The Disconnected Mind

Unlocking secrets of healthy mental ageing

The Disconnected Mind aims to understand how changes in the brain's white matter – its connectivity – contribute to age-related cognitive decline in humans.

Newsletter 68: December 2024

Welcome to the December edition of the Disconnected Mind Newsletter! Catch up on the news from the Lothian Birth Cohorts team between September and December, including our latest research and publications, and scientific and public engagement events.

Highlights of 2024

Celebrating LBC longitudinal research

The 2017 LBC reunion.

This year we celebrate two special anniversaries in the history of the Lothian Birth Cohorts studies: it is **the 25th anniversary of the LBC1921** established in 1999 and **the 20th anniversary of the LBC1936**. The participants have contributed to one of the longest studies of human cognitive ageing in the world. They have transformed our understanding of cognitive and brain health and ageing and have made the Lothian Birth Cohorts known worldwide. The richness of the data collected over two decades is unparalleled, contributing to the publication of more than 700 scientific papers using the cohorts' information. The publications have also directly influenced public health policy and guidance, with the team's research contributing to over 60 policy and advisory documents, detailed on the LBC website). The team are inspired by the participants' dedication and support, and we are incredibly grateful for their continuous commitment to the study.

Wave 7 of LBC1936

Alison Pattie (left) and Sabela Mendez (right) from the LBC1936 cognitive testing team with two LBC1936 participants.

In March this year, the team started inviting the participants born in 1936 for another wave of testing! Since then, the team has made excellent progress with Wave 7 of the LBC1936: over 100 participants at age 88 have now returned to the Wellcome Trust Clinical Research Facility for cognitive testing and over 60 participants have had an MRI brain scan at the scanning facility at Edinburgh Imaging Facility (EIF), Royal Infirmary of Edinburgh. We are delighted with the progress and would like to thank all participants for their continuous interest in the study and their contributions.

Staff highlights

Over two decades of LBC research translates into a long list of collaborators and students. This year we have welcomed new PhD and MSc students, **Charlotte Squires**, **Josie Robertson** and **Katie Robertson** who have now become an integral part of the team. Yet, the core LBC team boasts remarkable continuity, and many staff members remain on the team or have come back to work on the study.

The LBC team in 2008. *Bottom row from left:* Ross Henderson, Janie Corley, Paula Davies, Alison Pattie, Catherine Murray, Alan Gow. *Top row from left:* Lars Penke, Sarah Harris, Ian Deary, Michelle Luciano, Susana Muñoz-Maniega, Lorna Houlihan.

Ian Deary, the founding director, and **Alison Pattie** are amongst the original team members who continue working with the study. Alison has been a member of the LBC studies since 1998, when she helped track down the first LBC1921 participants; she retired in 2019 but has returned as an expert cognitive tester for the last two waves of testing. Professor Deary, while retired, remains an active member of the team, publishing and engaging with the public on behalf of the LBCs.

The LBC team in 2016. *Bottom row from left:* Ciara Madden, Dominika Dykiert, Alison Pattie, Adele Taylor. *Top row from left:* Paul Redmond, Simon Cox, Ian Deary, Ratko Radakovic, Janie Corley.

After almost 12 years, our team said goodbye to LBC Study Coordinator, **Adele Taylor** and welcomed Dr **Sarah McGrory**, who had worked on the LBC1936 study as a post-doctoral research fellow, and has returned as a new Study coordinator. This year, Dr **Janie Corley** celebrated 20 years of working with LBC1936. She joined the cognitive testing team in November 2004 and has been an indispensable member of the team as a cognitive tester and current LBC Co-Investigator. She has contributed to over 110 articles, including a seminal paper published in 2018 in *Psychological Medicine*, introducing the influential concept of Marginal Gains in healthy cognitive ageing. This Spring we also celebrated Dr **Sarah Harris**' promotion to the post of Senior Research Fellow. Sarah joined the team in 2003 as the LBC geneticist and has contributed to over 200 scientific papers using LBC data. She is a current LBC Co-Investigator and was recently awarded $4.7 million in grant funding from the US National Institutes of Health to lead a large-scale longitudinal proteomics study in the LBC focusing on the relationship between proteins in blood and cognitive function and brain structure before a clinical diagnosis of Alzheimer's Disease. Last but not least, the current LBC director has been promoted to professor: Dr **Simon Cox** took up his Personal Chair in Brain and Cognitive Ageing in August. Simon received his PhD in 2012 at the University of Edinburgh and since December 2020, has been the Director of the Lothian Birth Cohorts. He currently holds a Sir Henry Dale Fellowship from the Wellcome Trust and The Royal Society and is the Principal Investigator on the core LBC grant, jointly funded by the BBSRC and ESRC. He also recently established a new research collaboration worth an additional £1.1M to use the LBC blood samples to identify DNA fragments from brain cells, and investigate brain cells' DNA methylation over time. Congratulations, team, on a year of so many fantastic achievements!

Research themes

This year the team has published over 20 scientific publications based on LBC1921 and 1936 data alone! In each Newsletter, we summarise a few of the discoveries our researchers and collaborators have made. The topics this year have ranged from mental health, lifestyle factors, genetics and epigenetics to brain ageing. Here's a reminder of some of the themes: childhood intelligence and risk of depression in later life; the relationship between anxiety, depression and cognitive functioning in older adults; neighbourhood characteristics and brain structure in older age; what's behind exceptional longevity in LBC1921 centenarians; gardening linked to staying sharp in later life; LBC1936 blood samples help to understand blood clotting; DNA methylation data to study epigenetic changes to study the body and brain or genetic traits; or how LBC data allows to gain insights into cortical gene expression and their relation to cognitive function. This issue highlights four recent papers, including a new review of LBC studies by the founding and current directors; how researchers use LBC post-mortem brain tissue to study myelin integrity; using blood samples to study fibrinogen and DNA methylation. You can find the complete list of 2024 publications using LBC data on the LBC website.

Lothian Birth Cohorts' becoming part of Edinburgh Futures Institute

In May 2024, Edinburgh Futures Institute opened its doors to the public. Soon, its doors will open to the LBC team as a new home for the study. "*It is fitting that the LBC team should be taking up residence in the new Edinburgh Futures Institute in the new year since the LBCs are both a very 'Edinburgh' story and a very 'Futures' story,"* says the study director, Professor Simon Cox. *"The school test that assessed the intelligence of Scottish 11-year-olds in 1932 and 1947 and forms the foundation of the LBC studies was designed in Edinburgh,"* explains Simon, *"and a desire to contribute a legacy of knowledge for future generations is a strong motivation for the LBC participants to return for another wave of testing and remaining connected with the study."* We are delighted that the LBC studies will continue their work as part of the Edinburgh Futures Institute, allowing the participants' legacy to continue far into the future.

Lothian Birth Cohorts will soon join Edinburgh Futures Institute.

Next generation of staying sharp

This year we have had many opportunities to engage with the public – and particularly the younger generation – about the LBCs and what we know about healthy ageing. We have launched a new educational programme 'Marginal Gains in Cognitive and Brain Ageing', around a seminal paper by Dr Janie Corley and LBC colleagues. In addition to the popular Augmented Reality Glasses illustrating brain ageing and 3D printed brains, we have introduced a new LBC-inspired boardgame 'Who gets to be 100?'. This game introduces the public to the concept of Marginal Gains when small, incremental improvements across various lifestyle and health-related factors can collectively lead to benefits to cognitive and brain health as we age. The game as well as other hands-on activities, including our guided walking tours and accessible talks have proven popular amongst all ages, from 10-year-olds at the Edinburgh Science Festival, P5s at Niddrie Mill Primary School, school children and their parents at Castlebrae Community Festival, retired ladies celebrating their school reunion, young and old at the Curious Festival at the Royal Society of Edinburgh, visitors at Edinburgh Doors Open Day and in a 10-week educational programme for S5 students at Boroughmuir High School!

Raising awareness about brain and cognitive health with artwork

'Shedding Light on the Brain' with re-purposed LBC glass paperweights celebrating the study

We continue reaching out to wider audiences with a new LBC-inspired artwork. Joan Smith created a beautiful display, 'Shedding Light on the Brain', which arose from glass paperweights that were created in 2019 as gifts to mark the twentieth anniversary of the Lothian Birth Cohort 1921. While most were given as participants gifts, some of the remaining ones have been used in this artwork, referencing the LBC archives and celebrating the study. This display has been featured at the Inspace gallery, at the Royal Society of Edinburgh and shared with students at Boroughmuir High School where Joan came to talk about her science-inspired art. We look forward to showcasing this artwork at future events!

Scientific Highlights

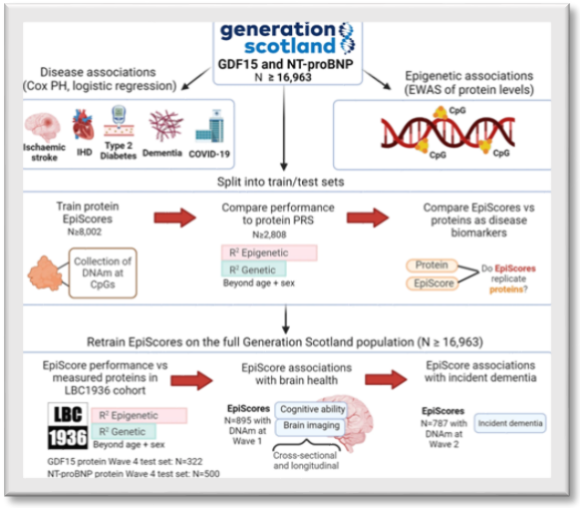
Lessons we learned from the Lothian Birth Cohorts of 1921 and 1936

Founding and current directors of the Lothian Birth Cohorts studies, Ian Deary and Simon Cox, reflect on over 20 years of LBC research.

What are the key insights from over 20 years of research with Lothian Birth Cohorts? In a new review article, the founding and current directors of the LBC studies, Ian Deary and Simon Cox, reflect on what they learned from working with the cohorts about how our brains age and what factors influence cognitive performance throughout life. The reader is reminded of the Scottish Mental Surveys of 1932 and 1947, which tested almost every child born in 1921 and 1936 in Scotland and provided a comprehensive baseline that allowed researchers to track cognitive changes across entire lifespans. This data has laid the foundation of the discovery that approximately half of the variance in intelligence test scores in older age can be traced back to childhood cognitive ability. Other scientific highlights include the finding that higher childhood intelligence is linked to better survival rates; DNA methylation patterns can predict mortality risk; that genetics influences intelligence differently in childhood versus older age; and that there are substantial variations in brain health among people of the same age. The authors also review the concept of Marginal Gains in cognitive ageing: the idea that there is no single factor that can explain individual differences in cognitive ageing; instead, many different factors can have small but important effects. The review was published in *Genomic Psychiatry*, a new journal by Genomic Press. *"This is the most accessed article with over 2,000 visits in the first few days after it was published online,"* reports the journal editor Julio Licinio. The review has received significant attention from international media and has been featured by CNN in an article Why brain ageing can vary dramatically between people.

Deary, I. J., & Cox, S. R. (2024). Lessons we learned from the Lothian Birth Cohorts of 1921 and 1936. *Genomic Psychiatry.*

LBC1936 contributes to a new epigenetic study

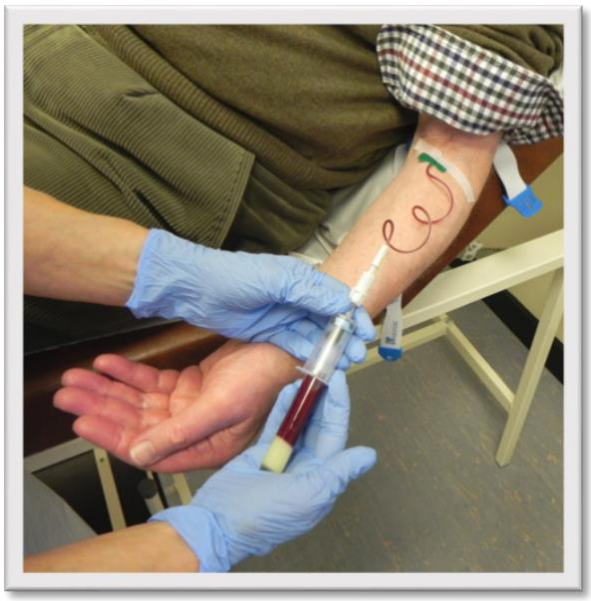


Study design for the assessment of GDF15 and NT-proBNP EpiScores as biomarkers (Figure 1 in Gadd et al., 2024).

A recent study used DNA methylation (DNAm) patterns to predict the levels of two types of protein in the blood that are linked to various physical and mental health traits. GDF15 (Growth Differentiation Factor 15) is a protein involved in regulating inflammation and cell growth. It is often linked to cardiovascular conditions, diabetes, and age-related disorders. NT-proBNP (N-terminal pro-B-type natriuretic peptide) is a fragment of a hormone released by the heart in response to changes in pressure that occur when heart failure develops and worsens. It is commonly used as a biomarker to diagnose and manage heart failure and other cardiovascular diseases. In this study, researchers aimed to develop GDF15 and NT-proBNP EpiScores as biomarkers for these diseases and brain health. They first examined levels of these proteins in a large group of people from the Generation Scotland study and found that higher levels of GDF15 were linked to a higher risk of developing dementia, ischaemic stroke, and type 2 diabetes; NT-proBNP was linked to a higher risk of heart disease, ischaemic stroke, and type 2 diabetes. They then looked at specific DNA changes related to these proteins and created scores (EpiScores) to predict protein levels, and tested these scores in a subset of the GS population. The GDF15 score successfully predicted the risk of dementia, type 2 diabetes, and ischaemic stroke. The NT-proBNP score predicted the risk of type 2 diabetes but not stroke. The scores were then tested separately on the LBC1936 to assess brain health: both EpiScores were linked to signs of poorer brain health, but neither score predicted dementia. The study provides important insights into DNA methylation patterns related to these proteins and their role in gene regulation, opening possibilities for therapeutic interventions to treat diseases linked to epigenetic changes.

Gadd, D. A., et al. (2024). DNAm scores for serum GDF15 and NT-proBNP levels associate with a range of traits affecting the body and brain. *Clinical Epigenetics*.

LBC1936 blood samples contribute to the largest and most diverse genetic study of plasma fibrinogen

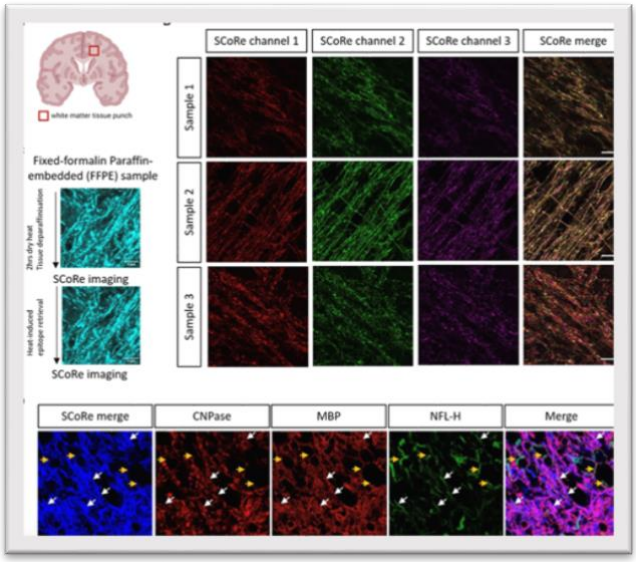


LBC1936 participants' blood samples used in a largest and genetically most diverse study of fibrinogen

Whole-genome sequencing (WGS) is a powerful tool used in genetic research. WGS reads the entire DNA sequence of an organism's genome, providing a complete picture of all genetic variations. It can identify new or rare genetic variants that might not emerge from alternative methods. A recent study aimed to better understand the genetic factors that influence plasma fibrinogen levels, which are important for blood clotting and cardiovascular health. Researchers used two types of genetic data: Whole-Genome Sequencing (WGS) data from the TOPMed program, which included 32,572 participants and Array-based genotype data from the Cohorts for Heart and Aging Research in Genomic Epidemiology Consortium (CHARGE) with over 131,300 participants, including the LBC1936 data. This data was imputed, meaning the researchers used statistical methods to predict missing genetic information based on reference panels. These two datasets were then combined (meta-analysed) to get a more comprehensive view of the genetic variations affecting fibrinogen levels. WGS data provided better coverage of the entire genome and included more genetic variants, especially those not commonly found in European populations. The study leveraged the strengths of both WGS and array-based genotyping to gain deeper insights into the genetic regulation of fibrinogen levels and highlights the value of WGS in discovering genetic factors in diverse populations, thus advancing our understanding and treatment of cardiovascular diseases.

Huffman, J.E., et al. (2024). Whole-genome analysis of plasma fibrinogen reveals population-differentiated genetic regulators with putative liver roles. *Blood.*

LBC1936 post-mortem brain tissue helps test new methods for the study of myelin integrity



A new imaging technique detects myelinated axons in aged human central white matter tissue (Figure 3 in Craig et al., 2024).

The structural integrity of myelin sheaths in the central nervous system (CNS) is crucial for proper nerve function. Myelin sheaths are protective coverings made of fat and protein that wrap around the axons of nerve cells (neurons) in the CNS and peripheral nervous system (PNS). They function similarly to the insulation around electrical wires, helping to speed up and maintain the strength of electrical signals as they travel along the nerve cells. If the structural integrity of myelin is compromised, CNS and axonal functions are jeopardized. Therefore, maintaining myelin integrity is increasingly recognized as paramount to ensuring neural health. Traditionally, electron microscopy is used to visualize these myelin sheaths, but the method can sometimes create artifacts that look like myelin damage. In this study, researchers explored an alternative method called Spectral Confocal Reflectance (SCoRe) microscopy. This technique uses light reflection to detect myelin sheaths. The study aimed to see if SCoRe can detect damage in myelin structure even when the amount of myelin remains the same. The method was tested on two types of mice that had changes in myelin structure but without myelin loss and also used SCoRe to see myelin sheaths in LBC1936 brain tissue samples that were preserved after death. The results showed that SCoRe can effectively detect individual myelin sheaths and structural abnormalities in both mouse and human tissue samples. Overall, the study found that SCoRe is a useful and effective tool for studying myelin integrity in both mouse and human CNS tissue.

Craig, G. A., et al. (2024). Reflective imaging of myelin integrity in the human and mouse central nervous systems. *Frontiers in Cellular Neuroscience*.

Knowledge Exchange

Curious 2024

For two weeks in September the Royal Society of Edinburgh hosted a festival of knowledge – Curious 2024. Lothian Birth Cohorts joined the festival this year with a hands-on workshop 'Who gets to be 100?'. We welcomed 'Curious' audience for an evening of talks by Professors Ian Deary and Simon Cox about the LBC history, findings and future; LBC team members – Drs Gail Davies, Sarah Harris, Colin Buchanan, Anna Furtjes and Barbora Skarabela – came along to support the event with small-group conversations around a game of the LBC-inspired 'Who gets to be 100?', with fun facts about the study and cognitive and brain health. One audience member shared that they were fascinated to *"learn about the Moray House Test"* and another one *"to hear about the wide range of LBC data collected over the years and that the blood samples are helping scientists to identify those at an increased risk of developing dementia*". With a glass of mocktail or two, the event's participants had many opportunities to chat with the team, have a glimpse of brain ageing with the LBC Augmented Reality glasses and admire Joan Smith's LBC-inspired artwork showcasing the study's archival materials and stunning images of the brain. The sold-out event brought together 40 attendees of all ages, and everyone thoroughly enjoyed the evening. A post-event survey revealed that the participants learned the key concept around Marginal Gains in cognitive ageing that many factors influence the speed of cognitive ageing, but each of these is not all that important on its own. They had fun taking quizzes, listening to the talks, and playing the game and that they particularly enjoyed having the chance to talk to the researchers in an informal setting around the tables – they all would come back for another event!

The audience at the RSE's Curious Festival listening to Ian Deary's talk.

Edinburgh Doors Open Day

Edinburgh Neuroscience team and visitors with high school volunteers at the LBC table at Edinburgh Doors Open Day in September.

The Lothian Birth Cohorts joined our Edinburgh Neuroscience colleagues for Edinburgh Doors Open Day on Saturday 28th September. This year, we set up a stand in the newly opened Institute for Regeneration and Repair. Together with scientists from the Spires-Jones and Doitsidou labs we had a busy day engaging with over 170 visitors stopping at our stand, showcasing neuroscience research using fruit flies, worms, cognitive tests and brain imaging to understand brain function, disease and ageing. With the help of our wonderful volunteers Annie and Sophie from Boroughmuir High School, it was a fun and exciting day.

Doors Open Day also brought back **'Bridge Your Mind'** walking tour, guided by Jana Tomastikova who is now in the fourth year of her Psychology degree. Jana led 15 attendees on a tour through the city, weaving connections between the city streets and local landmarks on one hand and the inner workings of the human mind on the other. A highlight of the tour was sharing insights from the Lothian Birth Cohort studies on Marginal Gains and healthy brain ageing. Stops along the route included the Meadows, where Jana discussed the cognitive benefits of physical activity, and the Futures Institute, discussing the importance of lifelong learning. The tour concluded at the National Museum of Scotland, where participants explored the Lothian Birth Cohort exhibit—a finish that left many attendees reflecting on the complexity of the brain. *"Members of the public ask such intriguing questions!",* shares Jana. *"I always finish the tours even more enthusiastic about the brain than when I start."*

Marginal Gains for healthy brain and cognitive ageing at Boroughmuir High School

Boroughmuir High School students visit Edinburgh Futures Institute for a neuroscience lecture by Professor Cox.

In the last issue of the newsletter, we announced the launch of our new educational programme 'Marginal gains: Enhancing Intergenerational Connections through Art, Science and Dialogue', funded by the CAHSS KEI fund. Over 10 weeks this Autumn LBC researchers and other UoE academics met with S5 students who signed up for the programme at Boroughmuir High School. The students participated in hands-on activities, including exploring 3D-printed brains and playing a game inspired by LBC research, 'Who gets to be 100?', as well as learning from research-based talks from the founding and current directors, Professors Ian Deary and Simon Cox; Dr Charlotte Squires, a geriatrician and a PhD candidate working with the LBCs, on who and why lives in care homes; Dr Barbora Skarabela about language and communication in older years. Students also took part in art activities led by Drs Nicky Melville and Malgorzata Bugaj, experimenting with Found Poetry and creating storyboards for alternative scenes for a film with an intergenerational theme. The students and staff were excellent, and we are particularly grateful to the deputy head teacher, Mr Damian Hayes and Miss Tanya Howden, who joined us for every session, for their fantastic support, guidance, and flexibility in accommodating the programme. We are delighted the School has invited us back for another season.

Boroughmuir High School pupils engaging in an LBC-inspired boardgame.

LBC researchers at the CHARGE conference

LBC team with other CHARGE members in Rotterdam.

The Lothian Birth Cohorts are part of several large consortia. The Cohorts for Heart and Aging Research in Genomic Epidemiology (CHARGE) Consortium was formed to facilitate genome-wide association study meta-analyses and replication opportunities among multiple large and well-phenotyped longitudinal cohort studies. These cohorts have an extensive collection of genomic data as well as repeated measures of risk factors, subclinical disease indicators, and cardiovascular events on over 50,000 multi-ethnic participants. The LBC data have contributed to over 50 CHARGE publications, including a highly influential meta-analysis focusing on genetic contributions to variation in general cognitive function, published in *Molecular Psychiatry* and a study examining independent genetic loci influencing general cognitive function, published in *Nature*. The LBC researchers, Professor Simon Cox, Drs Sarah Harris, Gail Davies and Anna Furtjes joined the CHARGE Consortium held for investigators from 15 October to 17 October in Rotterdam. The meeting included invited speakers, abstract-based presentations, a poster reception, and working group sessions. Dr Sarah Harris introduced her newly NIH-funded project 'Longitudinal multi-omic biomarkers for neurocognitive decline prior to dementia onset' and invited other cohorts to join. Dr Isabelle Foote from the University of Colorado at Boulder, presented a project co-led by members of the LBC team that is investigating genetic contributions to ageing-related cognitive change.

The Edinburgh-Cognitive Genetics group

Twice a year Dr Sarah Harris, the LBC 'resident' geneticist, organises the Edinburgh-Cognitive Genetics (E-CoG) group Round Table. The group consists of about 20 researchers from across the University, with an interest in cognitive and brain traits, and genetics and other omics. The group sits around a table and discusses ongoing and planned projects with the aim of increasing scientific collaborations across the University. At the most recent meeting in October, Professor Riccardo Marioni updated the group about the progress being made in recruiting younger participants to join Generation Scotland. Drs Gail Davies and Sarah Harris provided updates on the team's large-scale international projects to identify genes and proteins associated with cognitive decline. There were also discussions about how to best use Biobank data, including data from UK Biobank, All of Us and Our Future Health. The next Round Table will be in Spring 2025.

Professor Cox at the EU MIND conference

Professor Simon Cox attended the inaugural EU-MIND conference in Caen, France in September this year. This new European congress is dedicated to neuroimaging of neurodegenerative diseases, and brought together researchers from Europe and beyond to foster collaborations and innovation in neuroimaging. Simon spoke at a symposium dedicated to 'Modifiable Risk and Protective Factors and Neuroimaging in Dementia'. He presented new preliminary findings from the LBC1936 study which uses the recently completed clinical dementia ascertainment data, showing the cognitive and neuroimaging hallmarks in the early 70s that differentiate those who go on to develop a diagnosis of dementia up to 17 years later from those that do not (including new cortical diffusion data). Simon said: *"It was a fascinating and lively conference, which managed to achieve a broad reach in terms of international attendees while also maintaining a clear focus and theme throughout all the symposia and breakout discussions."*

Rethink dementia

A new national campaign challenging people to Rethink Dementia was launched this September, supported by the Scottish Government. To help address the stigma around the illness, people are being encouraged to continue doing everyday activities with friends or relatives diagnosed with dementia. Research shows that making this effort to include people in social activities can help them stay well for longer as well as alleviate symptoms such as depression, anxiety and apathy. Dr Tom Russ, an LBC Co-Investigator and Principal Medical Contact, said: *"Over the past 20 years I've engaged with hundreds of people who have been diagnosed with dementia, and often they will withdraw from social activities, which can have a negative impact on their overall wellbeing. For anyone with friends or relatives who have been diagnosed with dementia, it's vital to stay in touch to help them maintain their usual social activities, or even try something new together."* You can listen to Arlene Stuart's radio show on Greatest Hits Network about living with dementia - featuring Dr Tom Russ.

Publication updates

Corley, J., et al. (2024). Gardening and cognitive ageing: Longitudinal findings from the Lothian Birth Cohort of 1921. *Journal of Environmental Psychology.* https://doi.org/10.1016/j.jenvp.2024.102361

Craig, G. A., et al. (2024). Reflective imaging of myelin integrity in the human and mouse central nervous systems. *Frontiers in Cellular Neuroscience.* https://doi.org/10.3389/fncel.2024.1408182

Cox, S. R. (2024). Neurocognitive Aging. *Annual Review of Developmental Psychology.* https://doi.org/10.1146/annurev-devpsych-010923-102441

Deary, I. J., et al. (2024). Inspection time and intelligence: A five-wave longitudinal study from age 70 to age 82 in the Lothian Birth Cohort 1936. *Intelligence.* https://doi.org/10.1016/j.intell.2024.101844

Deary, I. J. & Cox, S. R. (2024). Lessons we learned from Lothian Birth Cohorts. *Genomic Psychiatry.* https://doi.org/10.61373/gp024i.0076

Gadd, D. A., et al. (2024). DNAm scores for serum GDF15 and NT-proBNP levels associate with a range of traits affecting the body and brain. *Clinical Epigenetics.* https://doi.org/10.1186/s13148-024-01734-7

Huffman, J.E., et al. (2024). Whole-genome analysis of plasma fibrinogen reveals population-differentiated genetic regulators with putative liver roles. *Blood.* https://doi.org/10.1182/blood.2023022596

de Kort, F. A. S., et al. (accepted). Cerebral white matter hyperintensity volumes: Normative age- and sex-specific values from 15 population-based cohorts comprising 14,876 individuals. *Neurobiology of Aging.* https://doi.org/10.1016/j.neurobiolaging.2024.11.006

Page, D., et al. (2024). Examining the neurostructural architecture of intelligence: The Lothian Birth Cohort 1936 study. *Cortex.* https://doi.org/10.1016/j.cortex.2024.06.007

Quidé, Y., et al. (2024). ENIGMA-Chronic Pain: A worldwide initiative to identify brain correlates of chronic pain. *Pain.* https://doi.org/10.1097/j.pain.0000000000003317

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Sweetman, J., et al. (2024). The Relationship Between Anxiety, Depression and Cognitive Functioning in Older Adults: An Exploratory Cross-Sectional Analysis of Wave 1 Lothian Birth Cohort 1936 Data. *International Journal of Geriatric Psychiatry.* https://doi.org/10.1002/gps.6151

Smith H. M., et al. (*in press*). DNA methylation-based predictors of metabolic traits in Scottish and Singaporean cohorts. *American Journal of Human Genetics.*

Contact

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Merry Christmas and Happy New Year from the LBC1936 team!

Left to right: Barbora Skarabela, Janie Corley, Alison Pattie, Simon Cox, Sarah McGrory, Sabela Mendez, Ian Deary.

UKRI

NIH National Institutes of Health

THE ROYAL SOCIETY

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age UK Love later life

LBC 1921 Lothian Birth Cohorts LBC 1936

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