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Study finds first genes associated with general cognitive function

Scientists have identified genes associated with people's general cognitive function – how we process information.

An international team led by the University of Edinburgh found significant small signals from four genetic regions that were associated with having stronger thinking skills. These regions contained genes that have previously been associated with neurological and psychiatric states.

Using DNA data, the scientists found general cognitive function was 28 percent heritable in people aged more than 45 years old.

The study found some genes that had been linked to the development of Alzheimer's disease were also associated with general cognitive ability.

The study analysed data from 54,000 people aged more than 45 years old who had taken part in 31 cohort studies in Australia, Europe and North America. Five of these studies involved Scottish participants and six were run by researchers at the University of Edinburgh. The study was conducted under the auspices of the CHARGE (Cohorts for Heart and Aging Research in Genetic Epidemiology) Consortium.

The participants had all taken a variety of memory and thinking tests which were summarised as a general cognitive ability score. All had genetic testing that examined their DNA in hundreds of thousands of locations. None had dementia or stroke.

Professor Ian Deary, Director of the Centre for Cognitive Ageing and Cognitive Epidemiology (CCACE), who led the research, said: "Before this study we knew that general thinking skills in older age were heritable to some extent, but we did not know which genes were involved. These small genetic signals are like the first lights on a distant shore. We find that, with these types of genetic studies, the larger the number of people tested, the more genetic signals emerge. These findings are exciting in themselves, but they herald more such discoveries as the studies grow in size."

Lead author Dr Gail Davies, of CCACE, said: "It is interesting to find that something as complex as people's thinking skills can be studied by these methods. What we are trying to do here is identify people's genetic differences and find out whether some of these contribute

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to their cognitive abilities. Many individual genes were suggested by small studies previously, but they have not held up. After identifying genes further work is required to understand their function in both the body and the brain.”

Professor Deary explained that the research takes place in the context of the growing world-wide concern about cognitive ageing: “It is good that the concerns of older people are receiving more attention in research. One of the major concerns is the loss of cognitive ability that some people experience with age. A part of that is due to genetic differences. This type of research tries to locate the genes involved, and how they work. And that’s the key. This is not about finding out something about which one can do nothing. The idea is to understand the biological mechanisms that support healthy thinking in older age and to pass that on to those working on possible ameliorations of cognitive decline.”

James Goodwin, Head of Research at Age UK which contributes funding said: “These findings are a real breakthrough, for the first time identifying genes that influence the way our brains work in older age. This work will be invaluable in understanding how our minds age and how dementia develops. It is also likely to play an important role in shaping our future thinking about health care and public health.

The study, published in *Molecular Psychiatry*, involved researchers in Australia, Austria, Croatia, Finland, France, Germany, Holland, Iceland, Ireland, Norway, Sweden, the UK and the US.

The Lothian Birth Cohorts are part of a larger project called the Disconnected Mind, which is supported by Age UK.

The analysis for this study was carried out at the University of Edinburgh Centre for Cognitive Ageing and Epidemiology (CCACE), which is supported by the Medical Research Council (MRC) and the Biotechnology and Biological Sciences Research Council (BBSRC) as part of the Lifelong Health and Wellbeing programme, a collaboration between the UK’s Research Councils (www.mrc.ac.uk/LLHW).

The Orkney Complex Disease Study (ORCADES) is a genetic study based in the Orkney isles and is funded by the Chief Scientist Office of the Scottish Government, the Royal Society, the MRC Human Genetics Unit, Arthritis Research UK and the European Union framework program 6.

The Croatia-Korčula and Croatia-Split cohorts, a genetic study by The University of Split and The University of Edinburgh is supported by grants from the MRC, the Ministry of Science, Education, and Sport of the Republic of Croatia, the European Union.

The Generation Scotland study is supported by the Chief Scientist Office of the Scottish Government Health Directorates, the Scottish Funding Council, and the MRC.

Professor Ian Deary and Dr Gail Davies are happy to answer emailed questions:

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