

Demography and genetics

Kissing cousins, missing children

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A wider choice of mates reduces people's reproductive output. That may explain why families in rich countries are smaller than those in poor ones

ONE of the biggest paradoxes in human biology is that as societies grow richer, people have fewer children. In most species, such an increase in available resources leads in the opposite reproductive direction. What makes the demographic transition, as this phenomenon is known, even more paradoxical is that in less developed times and places, the rich do not have smaller families than the poor.

Most explanations of the demographic transition are social. One school of thought emphasises reduced child mortality, suggesting this means that fewer "spares" need be generated to be sure that some children reach adulthood. Another points out that elderly people in rich countries do not depend on their children to look after them. A third suggests that as people are presented with more choices about how to spend their resources, they more often choose to consume things and experiences other than the joys and tribulations of parenthood. A fourth, somewhat more biological, posits that lavishing time and money on a few children, rather than spreading it around amongst many, produces adults who do better in the next-generation reproductive stakes. None of these ideas, though, is really satisfactory.

Now yet another explanation has been added to the pot. This is that the mixing-up of people caused by the urbanisation which normally accompanies development is, itself, partly responsible. That is because it breaks up optimal mating patterns. The demographic transition is thus, in part, a pure accident.

Love thy neighbour?

This suggestion is the corollary of a paper published in this week's *Science* by Agnar Helgason and his colleagues at deCODE Genetics, a firm based in Reykjavik. DeCODE's business depends on a unique resource—the entire population of Iceland, living and dead. The country's records since

its founding by a few, intrepid Vikings are so good that the antecedents of today's inhabitants (apart from a handful of recent immigrants) are known with precision. On top of this, its medical records are also good, and most Icelanders have willingly given genetic samples to an endeavour which is seen to be beneficial to the country's economy as whole.

DeCODE hopes to translate this knowledge into money by understanding the genetic underpinning of diseases and hence developing diagnostic tools and drugs. On the way, however, it is generating a lot of additional scientific knowledge—of which this study is one example.

The study's principal finding is that the most fecund marriages are between distant cousins. Using Iceland's genealogical records, which allow the degree of relatedness between husband and wife to be calculated with great precision, Dr Helgason showed the optimum degree of outbreeding (measured in terms of the number of children and grandchildren produced) lay somewhere between cousins of the third and fourth degrees.

Probably, the reason is that marriages between close relatives risk inbreeding depression (caused by individuals receiving two copies of broken genes from the same ancestor, but by different paths—one maternal and the other paternal). Outbreeding means this is unlikely to happen, and at least one functional copy of each gene will be received. But outbreed too far and other difficulties arise as genetic incompatibilities between the parents make reproduction harder. (A well-known example is the case of rhesus blood groups, when the mother's immune system may reject a fetus because of its father's genes.)

The optimal degree of outbreeding remained the same in every 25-year generation since 1800, although the overall number of children from marriages of every degree of relatedness did drop gradually over time—an observation that accounts for part of Iceland's demographic transition, and which probably has a social explanation. However, the level of outbreeding in Iceland has also increased markedly over that period, and Dr Helgason's findings suggest that this, too, drives down average family size measured over the whole population by reducing the number of third and fourth cousin marriages.

The strong relationship between kinship and fertility was so unexpected that the researchers have not yet calculated exactly how much it contributes to the demographic transition. But even from the figures they present, it is clearly an important factor, and one that is likely to apply in other parts of the world where the records needed to prove it are not so good. Even in poor countries, birth rates are now falling fast. An important part of the explanation may simply be the additional choice of mates that development and urbanisation bring with them.