Scientists reproduce evolutionary changes by manipulating embryonic development of mice

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A group of researchers from the University of Helsinki and the Universitat Autònoma de Barcelona have been able experimentally to reproduce in mice morphological changes which have taken millions of years to occur. Through small and gradual modifications in the embryonic development of mice teeth, induced in the laboratory, scientists have obtained teeth which morphologically are very similar to those observed in the fossil registry of rodent species which separated from mice millions of years ago.

To modify the development of their teeth, the team from the Institute of Biotechnology of the University of Helsinki worked with embryonic teeth cultures from mice not coded by the ectodysplasin A (EDA) protein, which regulates the formation of structures and differentiation of organs in the embryo throughout its development. The teeth obtained with these cultures which present this mutation develop into very basic forms, with very uniform crowns. Scientists gradually added different amounts of the EDA protein to the embryonic cells and let them develop.

The researchers observed that the teeth formed with different degrees of complexity in their crown. The more primitive changes observed coincide with those which took place in animals of the Triassic period, some two hundred million years ago. The development of more posterior patterns coincides with the different stages of evolution found in rodents which became extinct already in the Palaeocene Epoch, some 60 million years ago. Researchers have thus achieved experimentally to reproduce

the transitions observed in the fossil registry of mammal teeth.

The team of scientists were able to contrast the shape of these teeth with a computer-generated prediction model created by Isaac Salazar-Ciudad, researcher at the UAB and at the University of Helsinki, which reproduces how the tooth changes from a group of equal cells to a complex three-dimensional structure, with the full shape of a molar tooth, calculating the position of space of each cell. The model is capable of predicting the changes in the morphology of the tooth when a gene is modified, and therefore offers an explanation of the mechanisms that cause these specific changes to occur in the shape of teeth throughout evolution.

"Evolution has been explained as the ability of individuals to adapt to their environment in different ways" Isaac Salazar-Ciudad states, "but we do not know why or how individuals differ morphologically. The research helps to understand evolution, in each generation, as a game between the possible variations in form and natural selection".

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