University of Leicester

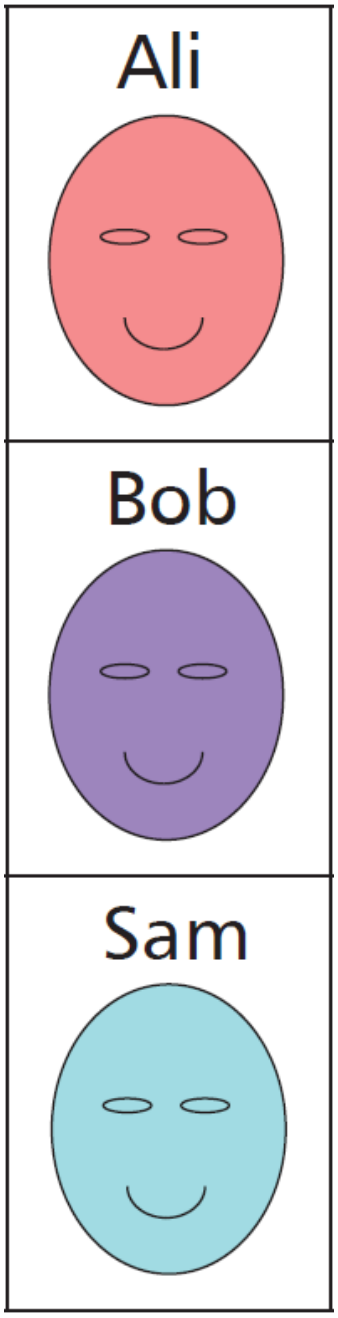
Where are the "Breathless Genes"?

Developed as part of the "Breathless Genes" exhibit at the Royal Society Summer Science Exhibition 2012.

selected The Royal Society summer science exhibition 2012

Ali, Bob and Sam all had their lung function measured, but they could not all blow out the same amount.

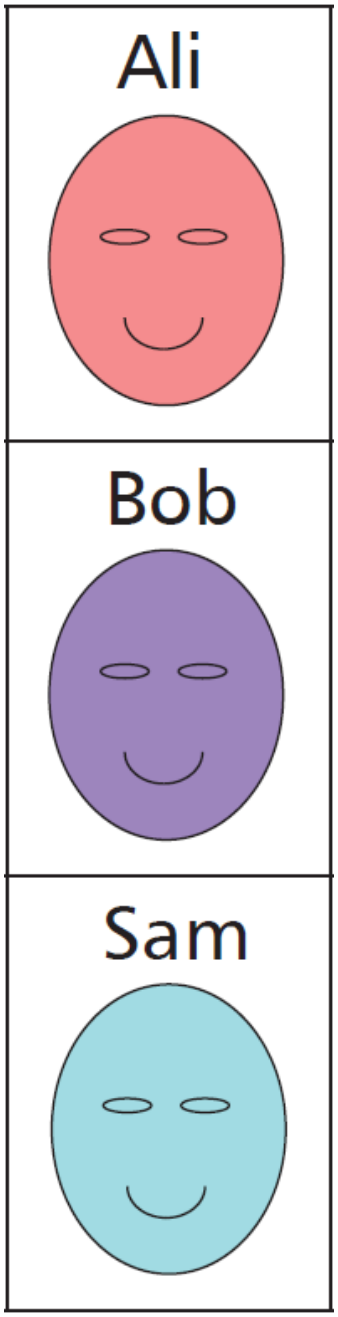
They also had samples of their DNA collected.



We want to investigate:

1. How they vary genetically.

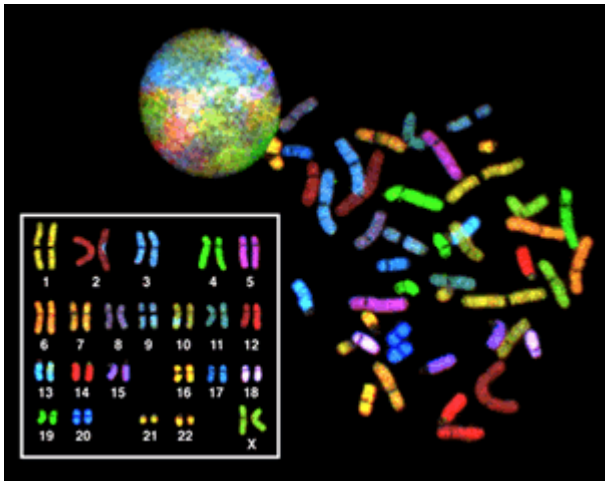
2. Whether this genetic variation affects their lung function.



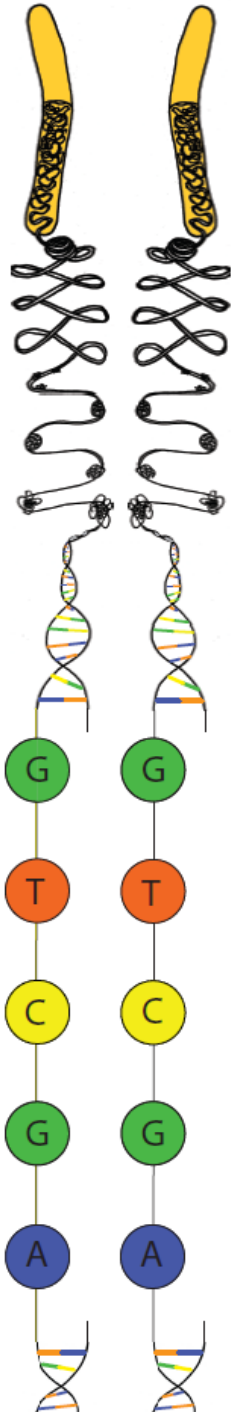
So what is genetic variation?

Our genomes are divided into pairs of chromosomes.

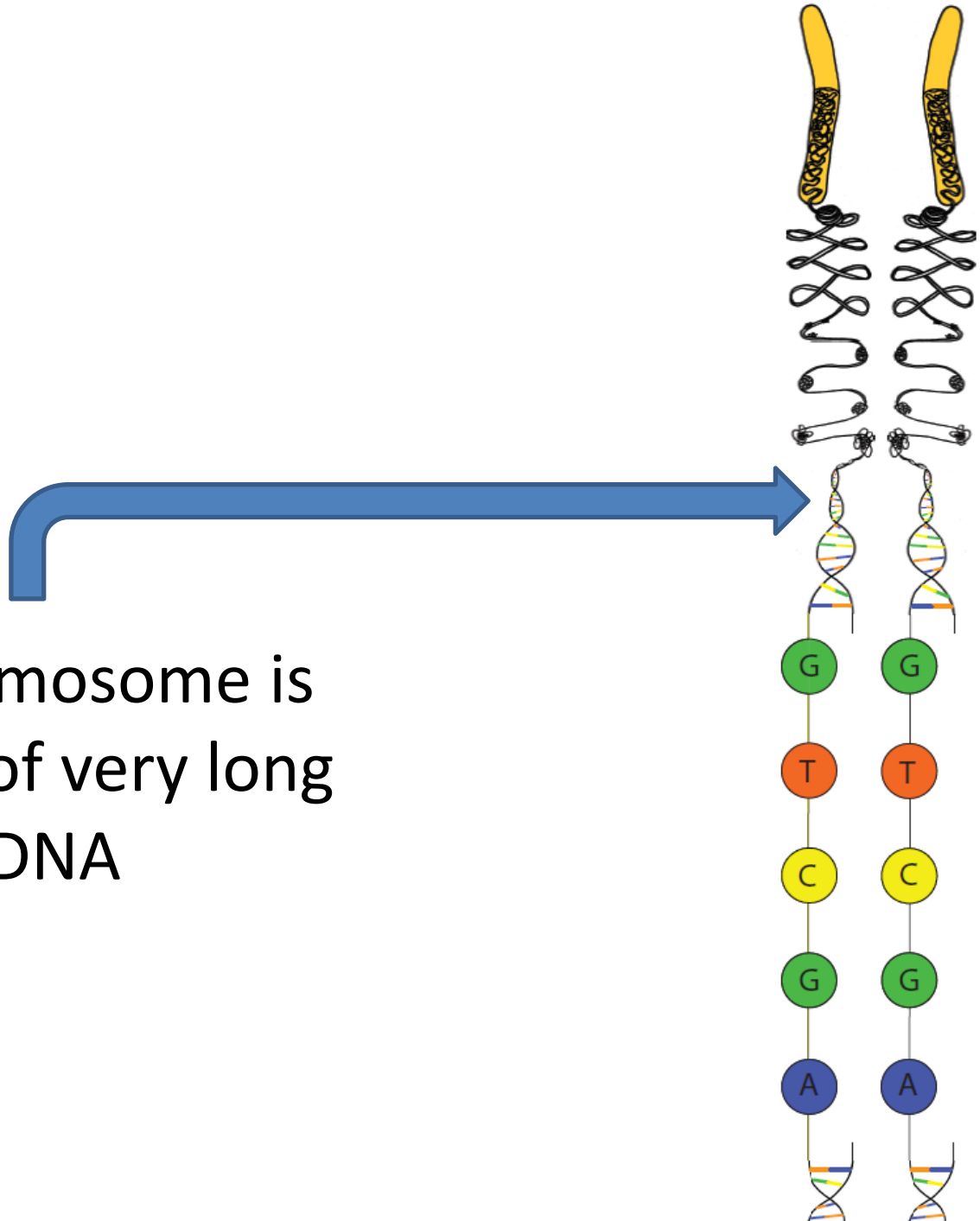
In each pair, one is inherited from your Mum, and one from your Dad.



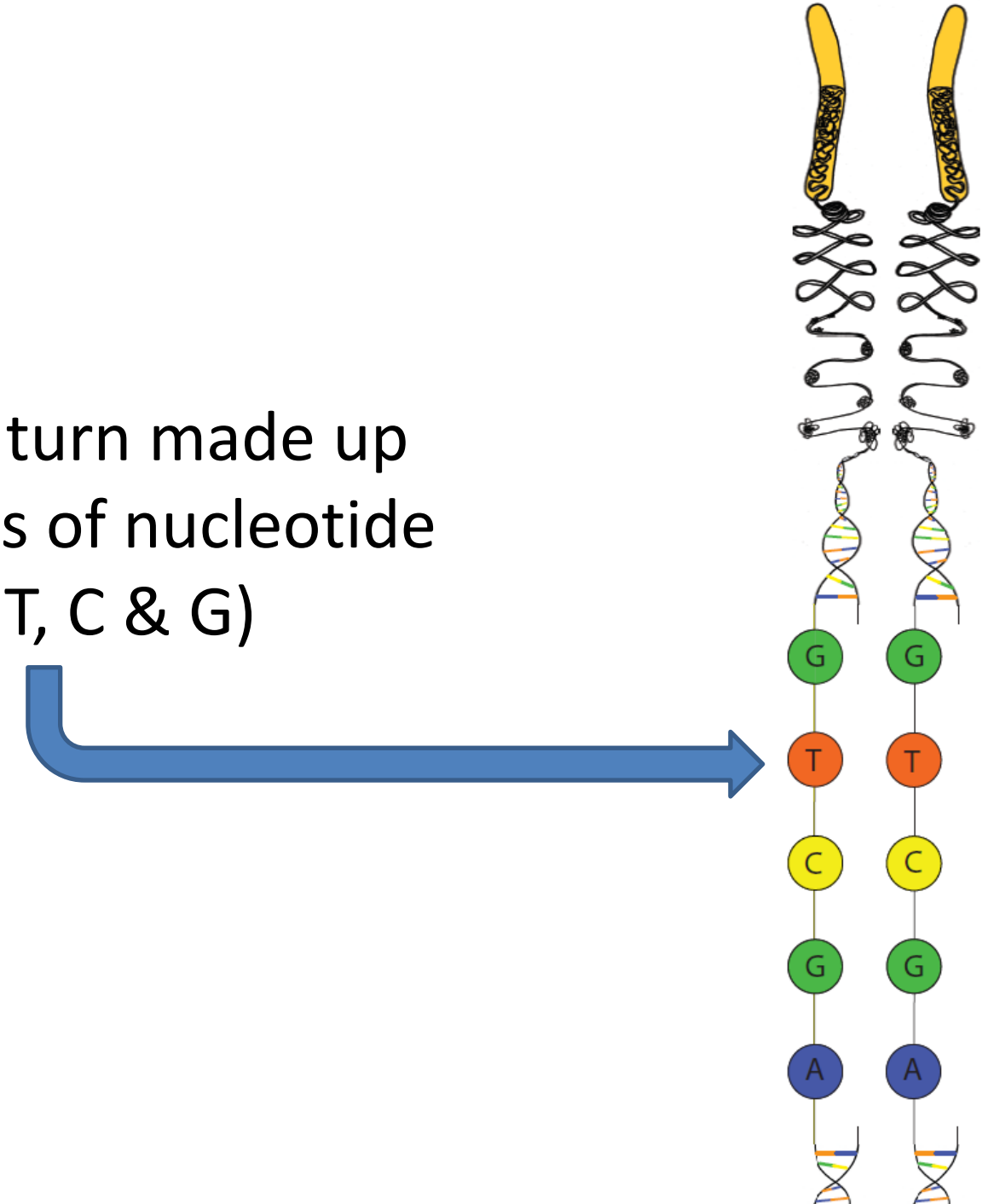
Lets look more closely at chromosome 7…



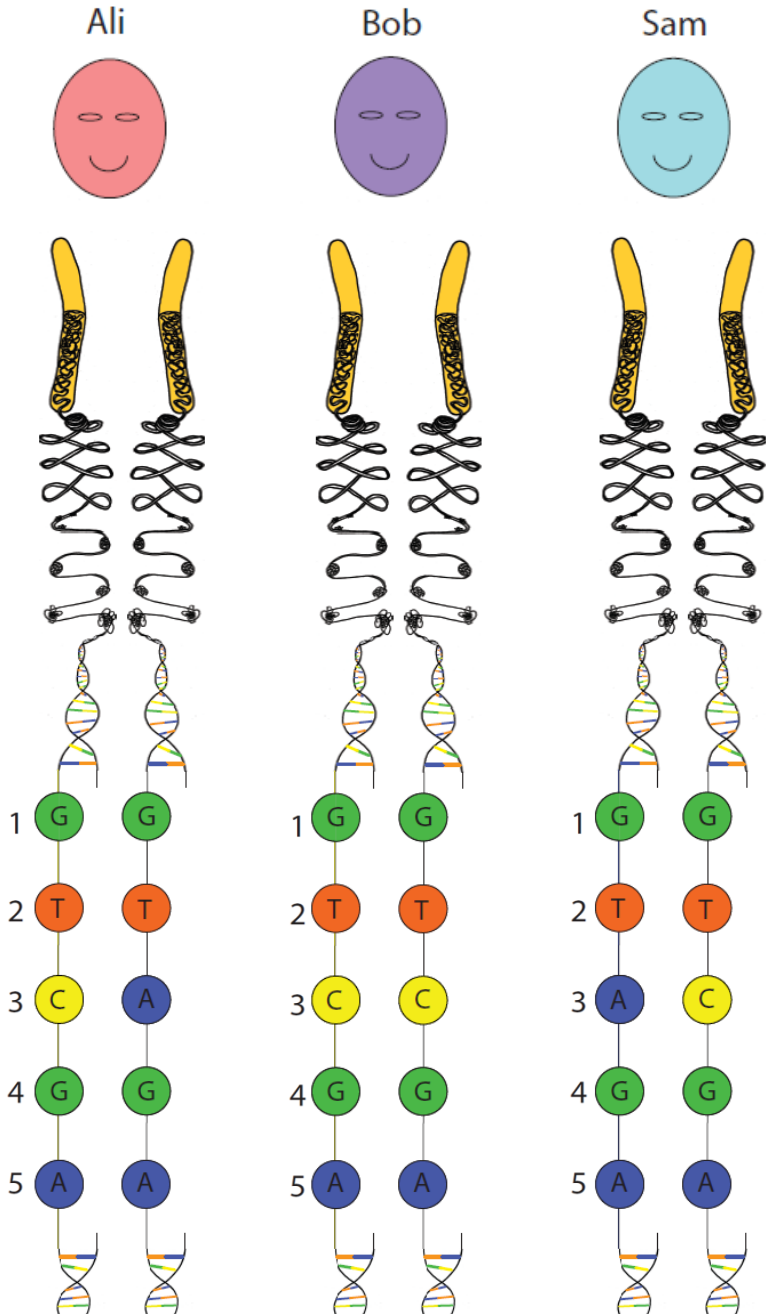
Each chromosome is made up of very long chains of DNA



DNA is in turn made up of millions of nucleotide bases (A, T, C & G)

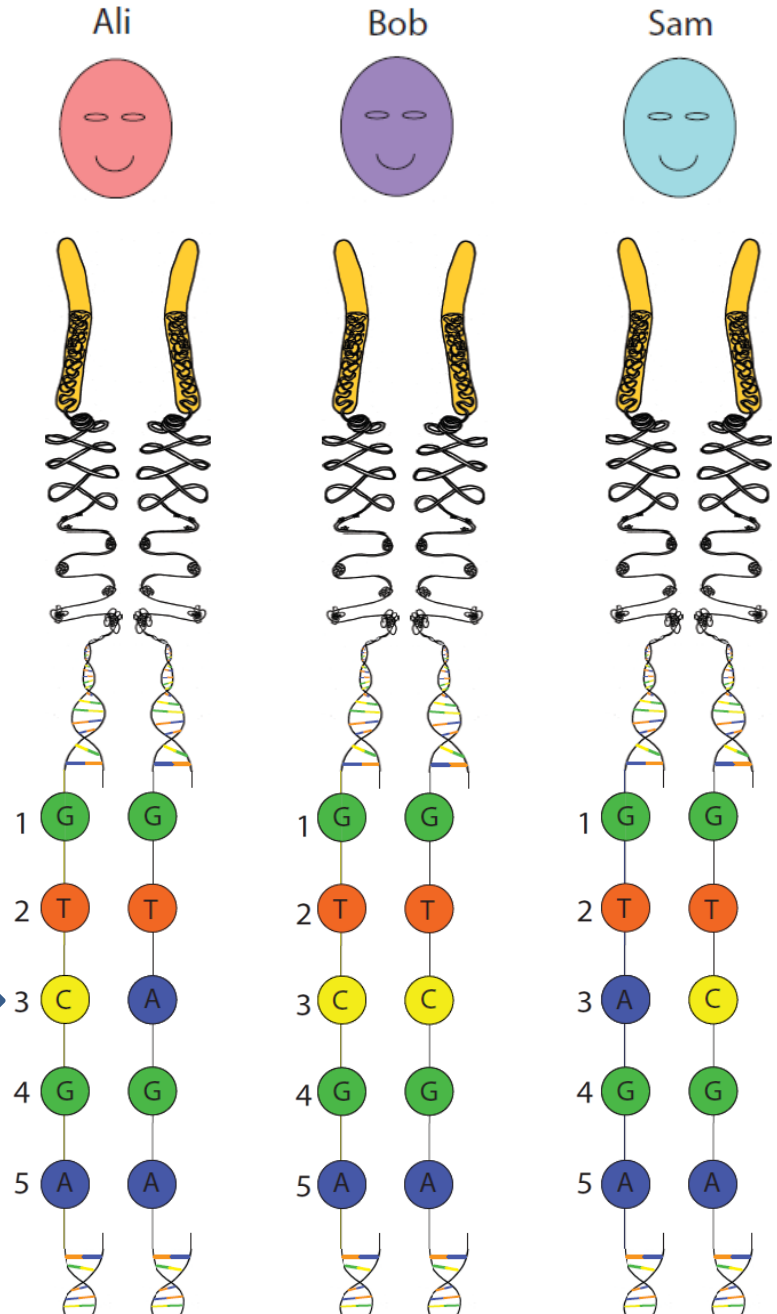


If we look at this section of chromosome 7 in Ali, Bob and Sam, we see that most bases are identical across all three people…

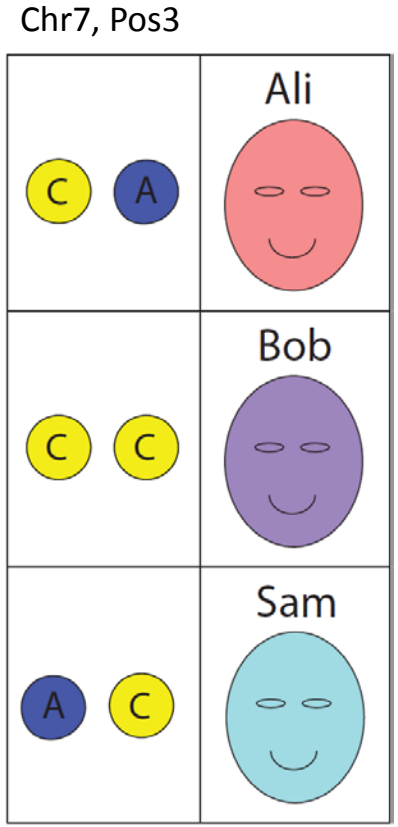


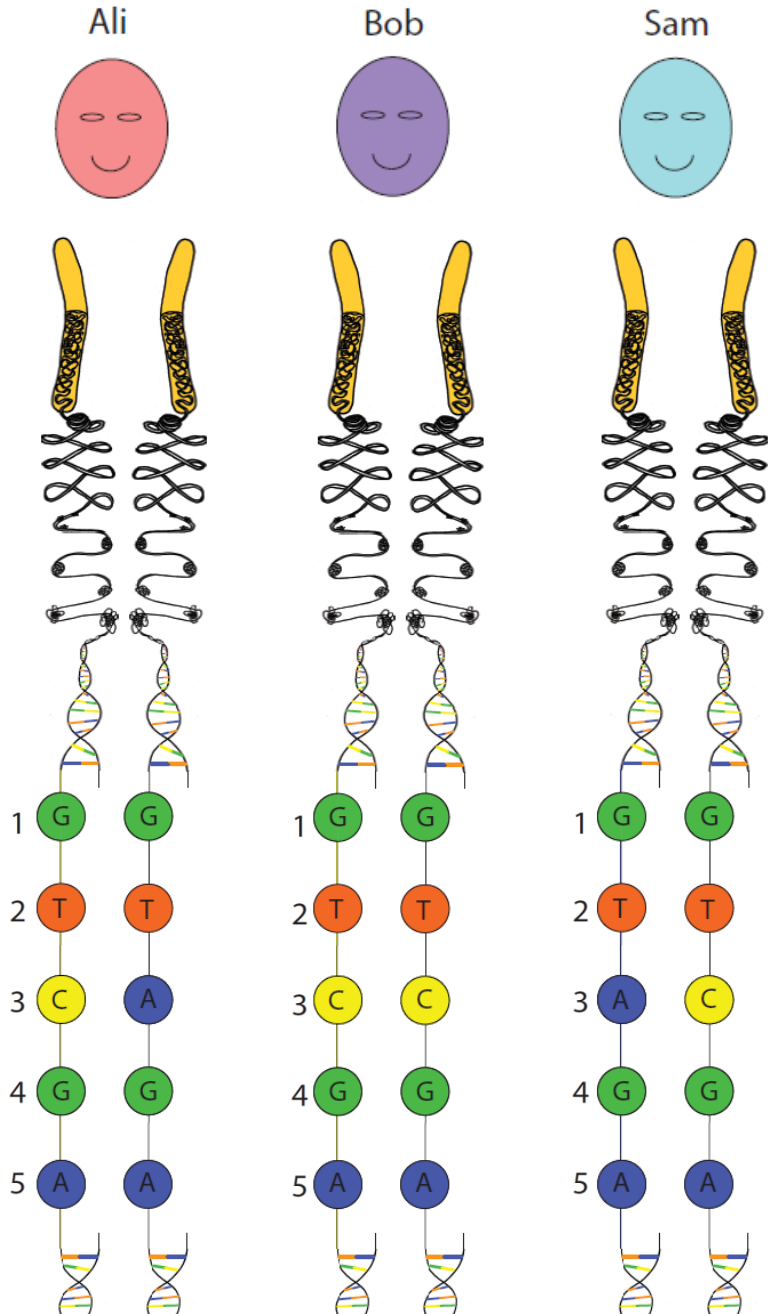
However at position 3, they are not all the same.

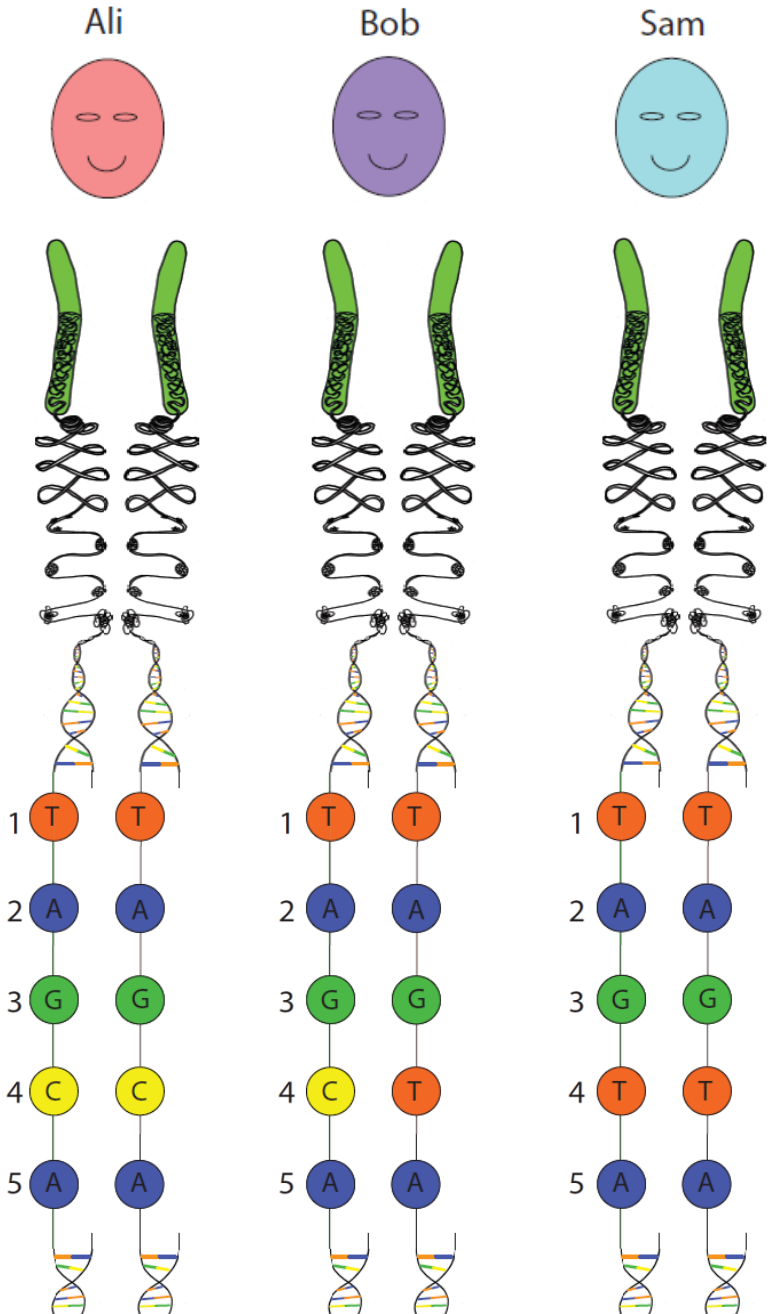
We shall refer to these differences as genetic variants.



We shall record which variants each person has at this position:

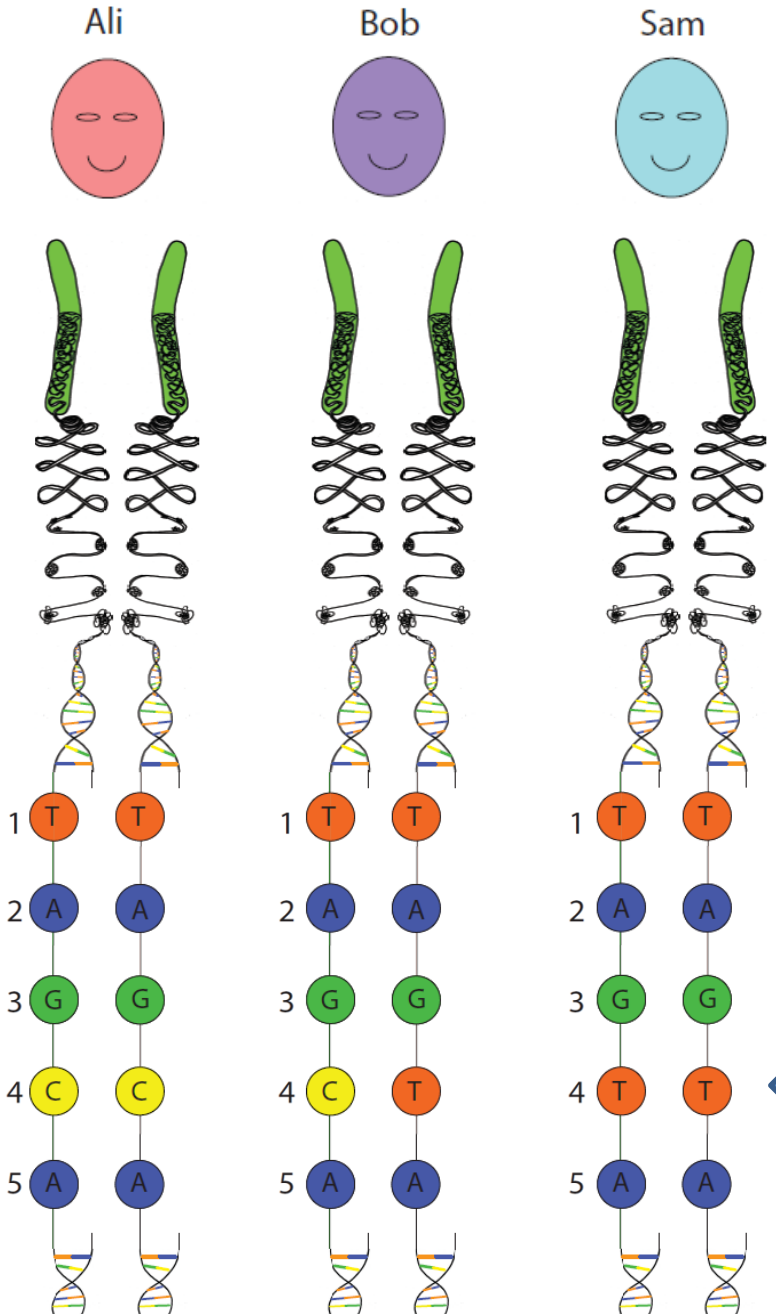






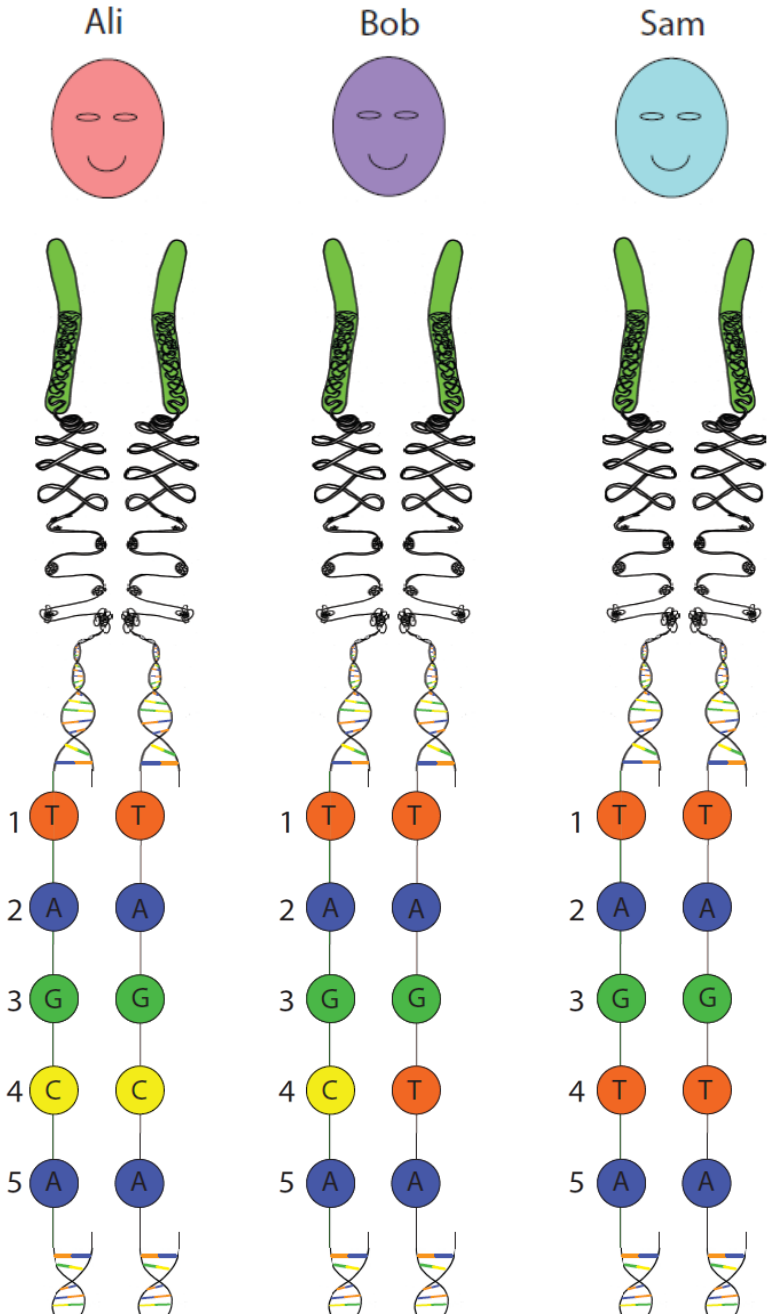
Now lets look at a section of chromosome 4.

Can you see a genetic variant?



Now lets look at a section of chromosome 4.

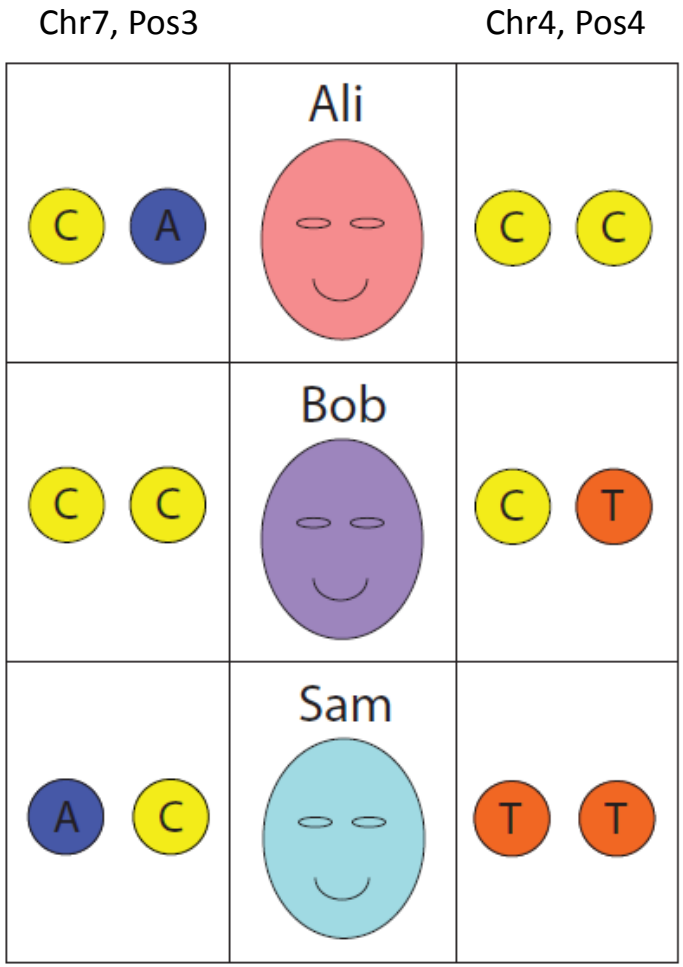
Position 4 has a variant.



We shall record which variants each person has at this position:

Chr4, Pos4

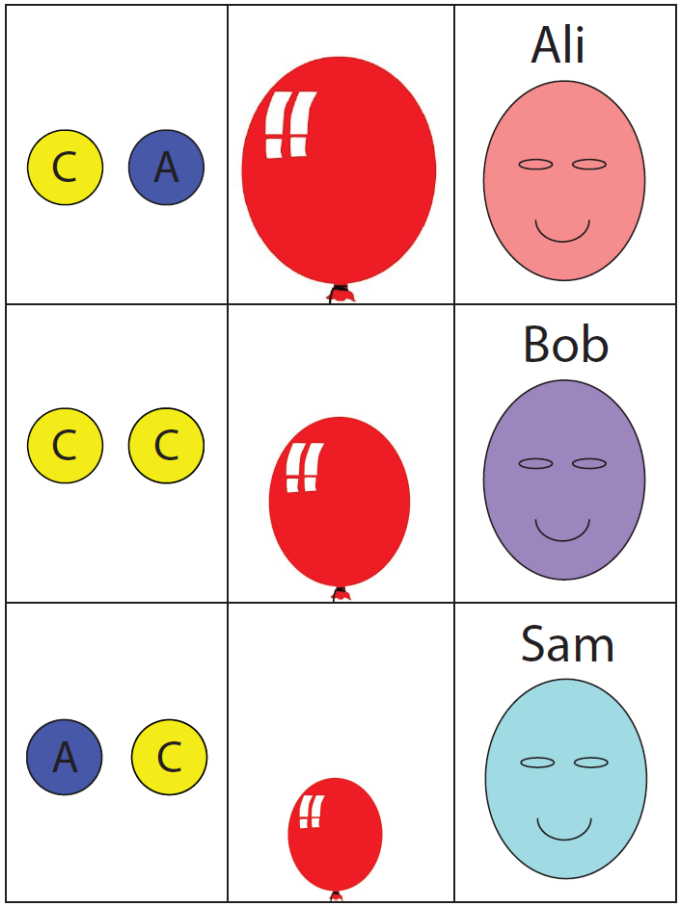
Ali	C C
Bob	C T
Sam	T T



We have identified 2 positions in the genome at which Ali, Bob & Sam differ.

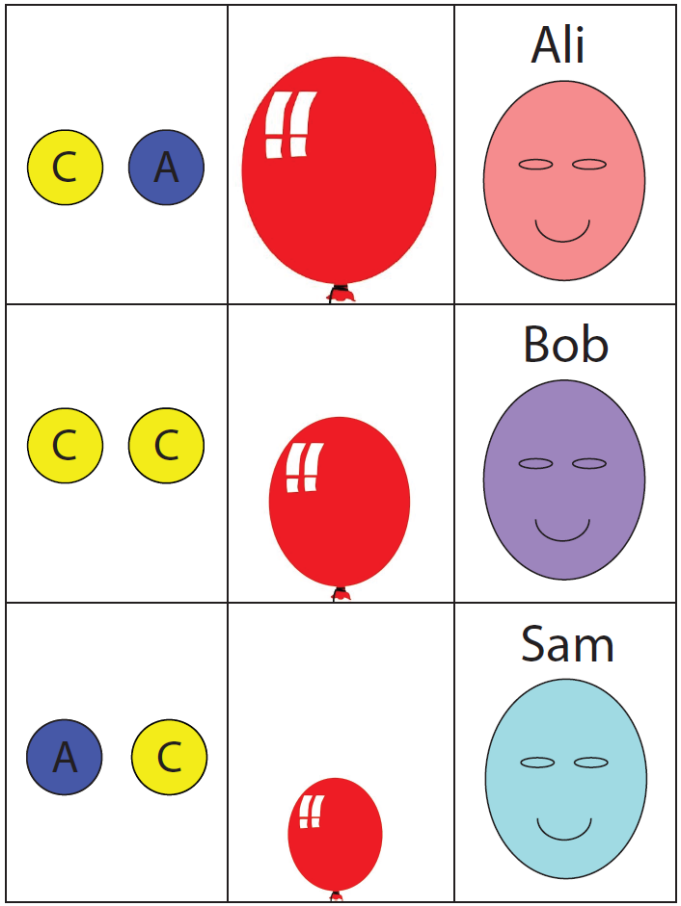
Could either of these genetic variants be associated with lung function?

Chr7, Pos3



The balloons show how much Ali, Bob and Sam were able to blow out.

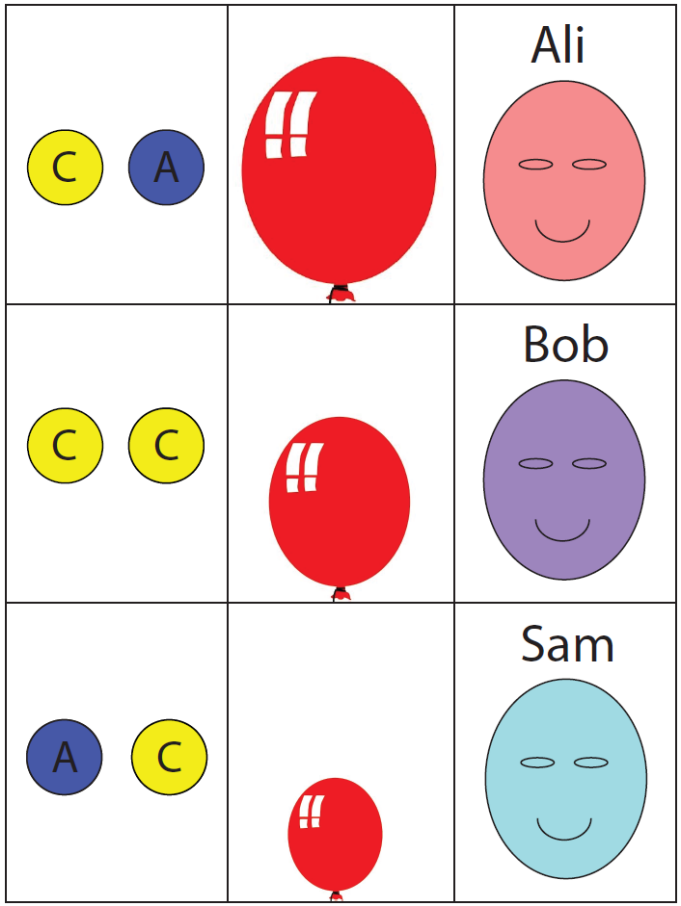
Chr7, Pos3



Compare the amount each person can blow out with the number of C variants they have at this position on chromosome 7…

Can you see a pattern?

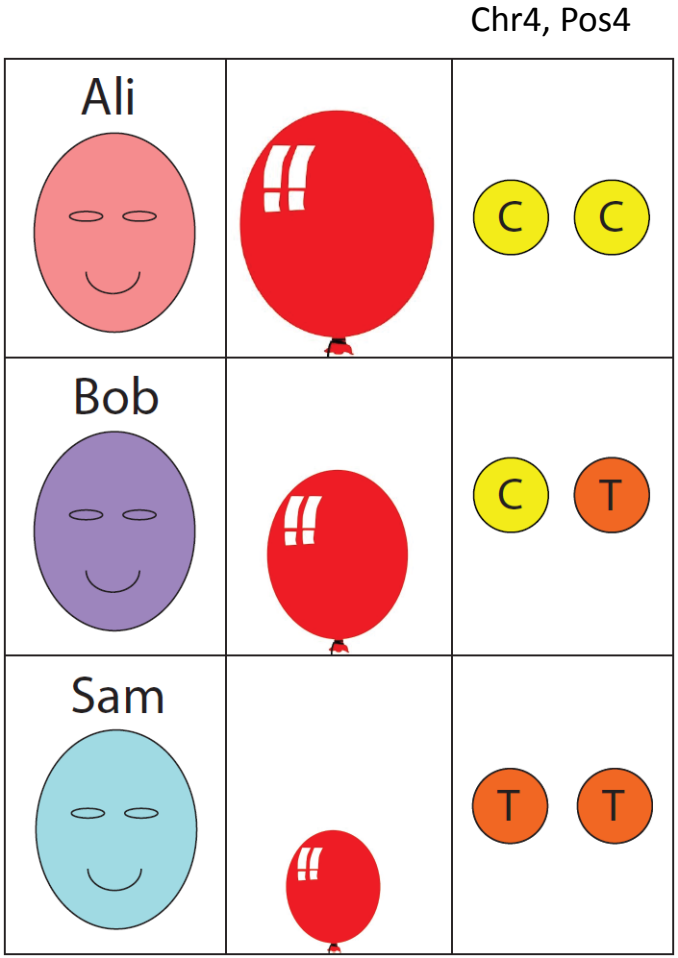
Chr7, Pos3



Compare the amount each person can blow out with the number of C variants they have at this position on chromosome 7…

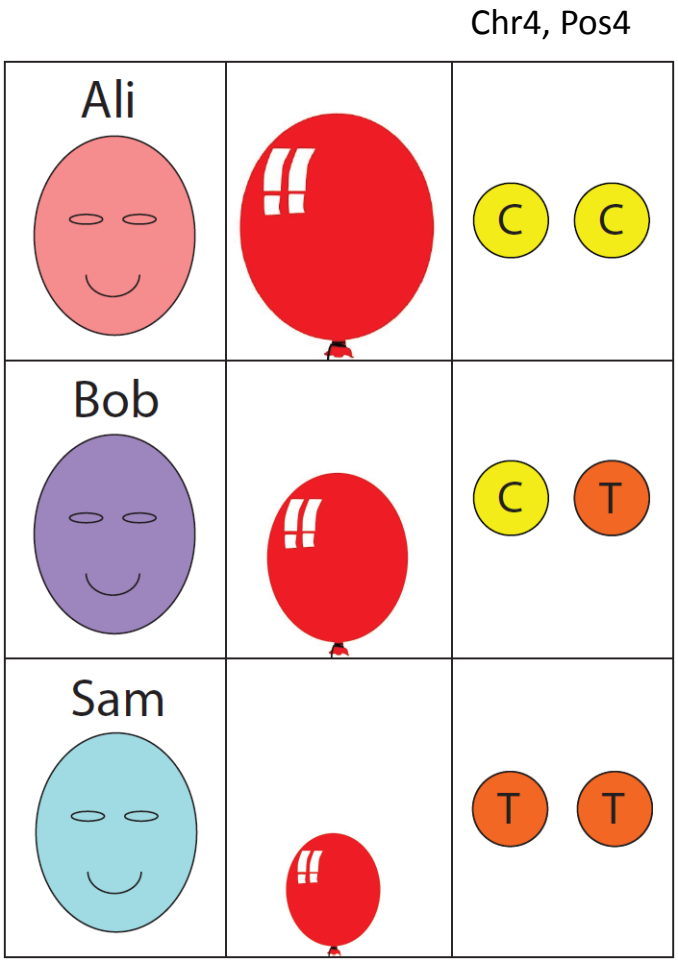
Can you see a pattern?

NO!



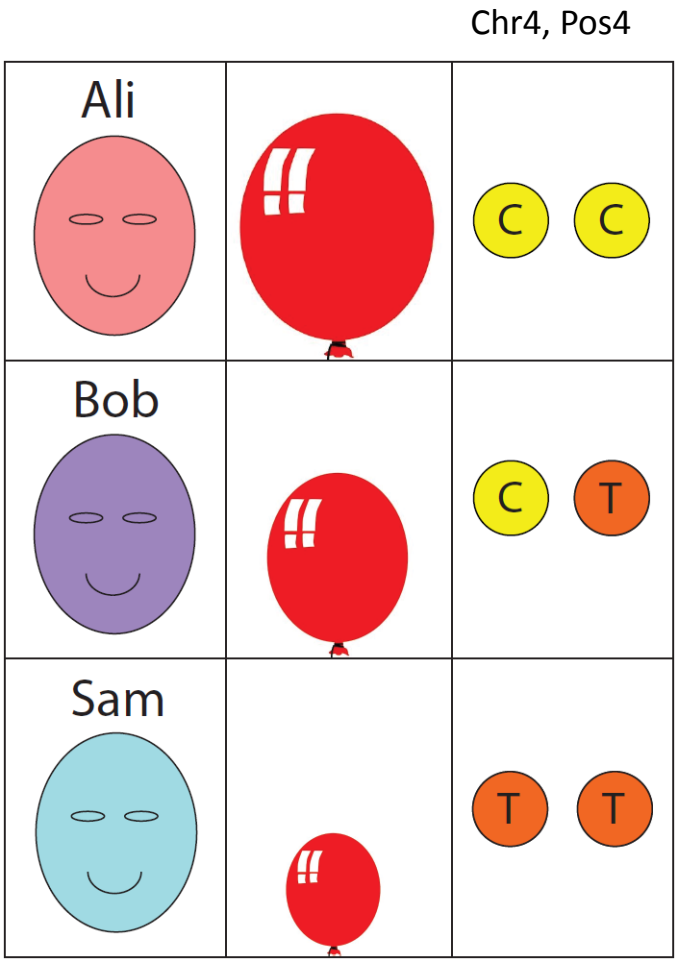
Now compare the amount each person can blow out with the number of C variants they have at the position on chromosome 4…

Can you see a pattern this time?



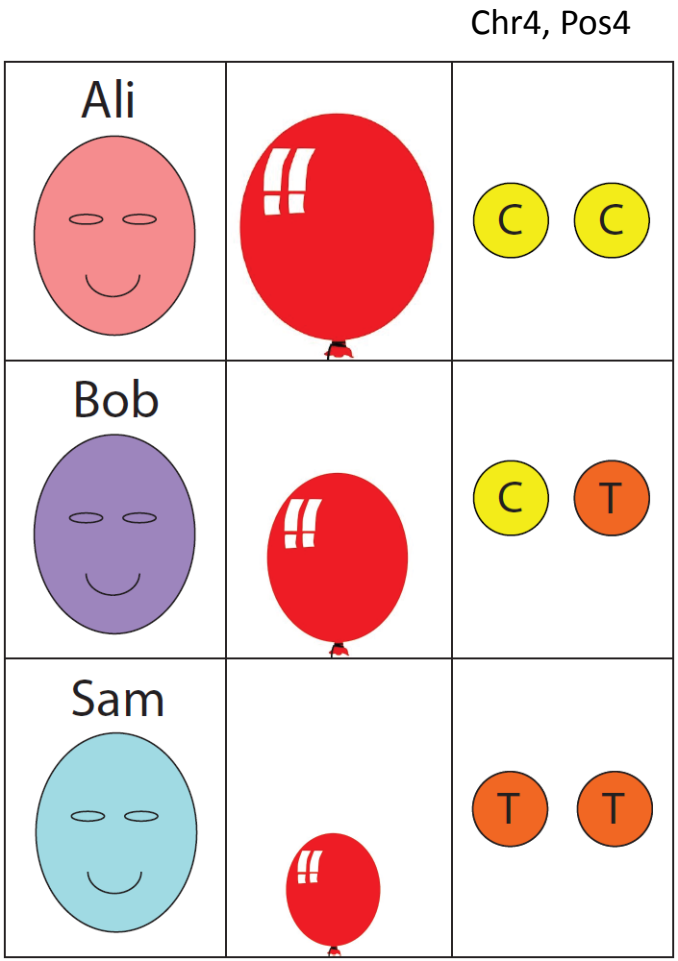
YES!

The more copies of the C variant each person has, the more they are able to blow out.



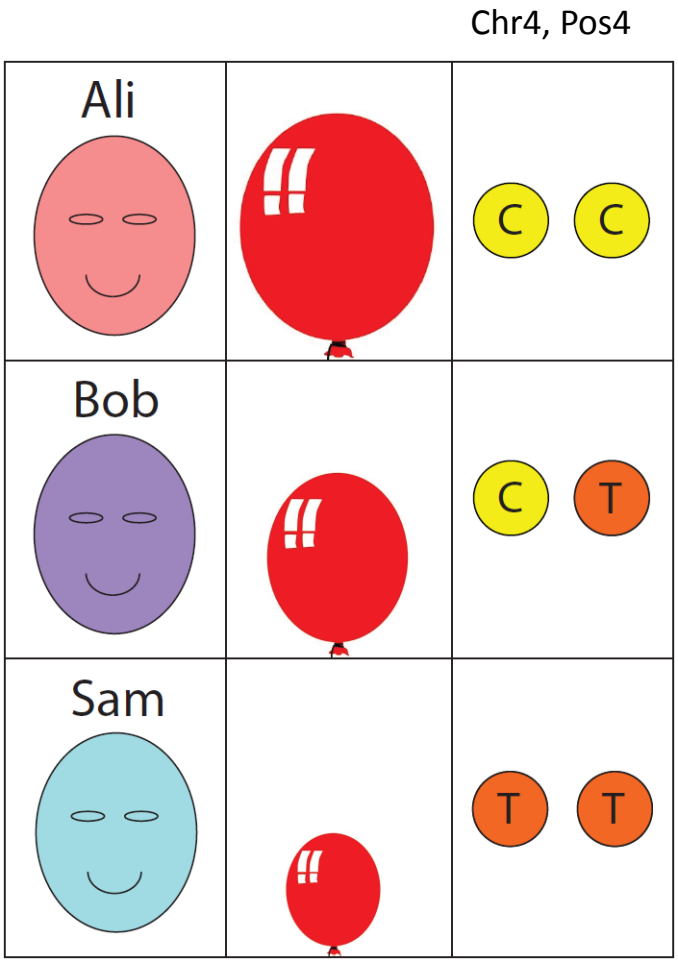
YES!

We would say that this variant has an additive genetic effect on lung function.



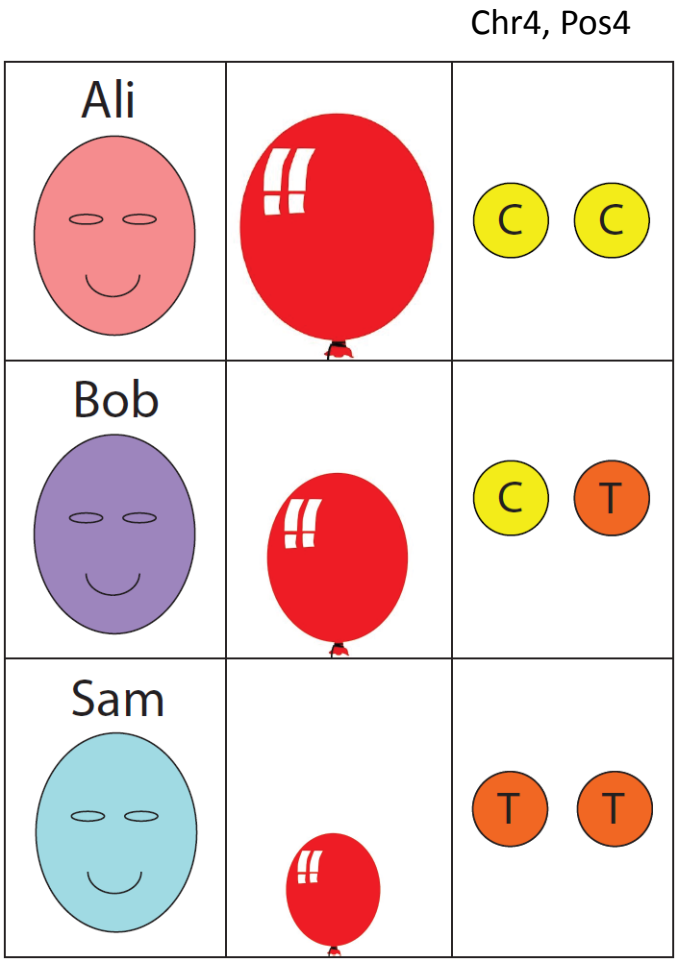
This pattern you have found today, is in fact based on a real association.

There is a variant on chromosome 4 which has been associated with lung function; the variant is in a gene called HHIP.



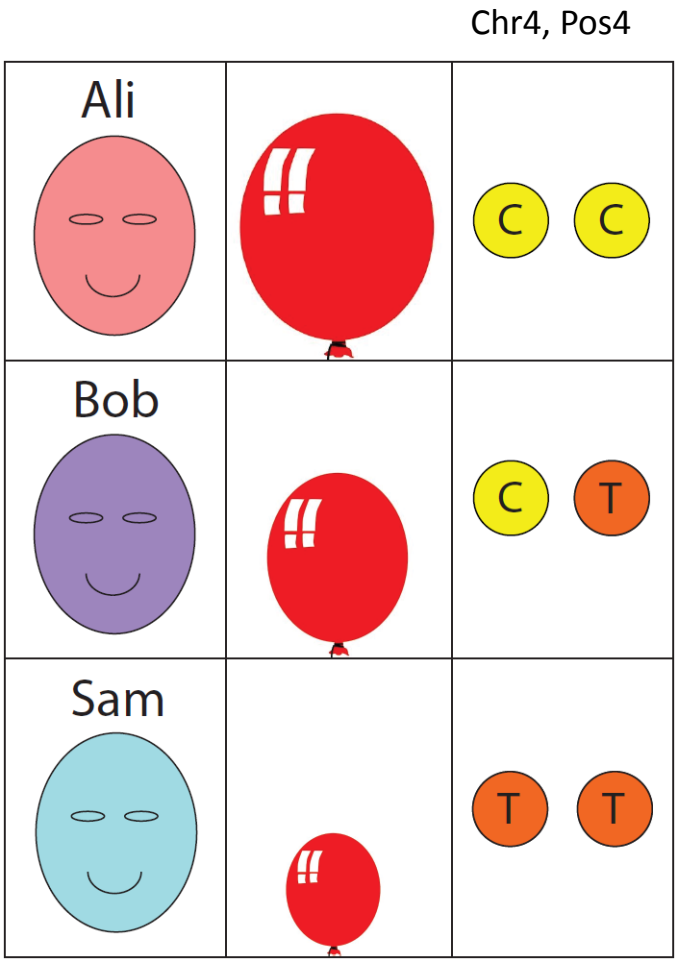
That wasn't too difficult was it?

But we were only looking at two genetic variants in three people.



There are in fact millions of variants across the genome which could potentially be associated with lung function.

Our job is to try to identify which ones actually are!



Furthermore, it is quite possible that an association, like we have seen here, might happen just by chance.

We have to compare genetic variants across thousands of people to make it more likely that any associations we do find are real.