, even when the DNA sequence itself does not change. These so-called "epigenetic" effects can occur through a process known as DNA methylation, where methyl caps bind to our DNA and act like dimmer switches on our genes.

Now, Dr Branwen Hennig and colleagues from the Medical Research Council (MRC) International Nutrition Group based at the London School of Hygiene and Tropical Medicine have been awarded £360,000 from the Wellcome Trust to look at whether a mother's diet during pregnancy can influence these epigenetic effects.

The study will be conducted at the MRC Laboratories in Keneba, The Gambia, where the seasonal variability of food provides the ideal

environment to conduct an "experiment of nature".

"During the 'hungry season' people eat mainly what they have in store, such as cereals and dried food," explains Ms Paula Dominguez-Salas, who will conduct the fieldwork in The Gambia. "They are working in the fields and have a very high energy expenditure, but their intake is very low. The 'harvest season' is the other way round and food, including fresh foods, is in relatively plentiful supply."

The researchers will measure the diets of women in early pregnancy for nutrients which affect methylation, such as folate and choline, and some B vitamins which are essential co-factors in methylation. They will compare these to levels of the nutrients in the women's blood and once the children have been born, the researchers will measure methylation patterns of the babies' DNA. This will help the researchers assess whether there is a correlation between the mother's diet and her nutritional status, and whether there are differences in methylation patterns in babies conceived during the harvest or hungry seasons.

If a mother's diet does affect her offspring's methylation patterns, this could prove very important as epigenetic changes mediated by DNA methylation are likely to have long term effects on the health and physical characteristics of offspring. Animal studies have shown that supplementing the diet of pregnant mice can lead to very marked differences in their offspring with mice fed a folate-depleted diet producing litter with different coat colour or "kinked" tails compared to those fed a diet rich in folate.

"Alterations in DNA methylation are thought to increase the risk of a child developing chronic conditions later in life, such as cardiovascular disease, cancers and type II diabetes," says Dr Hennig. "We think these epigenetic changes are established very early on in the womb."

This will be the first time that the effects of a mother's diet on epigenetic alterations of her children will be studied so extensively. A study published recently in the *Proceedings of the National Academy of Sciences* looked at the effect of wartime blockades in the Netherlands on the nutritional intake of mothers and whether this affected their children's expression of the IGF2 gene, which is involved in growth, as adults. It found that the IGF2 gene had 5 per cent fewer methyl caps in "famine babies" than in their siblings born outside this period. However, the study by Dr Hennig and colleagues will enable the researchers to accurately measure maternal nutritional intake and compare this to methylation patterns in their children.

The study has been welcomed by Dr Alan Schafer, Head of Molecular and Physiological Sciences at the Wellcome Trust.

"This is a very interesting and exciting area of research," says Dr Schafer. "Finding a link between these women's diet and epigenetic changes could ultimately have important implications for our understanding of long term health effects and advice on healthy eating."

Source: Wellcome Trust