In this issue

Unity in diversity – The molecular path!

'Unity in diversity' is one of the most enigmatic of ways in which this wondrous country of ours has often been described. And no where does it reveal itself more than in its people. From travelling solitary herdsmen to sedentary merchant joint families, from languages rich in person, number and gender to those without them, from food cooked invariably in coconut oil to a marked preference for mustard oil – all that one sees around is splendid diversity. We are all so different from each other – in our looks, in our thoughts and in our culture. And yet is there truly an underlying fundamental unity that binds us together? Is it possible that all of us share a common ancestry and it is only time that has made us walk various paths? Or is it that we have had different forefathers? – whose innate differences we have inherited today and are committed to display them – but within the limits of a common political boundary. These are obviously difficult questions, but it might be possible now for molecular biologists to look back far enough and try to see where it may have all begun.

And this is precisely what thirteen researchers from six institutions across four Indian states have attempted to do, cutting across different scientific disciplines – a splendid example of unity in diversity in its own right! On **page 1182** of this issue, Roychoudhury *et al.* take us back to the time when humankind began to migrate out of its cradle, eastern Africa, into other parts of the world, including India, approximately 60,000 years ago. How many waves of migration did India receive at that time? To how many founding populations can we trace back the ancestry of the teeming millions that populate this country today?

In an effort to trace these ancestral roots of modern Indians, the authors have analysed the structure of mitochondrial DNA of 23 ethnic populations from 6 states from north-eastern, eastern, north-central and southern India, representing tribal and caste populations at different levels of the social hierarchy and belonging to five linguistic groups. The mitochondrial DNA molecule is an unusual one that each of us has inherited only from our mothers. An analysis of the variation in this molecule thus allows one to examine the maternal ancestry of individuals, uncontaminated by genetic admixtures from any paternal source. Much of this variation arises from random changes in the nucleotide sequence of the molecule, leading to the gain or loss of recognition sites at which particular restriction enzymes cut the DNA molecule; this, in turn, leads to what are technically called restriction fragment length polymorphisms within the population. In the present study, the authors have investigated such variation at seven loci or locations in the mitochondrial DNA molecule and have calculated the frequencies with which the variants at each of these loci (alleles), particular combinations of alleles at these seven loci (haplotypes) or characteristic variants with constantly co-occurring mutations (haplogroups) occur in the different ethnic populations.

A remarkable finding of this analysis is that there is extensive sharing of a few haplotypic variants among the sampled populations – a clear indication that most of the present-day Indian populations have descended from a small number of females who had perhaps arrived during one of the earliest waves of migration out of Africa. This would mean that much of the variation that we see in each other today would have arisen later by local movements as well as the genetic and cultural mixing of different sub-populations that may have evolved in their own ways. Another illuminating, but perhaps a bit surprising, finding is that although different populations harbour varying frequencies of particular haplotypes and haplogroups, most of the mitochondrial DNA diversity observed in these populations, either in terms of haplotypes or haplogroups, is between individuals within populations alone. No consistent or significant variation could be found across geographical distribution of these ethnic groups, their linguistic orientation or their socio-religious affiliation. One could interpret this to mean that much of our cultural and linguistic differences are of recent origin and their beginnings do not trace back to our original ancestors.

Further analysis of the distribution patterns of the different haplogroups reveals that the most common Asian haplogroup is widely found amongst the tribal populations and southern Indian populations belonging to the Dravidian linguistic group – these populations thus probably represent the first Indians of African origin. The mitochondrial DNA of the caste groups of north India, on the other hand, show a high admixture of Caucasoid haplogroups, and this is, of course, historically well-supported by the documentation of several episodes of immigration by Caucasoid peoples into northern India over long periods of time. Finally, a comparison of the patterns of haplotype distribution between Indian and south-east Asian populations seem to indicate that south-eastern Asia was probably peopled by two independent waves of immigration from mainland Asia – a first one from India about 40,000 years ago and the other from southern China approximately 4000 to 3500 years before present. It is likely that the first wave was actually one that originated in Africa and swept through India as it moved on into south-east Asia.

In these difficult days of divisionary politics, it is remarkable that support for Pandit Jawaharlal Nehru's undying belief about a fundamental unity amidst our diversity is coming from a most unlikely quarter – molecular biology!

Anindya Sinha