Should we listen to our genes, or does mother know best?

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The new study shows in rapidly changing environments, offspring develop very different characteristics from their mothers to meet new challenges to survival.

Breaking the mould of inherited family characteristics could help you survive in a fast-changing world, scientists have discovered.

The way we look is for a large part determined by our genes, which have remained largely unchanged for thousands of generations. However, a pioneering new study, by scientists including from the University of Exeter's Penryn Campus, has shown that such slowly changing genes are only beneficial in a steady environment.

In periods of rapid environmental change, relying on genes can be highly disadvantageous. Instead you need new tricks that fit to your new surroundings, in order to survive.

In this pioneering study, scientists investigated whether natural selection would favour parents to have offspring that would largely resemble themselves (which is typically the case for genetically encoded characters); or whether parents would favour their offspring to be more different.

For example, it is known that parents born with a high susceptibility to certain disease often bear offspring with a much lower susceptibility, due to the transmission of multiple maternal factors, such as antibodies and hormones during pregnancy or breastfeeding.

The collaborative research saw scientists, including those from the University of Exeter, UCL and the University of Cambridge, use cutting–edge mathematical modelling to predict how these multiple maternal effects evolve to meet the needs of an organisms' natural environment.

The study showed that, in rapidly changing environments, offspring will develop very different characteristics from their mothers in order to meet the new challenges to survival.

However, traits that have helped a species survive over generations will continue to be displayed by offspring when the environment remains unchanged.

Professor Stuart Townley, from the University of Exeter's Mathematics department at the Penryn Campus in Cornwall, and one of the study's co-authors said: "What we can see from this study is that a significant change in an organism's inherent characteristic is a clear signature of environmental change."

Lead author Dr Bram Kuijper, from the University College London added: "What may have been a crucial characteristic for our ancestors to

display may become redundant as the world around us changes. In order to survive, organisms need to rapidly modify their own behaviour to meet new challenges and threats."

The study, The *Evolution* of Multivariate Maternal Effects, is published in *PLOS Computational Biology*.

More information: Kuijper B, Johnstone RA, Townley S (2014) "The Evolution of Multivariate Maternal Effects." *PLoS Comput Biol* 10(4): e1003550. DOI: 10.1371/journal.pcbi.1003550