

# Evolution during human colonizations

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Most human populations are the product of a series of range expansions having occurred since modern humans left Africa some 50,000 years ago to colonize the rest of the world, but how have these processes influenced today's population diversity? An international research team led by Damian Labuda at the University of Montreal, H  l  ne V  zina from the University of Quebec at Chicoutimi (UQAC) and by Laurent Excoffier from the University of Bern and the SIB Swiss Institute of Bioinformatics have studied the effects of rapid territorial and demographic expansions on recent human evolution.

Using genealogies including more than one million individuals in a recently colonized region of Quebec, they show that pioneer individuals on the edge of the colonization wave had a selective advantage, such that their genes are now predominantly found in the population. Similar processes are likely to have occurred in other regions of the world, so that this study suggests that range expansions played a key role in human evolution. The results of their study are published today in the prestigious journal *Science*.

The exact mechanisms of population expansions are difficult to study as they extend over many generations and hundreds or thousands of years. The expansion of humans into the Charlevoix Saguenay-Lac-Saint-Jean area of Quebec offered researchers a unique opportunity to study a range expansion in real time, thanks to the availability of deep and complete genealogies reconstructed from parish registers. The descending genealogies of all couples who married in these regions between 1686 and 1960 were reconstructed thanks to the BALSAC database managed

by H el ene V ezina. The analysis of this huge genealogy including more than one million individuals shows that the genes present in today's population were mostly transmitted by ancestors who were living on or close to the wave front of the expansion.

"We knew that the migration of species into new areas promoted the spread of rare mutations through a phenomenon known as 'gene surfing', but now we find that selection at the wave front can make this surfing much more efficient. There is thus a long-term evolutionary success of people living on the edge", Excoffier said. Women on the wave front had a selective advantage "We find that families who are at the forefront of a range expansion into new territories had a greater reproductive success.", Labuda explained. Women on the front of the expansion indeed married about one year earlier than women in the range core and had 15% more children and even 20% more married children. The higher fertility on the wave front is compatible with an increase in resource abundance and lowered competition among individuals to access these resources. "People could indeed marry younger as more farm land was available on the wave front than in the core, where good lands were mostly already occupied", says Excoffier.

## **Human curiosity, also an inherited trait from past range expansions?**

Some human traits others than those the team has measured may have also evolved during range expansions. More specifically, if there are some traits favoring dispersal and colonization, it is highly likely that they have also evolved during past range expansions. In other words, human curiosity and the desire to look over the next mountain or hilltop might be one of these inherited traits. "It is exciting to see how a study on a regional population of Quebec can bring insights on human processes that have been going on for thousands of years. The BALSAC

genealogical database is a powerful tool for social and genetic research and this study is a very nice demonstration of its possibilities", Vézina said.

Provided by Swiss Institute of Bioinformatics

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