Good Wiring
The Great British Brain Off
27 August, 3pm. Stand in the Square

Do you feel like your brain is half-baked? Or that your mental faculties are going off the boil? Join 'head' chef Dr Alan Gow in the Great British Brain Off to consider the recipe for the perfect brain, and what you can do if you feel your own grey matter needs some extra spice. Watch the trailer at https://youtu.be/X20p9oCYI8Y

Tickets from https://tickets.edfringe.com/

Ageing and Cognitive Decline:
Longitudinal Perspectives
24 July, 1.00 - 4.30pm

How does cognitive function change as people age? How can we assess the cognitive health of a population? And how might cognitive function interact with the important financial decisions that people have to make in later life? These issues are best addressed by HAGIS (Healthy AGing In Scotland) is a longitudinal survey which assess how older people’s health, well-being, social and financial circumstances change over time. This conference will address the issues of cognitive change among older people and provide an introduction to HAGIS. The speakers each have an established reputation in this area and include Ian Deary, University of Edinburgh, Ken Langa, University of Michigan, Robert Wright, University of Strathclyde and David Bell, University of Stirling.

Register at http://tinyurl.com/AgeCogDec15
Good Wiring - Children with Symmetrical Bodies have Speedier Mental Responses

CCACE research on how children with symmetrical bodies have speedier mental responses has attracted significant coverage in the press.

The study, carried out on 856 children at the Edinburgh Science Festival, sheds light on how the mind and the body develop together from childhood to old age, and provides important clues to health and well-being across the lifespan.

The work has been featured in over a dozen news outlets within and outside of the UK including The Telegraph. It has been released as an open-access publication in Developmental Psychology and was authored by David Hope, Tim Bates, Dominika Dykiert, Geoff Der and Ian Deary.


Davies et al. (2015). Molecular Psychiatry advance online publication 3 February 2015; doi: 10.1038/mp.2014.188

Nick Fox ‘Registers’ Good Response at CCACE

A large and varied audience attended CCACE’s last seminar of the academic year on 16th June. Professor Nick Fox from University College London gave a very well-received talk on how the brain changes in Alzheimer’s disease and other degenerative conditions.

With some audience participation he demonstrated how he has developed techniques to register brains so that even small amounts of shrinkage can be measured accurately. The power of registration was demonstrated by showing how much easier it is to compare the heights of two people who are standing back to back than it is to measure each and compare the measurements.

After a tour de force describing how valuable brain registration has been in finding out the progress and determinants of progress in dementias, Professor Fox ended by describing some treatment trials in which his brain registration techniques are being used.

Fox and Deary demonstrate ‘registration’. Who is taller?
Edinburgh Neuroscience Films Its Working Day

Edinburgh Neuroscience and CCACE have collaborated with MSc student Jenna Hinds on a short film *Ages of the Brain: a Day in the Life of Edinburgh Neuroscience*.

Using film and sound clips submitted by research groups from across CCACE and Edinburgh Neuroscience, Jenna has put together a short film on the huge variety of Neuroscience research across Edinburgh.

From 11-15 May Edinburgh’s neuroscientists documented their week to show what it’s like being a neuroscientist in Edinburgh. Jenna was seconded to CCACE as part of her MSc in Science Communication and Public Engagement, supervised by CCACE KE Officer, Robin Morton and working closely with Edinburgh Neuroscience co-ordinator Dr Jane Haley.

The film was premiered on 30 June with a great audience reaction and you can now view the film at https://youtu.be/zQqIHFy3c.

New IGMM Systems Medicine Building

The MRC Institute of Genetics and Molecular Medicine at the University of Edinburgh (IGMM) has opened its new building on the Western General Hospital campus. The impressive 5-story structure now physically links the three institutes that make up the IGMM.

CCACE has close associations with the IGMM as genetics plays a key role in the study of cognitive ageing. The IGMM is home to CCACE Group Leader Professor David Porteous and co-hosts CCACE fellow Dr Riccardo Marioni.

David was also keen to point out the impressive new open plan office space, including hot desks which are bookable through admin@igmm.ed.ac.uk
Smokers Tend to Have Thinner Brain Cortex

People who give up smoking might reduce accelerated thinning of the cortex – the brain’s outer layer which is important for thinking skills.

Researchers at CCACE and McGill University have found that people who avoided smoking had a thicker outer layer of the brain than people who had smoked.

Those participants who had given up smoking for the longest time had a thicker cortex compared with those who had given up recently – even after accounting for the total amount smoked in their lifetime.

The study gathered health data and analysed MRI scans of 504 men and women from the Lothian Birth Cohort 1936 who had an average age of 73. Around half were former or current smokers.

Using detailed MRI brain scans, careful image analysis and statistical models, researchers analysed how a person’s smoking habit was linked with the thickness of the brain’s cortex.

McGill’s Dr Sherif Karama and his co-authors suggest that avoiding smoking helps to keep the brain’s cortex thicker so therefore more normal. They also cautiously suggest that the cortex might regain some thickness once smokers quit, but that this was not seen in all regions of the brain.

Professor Joanna Wardlaw, Director of the Brain Research Imaging Centre at the University of Edinburgh, said: “The effects of smoking on the lungs and heart are well known, but our study shows that there are important effects on the brain as well, another good reason for not smoking”.

Professor James Goodwin, Head of Research at Age UK, acknowledges the public health challenge, saying: “Understanding how and why our thinking skills change with age is a major current health challenge. This work helps us to understand how smoking affects the brain in later life. The more we can find out about what influences our thinking skills as we age, the better the advice that we can give people on protecting their cognitive health.”

CCACE Director Professor Ian Deary said “It is important to know what is associated with brain health in older age. From these data we have found a small link between smoking and having thinner brain grey matter in some regions.

Prof Deary recognises that further studies are needed to confirm these results with larger numbers of current smokers studied over long periods of time. He went on to say “There are findings in our study that could suggest that stopping smoking might allow the brain's cortex to recover some of its thickness, though we need further studies conducted with repeat measures to test that idea.”

Eventually, cortical thickness of ex-smokers ‘catches-up’ with that of non-smokers. Recovery was widespread; however, it was not seen in all regions of the cortex. It could take an average of 25 years for an ex-smoker’s cortex to return to the thickness of a non-smoker’s.

The study is published in the journal Molecular Psychiatry and is part the Disconnected Mind which is supported by funding from the Age UK. The brain imaging was carried out at the Brain Research Imaging Centre, Neuroimaging Sciences, University of Edinburgh (www.ed.ac.uk/edinburgh-imaging).
DNA Clock Helps Predict Lifespan

CCACE scientists have helped to identify a biological clock that provides vital clues about how long a person is likely to live.

Dr Riccardo Marioni (right) and colleagues studied chemical changes to DNA that take place over a lifetime, and can help them predict an individual’s age. By comparing individuals’ actual ages with their predicted biological clock age, scientists saw a pattern emerging.

Biological Age
People whose biological age was greater than their true age were more likely to die sooner than those whose biological and actual ages were the same.

Four independent studies tracked the lives of almost 5,000 older people for up to 14 years. Each person’s biological age was measured from a blood sample at the outset, and participants were followed up throughout the study.

Results showed that the link between having a faster-running biological clock and early death held true even after accounting for other factors such as smoking, diabetes and cardiovascular disease.

Dr Marioni said “The same results in four studies indicated a link between the biological clock and deaths from all causes. At present, it is not clear what lifestyle or genetic factors influence a person’s biological age. We have several follow-up projects planned to investigate this in detail.”

DNA Modification
Scientists from the University of Edinburgh, in collaboration with researchers in Australia and the US, measured each person’s biological age by studying a chemical modification to DNA, known as methylation.

The modification does not alter the DNA sequence, but plays an important role in biological processes and can influence how genes are turned off and on. Methylation changes can affect many genes and occur throughout a person’s life.

CCACE Director Prof Ian Deary said “This new research increases our understanding of longevity and healthy ageing. It is exciting as it has identified a novel indicator of ageing, which improves the prediction of lifespan over and above the contribution of factors such as smoking, diabetes, and cardiovascular disease.”

International Collaboration
The study is published in the journal Genome Biology and was conducted by researchers from CCACE, University of Queensland, Harvard University, University of California, Los Angeles (UCLA), Boston University, the Johns Hopkins University Lieber Institute for Brain Development and the U.S. National Heart, Lung and Blood Institute.


*Genome Biology, 2015, 16:25 DOI: 10.1186/s13059-015-0584-6*
Study Finds the First Genes Associated with General Cognitive

An international team led by CCACE scientists has identified genes associated with people's general cognitive function.

Analysis of DNA data revealed that general cognitive function was 28 per cent heritable in people aged more than 45 years old. The study also found some genes that had been linked to the development of Alzheimer’s disease were also associated with general cognitive ability.

CCACE Director, Professor Ian Deary, Director, 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 findings are exciting in themselves, but they herald more such discoveries as the studies grow in size."

Lead author Dr Gail Davies, CCACE Genetic Statistician, 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 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.”

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.

Personality Development of Obesity

On 3-4 June, CCACE hosted colleagues Thorkild Sorensen, Erik Mortensen, and Christine Dalgard from the Geminakar Twin Study in Denmark to discuss collaborations with Wendy Johnson, Ian Deary, and other CCACE staff involving personality development of obesity. Thorkild Sorensen gave a talk with that title, in which he outlined the considerable accumulation of evidence that the obesity epidemic is much more than a recent increasing tendency for people to consume more food energy than they expend in physical activity. He also outlined some of the ways in which individual differences in fat storage capacity in the body may be involved both in emergence of obesity and its sometimes, but not always, considerable health consequences over ageing. He and Erik Mortensen also held independent discussion sessions with resident CCACE research staff and PhD students. Erik's focused on personality and more general health topics, while Thorkild's continued discussions inspired by his seminar talk on obesity. Several plans for specific collaborations resulted.
What’s in Our BrainBox?

What’s in the Brain Box? This is the question we asked 60 children at a new CCACE workshop at the National Museum of Scotland.

The workshop was developed MSc placement student Helen Staton (pictured left) working with KE Officer Dr Robin Morton and support from Dr Jane Haley in Edinburgh Neuroscience.

Drs Simon Cox (pictured on the right) and Stuart Ritchie, who helped develop the workshop, introduced the brain to the workshop participants and led them through a series of tasks which allowed them to try some of the scientific techniques they use in their research. Most popular was the 3D Brain task where the participants created a 3 dimensional model of the brain by drawing round brain slice sections on Perspex and assembling them in front of a light box to reveal the 3D structure of the brain.

The workshop introduced the brain and senses with hands on tasks, including a discovery box, in which children were challenged to test their senses. Throughout the workshop, participants were challenged to find hidden words which spelled out “Better Connected Brains Work Better”.

The finale of the workshop was a game of “Brain Slam” a new CCACE card game that tests the players choice reaction time. We are grateful Helen Staton for developing the game and fellow MSc student Jenna Hinds for designing the bespoke cards.

A New Introductory Book on Intelligence

A new short book, Intelligence: All that Matters, by Dr. Stuart Ritchie (CCACE Postdoctoral Fellow in Cognitive Ageing) will be published this month.

The book, part of the All that Matters series of introductory books published by Hodder & Stoughton, is a general introduction to the science of IQ and intelligence. It covers the past and present of IQ testing, explains why intelligence matters for our lives, examines the biological basis of intelligence, and discusses ways in which we might improve our intelligence. Many of the results discussed are from the Lothian Birth Cohort studies.

In a review on his blog Psychological Comments, Dr. James Thompson (University College London) wrote that: “In my opinion Intelligence: All that Matters is the best available short introduction to intelligence, and word for word the most effective.”

The book will be available for purchase in paperback and as Kindle edition from June 18 2015.
Two Scientists, a Comedian and a Filmmaker

CCACE hosted a sell-out discussion event at this year’s Edinburgh International Science Festival.

‘The Living Brain’ was hosted by comedian Susan Morrison who kept the audience laughing while quizzing a panel consisting of Drs Stuart Ritchie and Susan Shenkin and filmmaker Anne Milne.

The event sold out and was warmly received by the audience at Summerhall, who bombarded the panel with questions. During the show the audience tested their reaction times by playing a new CCACE card game: Brain Slam. Questions from the audience were sparked by a screening of Anne Milne’s short film The Living Brain, which introduces two participants in the Lothian Birth Cohorts 1921 and 1936. Watch the trailer for the show at https://youtu.be/5AgRgSODDnQ

New App to Aid the Early Diagnosis of Alzheimer’s Disease

CCACE members are showing how basic research can translate into the clinic to support diagnosis of Alzheimer’s Disease (AD). The team have developed a new tablet based App that they hope will help GPs identify AD early and allow appropriate referral to clinics.

Sergio Della Sala, Robert Logie and Mario Parra have spent many years developing a cognitive assessment technique which offers a reliable aid for non-invasive diagnosis and follow-up assessment for both sporadic and familial AD. The technique is based on robust and replicated studies carried out since 2001, showing that individuals with AD have a specific problem in combining multiple sources of information, known as ‘temporary feature binding’.

This impairment is specific to AD and does not appear in other forms of dementia nor in chronic depression or healthy ageing. The group are now capitalising on this assessment technique and have optimised the test for use on a tablet offering a feasible test with potential for commercialisation.

Sergio Della Sala said “The App we have developed is simple and is administered quickly. It has the potential for timely and accurate diagnosis and screening, and to reduce the number of unnecessary referrals for AD. There could be considerable economic benefit through faster diagnosis, improved patient management and better assessment of the patients’ needs and those of their carers.”

The App would be easy to adopt in primary care, does not require highly trained operators, is non-invasive, supports rapid and effective assessment, and would be cheaper to license and faster to administer than biochemical based testing. Moreover, the proposed instrument would prove ideal as a hallmark for future clinical trials, offering a quantitative measure of AD severity to measure the effectiveness of new treatments; with no practice effect.
Teenagers with slower performance on a test of cognitive processing speed are more likely to have depression and anxiety symptoms as adults.

According to the new research by CCACE member Catharine Gale and colleagues "Adolescents with slower processing speed may be at increased later risk of anxiety and depression". The results add new evidence that lower cognitive ability may be a contributor to depression, rather than a consequence of it.

The researchers analyzed data from 705 Scottish participants in a study including follow-up from adolescence into adulthood. At the age of 16, the subjects were evaluated on a simple test of cognitive processing speed—choice reaction time.

At the age of 36, the participants completed standard questionnaires assessing depression and anxiety symptoms. The relationship between reaction time in adolescence and mental health in adulthood was assessed, with adjustment for a wide range of other factors (including education, lifestyle habits, etc).

Slower cognitive processing speed—that is, longer reaction time—at age 16 was associated with increased anxiety and depression symptoms at age 36. After adjustment, the relationship remained significant for one of the two mental health questionnaires (the General Health Questionnaire), but not the other (the Hospital Anxiety and Depression Scale).

Smoking appeared to be a mediating factor in the relationship between teen reaction times and adult depression scores. "This might at least in part reflect the use of cigarettes as a method of relieving of coping with psychological symptoms," Dr. Gale and coauthors suggest.

The researchers were also interested in assessing the role of the cumulative effects of stress over time, or "allostatic load." As reflected by various measures related to stress—for example, blood pressure and general inflammation—allostatic load seemed to at least partly mediate the link between reaction time and anxiety/depression symptoms. However, this relationship was no longer significant after adjustment for other factors.

Previous studies have shown that people with more severe depression have slower reaction times and other cognitive deficits. It has generally been assumed that this "psychomotor slowing" is a consequence of depression, rather than a risk factor for it. The new study suggests that slower processing speed may contribute to the development of mental health disorders—possibly by leading to "increased stress and difficulties responding to adversity earlier in life."

Dr. Gale and colleagues note some key limitations of their study, especially the fact that the subjects had a narrow range of depression scores. The researchers conclude, "Further prospective studies of the relation between reaction time and mental health outcomes in other samples are needed to gauge whether reaction time is a true risk factor for mental disorders and to confirm the mediating roles played by smoking and allostatic load."

£1m to Support Whole Genome Sequencing

In January 2015, researchers at the CCACE and the Roslin Institute announced £1million from the Biotechnology and Biological Sciences Research Council to fund whole genome sequencing of the Lothian Birth Cohort 1936. The story has attracted considerable attention in the media with Professor James Goodwin of Age UK representing the study on BBC Breakfast.

This research has been made possible because of a major recent investment in gene sequencing technology by the Universities of Edinburgh and Glasgow to establish the Scottish Genomes Partnership. The Universities are investing in equipment that can sequence a person’s genome for less than £750. It will also deliver better quality results much faster than was previously possible.

The Lothian Birth Cohort have already taken many cognitive and other medical tests. By linking these test results with information about their genetic make-up, CCACE scientists hope to gain new insights into the factors underlying healthy ageing.

Professor Ian Deary, CCACE Director, said: “As well as lifestyle factors and health, we think that genetic factors contribute to why some people’s brains and thinking skills age better than others. This new award will allow us comprehensively to examine people’s genetic status, and will add further value to the rich data provided by these dedicated participants.”

Aina Juan: Visiting Report

My research in the Centre focuses on the association between social activity, alcohol intake and cognition. I had a great collaborator in Dominika Dikiert where we have analysed these associations with data from the LBC1936 study. It was also a great opportunity to collaborate with Iva Cukic as we share an interest in personality traits. We have now written an article about personality and adolescent smoking during my time here.

During the four months that I was at CCACE I was able to attend interesting and stimulating seminars and workshops. I have also had the opportunity to learn advanced statistical methods such as structural equation modelling and Latent Growth Curves. Dominika Dikiert, Stuart Ritchie and Mike Allerhand were all excellent guides in this!

I also had the opportunity to discuss some of my research ideas with different members of CCACE. My hope is to apply my new acquired knowledge to study the relationship between modifiable risk factors for cognitive decline in a large ongoing clinical trial about cardiovascular disease.

I am very grateful for the hospitality of the CCACE members for the four months I have been here. Especially to Ian Deary, Beverly Roberts and Anna Sim. They have provided an enjoyable and productive period of research and study. I hope that there will be exciting opportunities for future projects and collaborations.
The Centre for Cognitive Ageing and Cognitive Epidemiology is delighted to announce that their Clinical Fellow Dr Alixe Kilgour has passed her PhD viva with minor corrections. Her thesis looked at the relationship between age related muscle loss, or Sarcopenia, and Cognitive Ageing, their biological correlates and the role of glucocorticoids. Congratulations to Catherine Gale promoted to a Personal Chair at the University of Southampton. From 1st August I’ll be Professor of Cognitive Epidemiology. Professor Gale splits her time between CCACE and Southampton. Congratulations also go to Wendy Johnson who has been promoted to a personal chair and Dr Alan Gow, who has been promoted to Associate Professor both from 1 August 2015.

Aja’s research focuses on modelling the development of criminal, psychopathological and otherwise maladaptive behaviours that have important implications for long term individual success and happiness.
Congratulations to Centre member Professor Gillian Mead (right) who has been awarded the Worshipful Society of Apothecaries of London William Farr Medal. The William Farr Medal is given to medical practitioners who have made a particularly significant contribution in clinically related or research disciplines to the management of elderly people. The Worshipful Society of Apothecaries of London acknowledges innovations in the care of the elderly. The award has been made to Gillian in recognition of her major contribution to the promotion of safe and effective exercise for frail and older stroke survivors. This medal will be awarded in May 2016.

Professor Ian Deary said, "As CCACE Director I am delighted to hear that Gillian has received this award. It is a high distinction and it's all the more gratifying for CCACE that it recognises practically useful research for the older people to whom we dedicate our research efforts. Well done Gillian!".

Congratulations also to Prof. David Porteous (left) who has been awarded La Foundation IPSEN international prize in the field of Neuronal Plasticity 2015. He was awarded this prize jointly with Prof. Mark Bear (MIT, USA) and Prof. Thomas Bourgeon (Institut Pasteur, France). The award will be presented at the International Brain Research Organisation (IBRO) meeting in Rio this July.

Professor Ian Deary said, "This is a high honour and David's in good company with the award. He's a credit to CCACE. Few scientists will lead a team that discovers and characterises a new gene whose alterations and their interactions can affect profound aspects of mental health. That's fundamental and practical science combined, and it's right that it has attracted this elite decoration."

**Dates for Your Diary**

**1st September 2015** - CCACE 8th Annual Research Day. Keynote speaker: Professor Katri Raikkonen, Institute of Behavioural Sciences, University of Helsinki. 1-5pm, Room F21, 7 George Square (preceded by lunch & posters, and followed by a drinks reception).

**24th November 2015** - St Andrews Day invited lecture Professor Pat Rabbitt, University of Oxford. 5pm, Room F21, 7 George Square (followed by a drinks reception). Open to all.

**10th May 2016** Professor Julie Williams, MRC Centre for Neuropsychiatric Genetics and Genomics, Cardiff University. 5.00 pm, Room F21, 7 George Square. Open to all.

**6th September 2016** - CCACE 9th Annual Research Day. Keynote speaker: Professor Yaakov Stern, Cognitive Neuroscience Division, Columbia University, USA. 1-5pm, Room F21, 7 George Square, Edinburgh EH8 9JZ (preceded by lunch and posters, and followed by a drinks reception).
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