

care of. With the app, all a beekeeper need do is to hold their smartphone near to the hive's entrance for 30 seconds while it analyses the sound of the bees. The app then lists any health problems which it detects.

Seven different disorders will at first be checked, says David Firth, a team member who is helping to bring the app to market. These include the presence of hive beetle, a serious honeybee pest, parasitic mites and "foulbrood", a bacterial infection which can destroy bee colonies.

The results might also point to early signs of CCD, which is now regarded as being caused by a combination of problems rather than one particular disease. In a 2010 paper in *PLOS One*, Dr Bromenshenk

and his colleagues found that a bee virus and a fungus from a species known as *Nosema* were often prevalent in collapsed honeybee colonies, and that it was likely the two working together were more lethal to bees than either pathogen alone.

With the permission of users, data from the app can be shared with the researchers, who plan thereby to update the software to detect other diseases and problems, says Dr Firth. This could include exposure to pesticides, in particular a group called neonicotinoids which are suspected of harming honeybees (pesticide producers reject such claims). Finally, if all works to plan, bees will get to have their say about the things that cause them harm. ■

Education policy

Selective evidence

Genes and backgrounds matter more to exam results than the type of school

PARENTS in England are faced with a choice when their children are old enough to attend secondary school. They can pay to send their offspring to a private school, which usually involves sitting an entrance exam. Alternatively, in some parts of the country, the child can sit an eleven-plus exam and, provided they pass, attend a grammar school. Grammar schools are publicly funded and tend to excel in league tables of academic performance. The overwhelming majority (about 90%) of British pupils, however, attend non-selective state schools.

Debate has raged for years over whether most selective schools do well because they provide a better education than state schools, or merely because they cream off the brightest and most privileged. According to research led by Robert Plomin and Emily Smith-Woolley, both of King's College London, the educational benefits of selective schools largely disappear once

the innate ability and socio-economic background of pupils at selective schools are taken into account.

As they report in *npj Science of Learning*, the researchers selected over 4,000 unrelated individuals from the Twins Early Development Study, a large ongoing project gathering information from British twins born in the mid-1990s. That information includes DNA data and the results of intelligence tests and exams.

At first the researchers calculated a genetic score taken for each child by adding up contributions from thousands of minor variations in their DNA that past studies (including data from 300,000 individuals) have linked to educational attainment. Pupils attending grammar and private schools had significantly higher genetic scores than those in comprehensives. But when those scores were adjusted to reflect each child's test results at 11, as well as the education and occupations of their par-

ents, the differences vanished. That makes sense. Previous research has shown that many of the traits that selective schools are screening for are, in part, inherited from their parents. The tests being used by schools appear to be inadvertently picking up some of these genetic differences.

The researchers then scored each child based on the results of science, maths and English GCSE exams, typically taken by all schoolchildren in England and Wales at the age of 16. On average, the results of children at private or grammar schools were a full GCSE grade higher than those at state schools. That suggests attending a selective school gives children a boost. Without correcting for any other factors the researchers calculated the boost to be worth about 7.1% of the difference in GCSE results.

But was this due to better teaching at these schools or an outcome of the selection procedure? To see, the team adjusted the grades based on the results of each child's test scores, family circumstances and genes. Once they did this, the gap between the schools narrowed dramatically, with school type explaining just 0.5% of the difference in average GCSE grades. For any individual, genetics accounted for about 8% of the difference, modest in comparison with the many other factors involved, such as socio-economic backgrounds, test results at 11 and things still to be accounted for.

The research comes with important caveats. First, the thousands of genetic variations so far linked to educational attainment are not well understood. Many of these variations may not be linked to intelligence at all. If, for instance, a weak bladder leads a child to perform poorly in timed exams or protuberant ears means bullying blighted their education, genetic variants for these traits will show up as disadvantageous. Stronger bladders and flatter ears will therefore confer advantages and better genetic scores. Second, had the study also been conducted in a nation, such as Denmark, where wealth is more evenly spread it is possible that genetics would appear to play a bigger role in educational outcomes, because socioeconomic disparities would have a lesser impact.

The research does not appear to support "progressive eugenics", as advanced by Toby Young, a journalist and a co-author of the study. Mr Young has argued that poor people should be able to screen embryos free on the basis of intelligence, if the technology becomes available. Setting aside ethical questions, many of the genetic differences that might appear to contribute to social mobility (think flatter ears, etc) may not be associated with actual intelligence. Overall, such an idea might shift educational attainment by a few percentage points at best. That is tiny compared with the advantages enjoyed by the children of the educated and wealthy. ■



I blame my parents, one way or the other