

PLOS Science Wednesday: Hi reddit, we're Arslan and Mark and our PLOS Genetics study shows differences in human nose shape may have evolved due to local adaptation to climate – Ask Us Anything!

PLOSScienceWednesday ¹ and r/Science AMAs¹

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How does a growing mixed race population affect your research? I am not referring to populations that become racially integrated on a large scale (as commonly occurs when indigenous populations are colonized by foreigners), but more so to people like me, who are the product of the mostly random and complex decisions of two individuals from totally different racial backgrounds. In my case this is Navajo and Ukrainian. In our modern world this kind of random individual mixing is happening more and more often. So do you discount these people as outliers when studying change across a particular group? Or how else do you account for them?

Thank you! This is interesting research. And sorry if that was kind of long--I wasn't sure how else to clarify!

[Nintendo_Innuendo](#)

Arslan: First of all, great question. I understand what you mean but the term 'race' is indeed complex and has little biological basis. It is helpful to use terms like 'genetic ancestry' or simply 'ancestry'.

Yes, when performing this kind of study, taking into account the ancestry of the people under study is important. When looking at whether nose shape might have evolved because of climate-related selection pressures, we focused only on people whose ancestry was mostly from only one of the four populations: W. African, S. Asian, N. European, E. Asian. We did this because we wanted to restrict more signals of recent admixture (mixing of people with different ancestries), which can cloud older signals such as those of adaptation to climate. We determined the ancestry of individuals in our study based on their DNA sequence.

How does a growing mixed race population affect your research? I am not referring to populations that become racially integrated on a large scale (as commonly occurs when indigenous populations are colonized by foreigners), but more so to people like me, who are the product of the mostly random and complex decisions of two individuals from totally different racial backgrounds. In my case this is Navajo and Ukrainian. In our modern world this kind of random individual mixing is happening more and more often. So do you discount these people as outliers when studying change across a particular group? Or

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Mark: Good question. Admixed populations are what we call groups who show ancestry from populations that were separated until recent migration events brought them together again. These populations can be especially useful for studying the genetic and environmental factors that affect traits and disease risks that vary across the parental populations. A number of skin color genes have been identified using admixture mapping, the technical name for using this recent admixture to identify the location of genes affecting the population differences. We've only done one initial analysis of facial variation in admixed populations, which was also published in PLoS Genetics in 2014.

What results have you come across for Aquiline nose shapes?

[raechiana](#)

Arslan: We did not look at this trait specifically so we don't know yet. :)

Do the environmentally adapted nose developments effect sinus cavities making an individual more likely to have deviations and/or medical issues such as sinusitis?

[hollyndaze](#)

Arslan: Interesting hypothesis. There is some evidence that nose width increase has led to a decrease in the volume of the maxillary sinuses (Source: Butaric 2015 <http://onlinelibrary.wiley.com/doi/10.1002/ar.23182/abstract>). Whether this variation explains differences in risk of sinusitis is unclear but worth pursuing!

What kind of changes are you predicting in nose/nostril size in the near future in North America and other countries?

[zxcv6](#)

Arslan: Some people have already answered this question in the replies. While there are some forces of evolution (e.g. selection), which can lead to predictable changes over time, many other forces, such as genetic drift which is quite powerful in humans, are very unpredictable. Depending on the relative strength of each of these, evolution can be quite unpredictable. Movement of people across the globe and genetic admixture makes this even more complicated.

What kind of changes are you predicting in nose/nostril size in the near future in North America and other countries?

[zxcv6](#)

Mark: We can also expect that sexual selection will have a stronger role in the future evolution of the human species than it has had in the past and stronger than ecological selection or genetic drift. Selection (either sexual or natural) can change frequencies and traits very quickly, on the order of 5,000 years.

Hello! Thank you for doing this AMA! I have a few questions for you:

1. In your opinion, why might different nose shapes be better explained by climate-driven selection than by sexual selection?
2. Why do you think similar nose shapes evolved in the tropical Indian and temperate European subcontinents?
3. I noticed your dataset doesn't include individuals from historically desert-dwelling populations. Bearing in mind the limitations of data available, what nose shapes do you predict such peoples might have evolved?
4. Human population genetic data tends to overrepresent populations in developed or rapidly developing parts of the world. Might your conclusions change if a broader, more diverse dataset were to become available?

[sbbln314159](#)

Mark: Thanks for your interest. 1) We don't have a clear way to compare sexual and ecological selection pressures. One reason we expect sexual selection has helped shape the nose, in addition to climate-driven ecological selection, is the high level of sex difference observed in nose traits. Sexual dimorphism is most easily explained as sexual selection. 2) Among the groups we studied, the South Asian and European populations were the most similar pair of similar to one another due mostly to a recent separation of the ancestral populations and migration (gene flow) since. 3) It would be very nice to study desert-adapted populations as well as cold-adapted and altitude-adapted groups. More to your question, I'd expect desert-adapted populations would be better served by noses that facilitate substantial convective humidification of inspired air. 4) I think these conclusions are pretty solid and the populations we represent a nice sample of human diversity. Clearly, there are many more human populations and these can and should be analyzed to better understand the forces shaping the nose as well as to help us identify the underlying genes affecting nose shape and how these genes have evolved.

Nose related question. How plausible is it that humans sniff flowers and enjoy the smell of other plants as a way to prevent allergic reactions in the future? Are we possibly microdosing ourselves with pollen and other various plant materials?

[RedditTrollin](#)

Arslan: Interesting hypothesis. Not sure if someone has looked at this but I bet it would be difficult to test.

If one parent has a somewhat long, narrow, pointy nose and the other has a somewhat short, wide, upturned nose - just curious - what determines if those features average out or are selected wholesale?

In other words, usually mixed kids' skin tone is a blend of skin tones of the parents. Are nose features like that or wholesale traits like curling tongues or connected earlobes? Thanks!

[555nick](#)

Arslan: Good question. Actually, we believe nose shape is just like skin pigmentation in this respect. It is controlled by many genes and tends to 'average out' in kids of parents of different ancestries.

Are the nose changes dispersed among humans in a fine gradient or would it be possible to sort people into groups based on their nose shapes that are clearly defined populations, i.e. races?

[Soktee](#)

Arslan: Human variation is continuous, which means we exist on a spectrum. Some have broad noses, some have narrow noses and some in between. We also observe the same trend on a genetic level. It is not possible to draw a line somewhere to separate people into disparate groups on any biological level just like there's no way to separate black and white on a grayscale.

I understand that there are sub-specialties in the field of genetics, but I hope that this is relevant enough to your research broadly that one of you can answer!

It seems that within humans, there is a good amount of variation between subgroups in terms of physical traits (facial features, muscle density, etc) but not for cognitive traits (i.e. I've never heard of evidence of certain regions of the brain being stronger in certain subgroups than others)

Is there a reason for this? Wouldn't one expect the brain to have as many environmental variations as bodies do? If not, why?

[daynightninja](#)

Arslan: Humans don't have a lot of differences among groups even for traits such as skin pigmentation and facial shape, even though it 'seems' like there might be. Even the differences observed in these traits are an exception rather than the rule. They are likely different because they are exposed to the environment or are important for social interactions, both of which can be different in different geographic regions. Other traits are much less different between groups. So far there is not a lot of evidence supporting large differences in the brain among human groups.

Have you guys identified any genes or sets of genes that control for nasal phenotype?

[swiftturtle](#)

Arslan: There are several papers out, which have identified several genes for nose shape. More are likely to be in the works. Some good examples:

1. <http://journals.plos.org/plosgenetics/article?id=10.1371/journal.pgen.1002932>
2. <https://www.nature.com/articles/ncomms11616>
3. <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0176566>
4. <http://journals.plos.org/plosgenetics/article?id=10.1371/journal.pgen.1006149>
5. <http://journals.plos.org/plosgenetics/article?id=10.1371/journal.pgen.1004224>

How does a person's height relate to the climate their ancestors evolved in?

[mickmattie](#)

Arslan: I don't think anyone has rigorously tested this but it is thought that people in warmer climates tend to be taller with longer limbs and people in colder climates tend to be stockier. The longer body

and limbs tends to dissipate heat more effectively while the stockier bodies tend to keep heat in. This pattern is known as Allen's rule and is thought to be due to adaptation to temperature.

https://en.wikipedia.org/wiki/Allen%27s_rule

In fig7, it is mentioned that when Northern Europeans are removed from the analysis, the correlation between nares width and climate is lost. This kind of makes sense, because what seems to be the main driver of nose width is a colder drier climate requiring a narrower nose to more efficiently warm/humidify the air, rather than warm temperatures needing a wider nose or having a negative consequence of a narrower noses.

But I don't understand why the correlation between melanin index and UV irradiance is also lost? If anything, you would expect the correlation to get even stronger, because now it's the reverse process, where melanin confers fitness in sunny climates by presumably protecting against skin damage and mutations. Any explanation apart from sexual selection?

[Research2017](#)

Mark: Granted darker skin protects from too much UVR. Lighter skin is also adaptive in facilitating the production of greater amounts of vitamin D. Sexual selection could move skin color in either direction.

As someone who has been noticing an increase in pushing for the public to value scientists, could you explain for us why studying this type of thing is important?

[Ibelieve919](#)

Arslan: This is an important question. There are two answers:

1. Studying human evolution and adaptation helps us understand how genetic disease arise, what genes are underlying their risk, and how the risk might be different for different people. This information could be helpful in narrowing down the cause of the symptoms of someone who walks into a clinic and perhaps even in treating them.
2. Basic science is the raw material on which applied science, such as medicine progresses. Faraday used to perform 'magic tricks' with electricity before he knew that it would be essential to our way of living today.

What is our current understanding of the genetics of facial shape? Have we identified the genes that determine the shapes of facial structures like the nose which was investigated in this study?

[Yelkine](#)

Mark: Very few of these are currently known. Probably the biggest problem has been how to quantify a trait as complex as the face. Some good groups are working on this and we will know more in the near future.