Cam-CAN Newsletter 2019

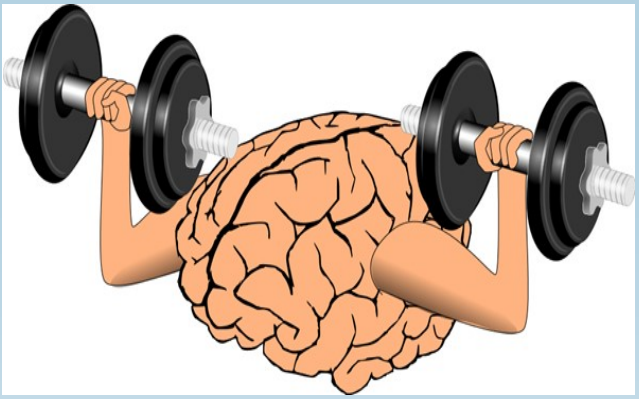
Link between physical health and brain health

Two recent CamCAN studies reinforce the importance of physical health for brain health:

Healthy hearts mean healthy brains

Delia Fuhrmann

We know that for some people, cognitive function declines as they grow older. Many studies suggest that changes in brain structure are likely to play a role in these declines. For this reason, we want to understand the factors that play a role in governing changes in brain structure. One such factor is cardiovascular health: on average, people with better cardiovascular health tend to age more healthily. In this new study, led by Dr. Delia Fuhrmann, we sought to examine the effects of cardiovascular health on the connections between brain regions known as white matter tracts. We found a strong relationship between the two: on average, individuals with lower systolic blood pressure (the upper bound of blood pressure), lower heart rate, and a smaller difference between systolic and diastolic (the lower bound) pressure, tended to have more healthy-looking brains. Interestingly, some parts of the brain seemed more resilient than others. Together, these findings suggest that one way through which healthy and active lifestyles contribute to healthy aging is by ameliorating the possible negative effects of high blood pressure on brain structure.



Fuhrman, D., Nesbitt, D., Shafto, M., Rowe, J. B., Price, D., Gadie, A., Cam-CAN & Kievit, R.A. (2019)
https://www.sciencedirect.com/science/article/pii/S0197458018303683#aff1

Active lifestyles help keep the brain fit

Juho Strömmer

Physical activity is beneficial to mental and physical health. For example, exercise has been shown to reduce stress, decrease depression and anxiety, lower blood pressure, reduce the risk of stroke and dementia, and maintain muscle and bone structure, particularly among older adults. Physical activity has also been shown to reduce age-related brain atrophy and cognitive decline. In a recent CamCAN study, we found that higher self-reported daily physical activity was associated with greater preservation of the white matter (fibres that connect together different parts of the brain) in several regions in the front of the brain. These regions are important for planning, decision making, and controlling our behaviour. Interestingly, we also found that better-preserved white matter within some of the same regions correlated with less dramatic slowing of cognitive speed with age. Together, these findings complement the evidence from previous work in suggesting that a physically active lifestyle has protective benefits against age-related brain changes and cognitive decline. The

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findings of this study further support public health recommendations about the benefits of leading a physically active lifestyle across the life span, including well into old age.

Juho M. Strömmer, Simon W. Davis, Rik N Henson, Lorraine K. Tyler, Cam-CAN & Karen L Campbell (2018)
https://academic.oup.com/biomedgerontology/advance-article/doi/10.1093/gerona/gly220/5114653

Global Brain Health - online survey

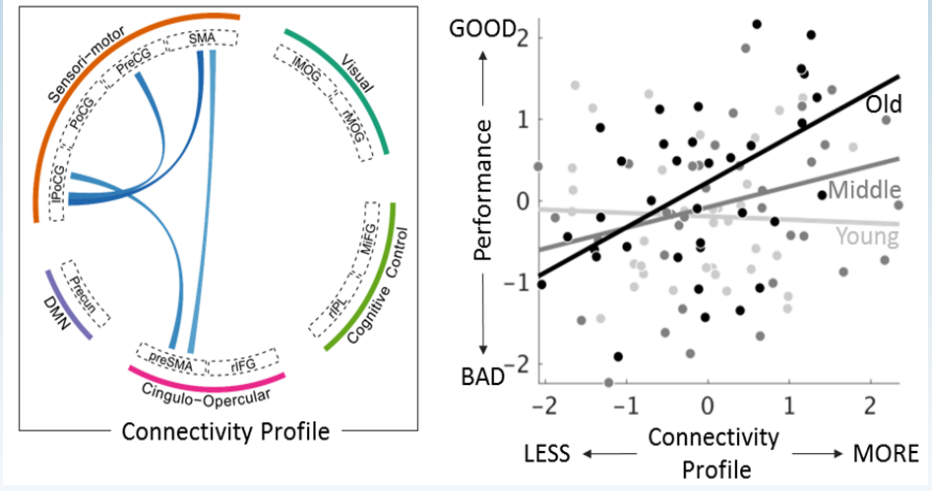
If you are willing, please consider taking part in this "Global Brain Health" online survey, run by collaborators of ours: www.lifebrain.uio.no. It is for research purposes only and should only take approximately 15mins.

A well-connected brain is the key to mental agility in old age *Kamen Tsvetanov*

Cam-CAN scientists have shown that staying sharp as we get older depends on how well different regions of the brain can to 'talk' to each other, at least in part.

It has been a puzzle why some people can maintain very good memory and intelligence despite brain-wide structural loss as they get older. While we know that brain function may play a role in this, it is unclear which aspect of brain function is particularly important, e.g. the extent to which brain regions are activated (functional activity) or the extent to which regions "talk" to each other (functional connectivity). In new Cam-CAN research, we show that in young people *cognitive control* – the ability to select and monitor relevant behaviour – can be good whether the brain is well or poorly connected. But, as we get older, it starts to matter more and more how well connected the brain is. In later life, well-connected brains enable better cognitive control and thinking powers.

The research, led by Dr. Kamen Tsvetanov and colleagues at Cam-CAN, looked at brain scans from more than 100 healthy people by using functional magnetic resonance imaging while they performed a cognitive control task. From the brain scans, it was possible to measure how well different brain regions can activate and share information, (i.e. how they are connected), during the task. Their study showed that as we get older, it starts to matter more how well brain regions 'talk' to each other, rather than how active each brain region is on its own.



This is the first study of its kind, using the power of Cam-CAN's volunteers – from 18 to 88 years old – to prove the importance of brain connectivity on mental well-being as we grow older. The team are now turning their attention to the lifestyle and genetic factors that influence brain connectivity, and how they might be able to boost connectivity in the future.

Kamen A. Tsvetanov, Zheng Ye, Laura Hughes, David Samu, Matthias S. Treder, Noham Wolpe, Lorraine K. Tyler, James B. Rowe and for the Cambridge Centre for Ageing and Neuroscience (2018)
http://www.jneurosci.org/content/38/36/7887 (DOI: 10.1523/JNEUROSCI.2919-17.2018)

Your participation in Cam-CAN research

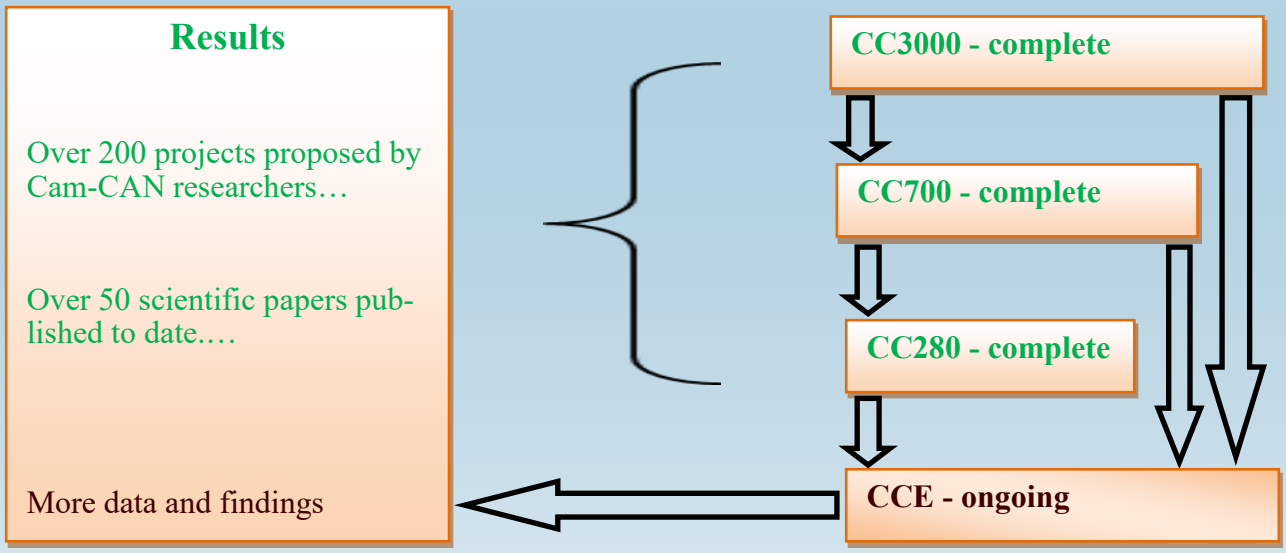
Tina Emery

The Cam-CAN project is still ongoing but to recap, we originally had enough funding to run 3 stages from 2010-2014:

- **2010-12: Stage 1 - CC3000:** Nearly 3000 people (including yourself) aged 18+ were interviewed in their homes to provide information about themselves and also to do some pen and paper tasks.
- **2011-13: Stage 2 - CC700:** 700 of the 3000 (100 from each decade between 18 and 87) underwent further testing which included MRI and MEG scans to look at brain activity.
- **2012-14: Stage 3 - CC280:** 280 of the 700 were scanned again on additional tasks.

Since then, Cam-CAN obtained further funding from the EU to join forces with the "LifeBrain" project, a European collaboration of 14 cohorts across 8 EU countries. The aim of this project is to coordinate and standardise data collection across the cohorts, in order to better identify factors that influence brain health. We were then able therefore to run a fourth stage of collecting new data, which we called the Enrichment Stage:

- **2018: Stage 4 – CCE (Cam-CAN Enrichment):** All available participants from CC3000 were contacted either by email or post and invited to take part.



To date, nearly 650 people from our original CC3000 cohort have participated in the Enrichment phase, either by completing the tasks and questions on-line, or via a postal pack. Many thanks to those that did! The study is still on-going, so if you have not participated but would like to do so, please contact me on the details below and I will send you the information. You could earn up for £20 Amazon vouchers for your participation and contribute to Cam-CAN's on-going success. As we continue to seek further funding, we hope that we can stay in contact with you and one day resume our research into healthy aging.

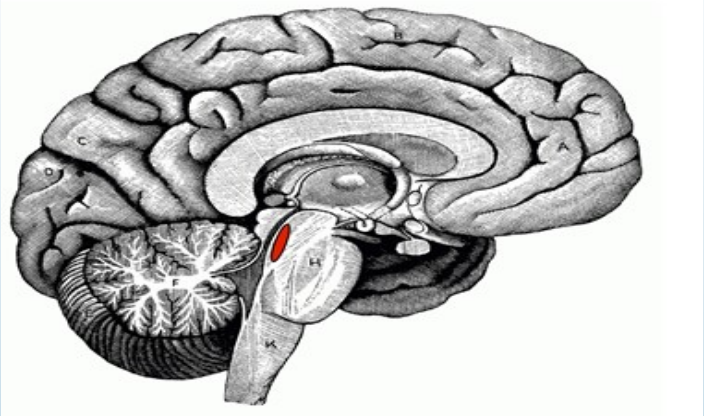
For further information, postal packs or internet links for the CamCAN Enrichment study:

Email: tina.emery@mrc-cbu.cam.ac.uk or **Tel:** 01223 769442

The locus coeruleus: A small but important brain region for healthy aging

Kathy Liu & Dorothea Hammerer

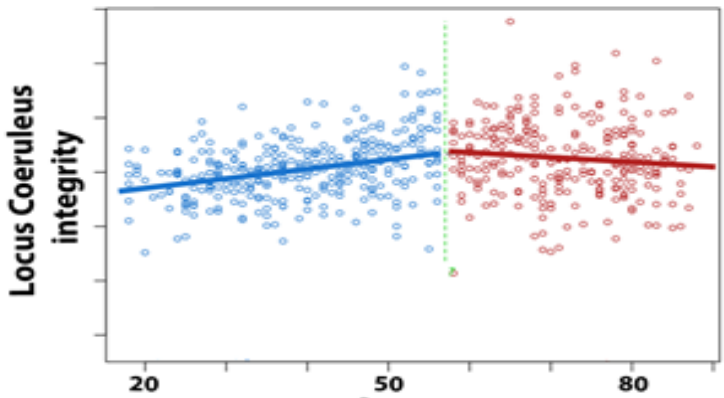
Figure 1: Locus Coeruleus (red) in the brainstem



The locus coeruleus (Fig. 1) is a small brain structure that produces a chemical called noradrenaline, which is vital for regulating brain functions such as memory formation, emotional regulation or our ability to focus our attention. Previous studies have found that changes to this structure occur with increasing age, which might explain the observation that some cognitive functions decline with age. Up to now, it has been difficult to visualise and measure the integrity of this structure (which is roughly the size of a matchstick) in brain scans, and there has been a lack of large datasets across the lifespan to make firm conclusions about its relationship with age.

In our recent study led by Dr Kathy Liu, we used the CamCAN database to examine age-related differences in locus coeruleus integrity across the lifespan using brain scans from over 600 volunteers. These scans were the result of specific imaging techniques that allowed visualisation of the locus coeruleus so that information on its integrity could be extracted. We observed that locus coeruleus integrity on average declines in older adults from around 60 years (Fig. 2). However, we also found that interindividual differences in locus coeruleus integrity were larger in older adults, suggesting that a decline in locus coeruleus integrity might not be a universal phenomenon in aging. Follow-up studies that combine locus coeruleus integrity and cognitive behavioural measures in the CamCAN database are being undertaken to shed light on the functional implications of our findings.

Figure 2:
Decline in Locus Coeruleus integrity in older adults



Liu, K. Y., Acosta-Cabronero, J., Cardenas-Blanco, A., Loane, C., Berry, A. J., Betts, M. J., Kievit, R. A., Henson, R. A., Düzel, E., Cam-CAN, Howard, R., Hämmerer, D. (2018)

https://www.sciencedirect.com/science/article/pii/S0197458018303786?via%3Dihub

Thank you for taking part and please do keep in touch...

We are very grateful for your participation in the Cam-CAN project and for the time you have generously given us. Your contribution to our research is invaluable - we really couldn't do it without you!

We will be in contact again so please let us know if you have recently changed your contact details or if you have any questions about the research. You can contact us on:

E-mail: camcan-admin@mrc-cbu.cam.ac.uk Tel: 01223 769442
Cam-CAN, University of Cambridge, MRC-CBU, 15 Chaucer Road, Cambridge CB2 7EF

Thank you!