Our brains

- The adult brain weighs about 1.3 kg – fat/fluid

20% body’s $O_2$
20% body’s glucose
Preferential access to $O_2$ and glucose
Brain cells very active, sending out branches, making connections
Dementia – two main causes

• Alzheimer’s disease (AD)
• Cerebrovascular disease (CVD) eg strokes
• CVD increases risk of Alzheimer’s
• Prevention strategies may be acting through improving brain circulation
Amyloid plaque
Plumbing and arteries

Pipes

Arteries
Cerebral aneurysm

Cerebral haemorrhage
What is cognition?

Who is worried about their ……

• Memory?
  – Names? Title of movie you last saw?
  – Conversations? Appointments?

• Finding Words?

• Finding your way? Getting lost?

• Understanding concepts?

• Following plots of movies?

These are all aspects of COGNITION
Cognition and ageing

• As we get older some cognitive abilities decline
  – Speed of information processing
  – Ability to remember random list
• But some abilities improve
  – Reasoning
  – Organisational ability
  – Vocabulary
Centre for Healthy Brain Ageing

https://cheba.unsw.edu.au/

Our vision is to achieve, through research, healthier brain ageing and better clinical care of age-related brain diseases
CHeBA research

• Cohort studies
  – Sydney Memory and Ageing Study
  – Sydney Centenarian Study
  – Older Australian Twin Study
• Neuroimaging
• Genetics
• Intervention studies
Why study cognitive ageing?

- Some cognitive decline is usual
- Mild cognitive decline is common with age
- Major cognitive decline interfering with daily function is dementia
- Rate of dementia doubles every five years from 60-64 year olds (<1%) to 90+ >30%
- 50% in people 100+
- The world is ageing
- Challenge for Australia & the world
What do older people fear most?

- Memory, Alzheimer’s disease, dementia
- Cancer
- Stroke
- Heart disease
- Parkinson’s
- Falls, problems with walking
- Declining vision or hearing
- Mental disorders - depression, anxiety
Subjective Cognitive Complaints
Sydney Memory and Ageing Study

• 95% of participants or their informants

• Participants more likely to endorse a memory complaint overall

• Informants seemed more accurate
  – endorse complaint when objective cognitive impairment also present
Subjective Cognitive Complaints

• Complaints related more to
  – mood (depression, anxiety) and
  – personality (neuroticism but inversely with openness and conscientiousness)

• Psychological factors explained the number of complaints more than performance on cognitive testing
SCC and outcomes over 4 years

• Participant complaints
  – Did not predict cognitive or functional change
  – Memory specific complaints predicted diagnostic conversion

• Informant complaints
  – More predictive than participant complaints of cognitive, functional and diagnostic outcomes

Slavin et al. (2014). AJGP, 10.1016/j.jagp.2014.09.001
Falls and cognition

• Falls are common
  – Major cause of disability
• Multiple causes
  – Feet, vision, balance
  – Brain

• Collaboration with NeuRA: Stephen Lord, Kim Delbaere, Jasmine Menant
The brain and falls

Falls more likely if people

• poorer executive function (planning, organisation, shifting concepts)
• more deep white matter changes on brain MRI
  – Mostly caused by vascular disease in brain

Delbaere et al., BMJ; 2010; Zheng et al., Stroke; Neurobiol Aging; 2011
Fear of falling and falls

- Disparity between perceived and actual fall risk
  - primarily associated with psychology
  - strongly influence risk of falling

Delbaere et al., BMJ; 2010
Vitamin D & falls (N = 463)

- 30% prevalence of vitamin D insufficiency (serum 25OHD ≤ 50nmol/L)
- **Small association** with cognitive function
  - executive function, visual-spatial domain, processing time
- **Strongly related** with poorer neuromuscular function and balance

Menant et al., Osteoporos Int; 2011
Vitamin D & falls (N = 463)

- Increased risk of injurious and multiple falls for men with vitamin D insufficiency (RR=1.63, 95% CI=1.10–2.40)
- Vitamin D insufficiency associated with impairments in physiological and cognitive functions that predispose older people to fall
- Vit D and mood

Menant et al., Osteoporos Int; 2011
Depression and cognitive decline

Depression
- 6% depressed
- 16% history of depression
Diabetes and dementia

- Type 2 diabetes risk factor for vascular dementia and Alzheimer’s
- Does *not* mean all people with diabetes will develop dementia
- Development of impaired fasting blood sugar or diabetes was associated with more cognitive decline and smaller brain volumes

Samaras K, 2014 Age
What are implications?
Prevention: Eliminate v Postpone

• Disease elimination
  – eg smallpox vaccination
  – best prospect is AD vaccine

• Disease postponement (Brookmeyer R, 1998)
  – delay AD onset by
    – 2 yrs $\rightarrow$ ↓ prevalence by 20%
    – 5 yrs $\rightarrow$ ↓ prevalence by 50%

• Environmental factors $\rightarrow$ 1/3 of risk for Alzheimer’s (and more for vascular dementia)
What are implications?

• What is good for your heart is good for your brain
• Prevent problems with circulation to brain
  – Strokes, deep white matter
• Maintain body strength, balance - exercise
More strategies to avoid dementia

- Physical exercise
- Computer cognitive training
  - + small electrical current?
- Treat high blood pressure in mid-life
- Treat depression
- Socialise
- Stop smoking, avoid excess alcohol
- Diet
More CHeBA Current Research

• Interventions
  – SMART trial (Fiatarone Singh)
  – Dance therapy in nursing homes
  – Transcranial Direct Current Stimulation plus computer cognitive training
CHeBA – big data
International collaborations

- COSMIC: >25 studies from around world of older people to find risk and protective factors for cognitive decline
- ICC-Dementia: 10 centenarian studies combining data – secrets to long life
- Genetic consortia: gene discovery
- StroKog: vascular contributions to cognitive decline
- PROMOTE: psychosocial research, Asia-Pacific
Prevention trial, NHMRC funded, 5 years
- Internet based, largest trial in world
- 18,000 Australians 55-75 years old
- Exercise, cognitive training, diet, blood pressure, cholesterol, glucose, depression
- Tailored to individual risk factors