Welcome to today's Webinar:

Understanding Cognitive Change in Multiple Sclerosis

Your Presenter is Dr Ben Harris
Your Facilitator is Nicola Graham

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Introduction to Dr Ben Harris

Clinical Neuropsychologist

Masters in Clinical Neuropsychology, PhD in Cognitive Neuroscience. Member of the Australian Psychological Society, a Fellow of the College of Clinical Neuropsychologists (CCN) Previously member of the National Executive of the CCN.

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Informed Choice

This presentation has been prepared and is presented by an independent expert.

The views presented are not necessarily the views of Multiple Sclerosis Limited.

Individuals are encouraged to seek further advice regarding the relevance of the information presented for their situation.

Multiple Sclerosis Limited Health Professionals Education Session

Dr Ben Harris
Mpsych, PhD, MAPS, FCCN
Clinical Neuropsychologist

Webinar Objectives

- Understanding of brain changes in MS
- Knowledge of cognition and the likely strengths and weaknesses associated with MS
- Understanding of executive function and how it is affected
- Understanding of the differentiation between personality and cognitive function and between dementia and MS cognitive changes
- Awareness of the functional implications of cognitive changes in MS
- Awareness of neuroplasticity and its effects

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MS overview

- Highly variable illness course:
  - Relapsing-remitting
  - Secondary progressive
  - Primary progressive
- Variable effect on a person's cognitive function, mobility, other physical functions, mood, etc.
- Changes to cognition can be unrelated to changes in physical function

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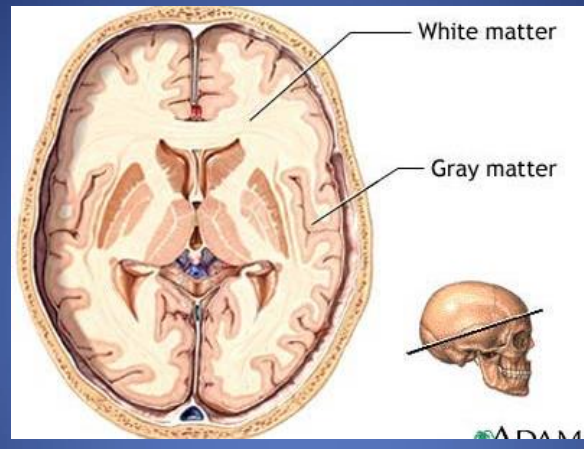

Grey matter
- cell bodies and dendrites of the neurons
- where the messages "synapse"

White matter
- the axons of the neurons
- carry information from one neuron to another

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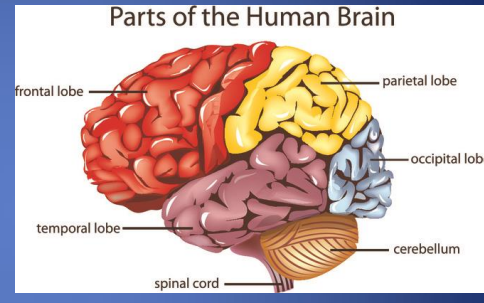
Grey matter

- Makes up what we refer to as the different 'lobes' of the brain:
  - Frontal
  - Parietal
  - Temporal
  - Occipital
- Different regions of grey matter play different roles in terms of thinking and memory functions



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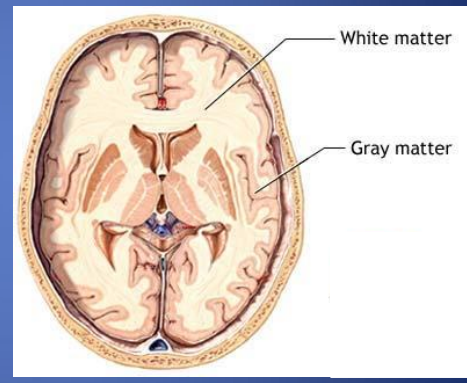
White matter

- The way in which information is taken from one neuron to another
- Critical to effective communication between regions of the brain
- Is white because axons are coated in a fatty substance called 'myelin'
- 'White matter tracts' are made up of huge numbers of axons travelling together



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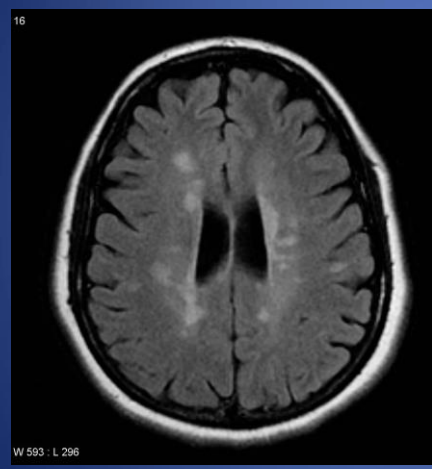
MS changes on MRI



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Processing Speed

- The most common cognitive problem in MS
- Is a general measure of a person's cognitive efficiency
- Refers to our ability to absorb and manage information in an effective and time-efficient fashion
- Relies on the integrity of white matter in the brain

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Attention

- Best considered in conjunction with processing speed as both reflect a person's ability to efficiently manage and handle information in the environment
- Basic attention (e.g. repeating numbers) is often not majorly affected by MS
- Complex and sustained attention represent another very common cognitive problems in MS

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Attention

- Complex attention refers to a person's ability to maintain information in their mind for a short time and to manipulate that information
- Example: mental arithmetic
- Difficulties with complex attention and processing speed interact:
  - As the demands on attention increase, performance slows down and information is less able to be held in mind
  - Experienced as information overload

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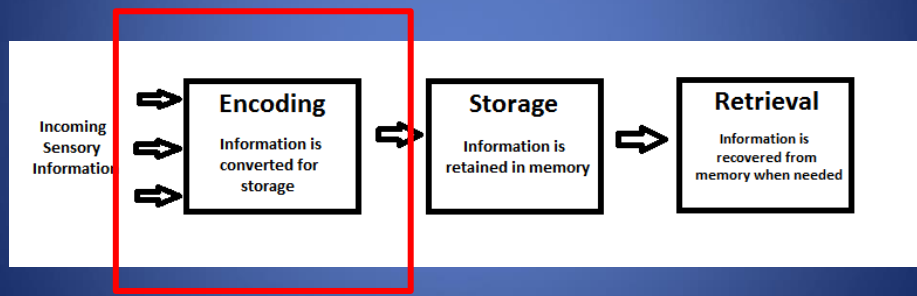
Memory

- Most common reason for memory problems in MS is inefficiency at the first stage:



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Executive Functions

- A collection of cognitive processes that underlie more complex and goal-directed behaviour
- 'Executive' refers to the boss of the company, i.e. responsible for managing the performance of all the individual employees to achieve a good outcome for the whole company
- Executive functions are required when we face unusual or complicated situations in daily life

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Executive Functions

- 'Executive function' is an umbrella term that includes:
  - Problem-solving
  - Planning and organising
  - Initiating behaviour
  - Self-monitoring performance
  - Self-correcting and thinking flexibly
  - Reflecting
- Example: cooking a complex meal

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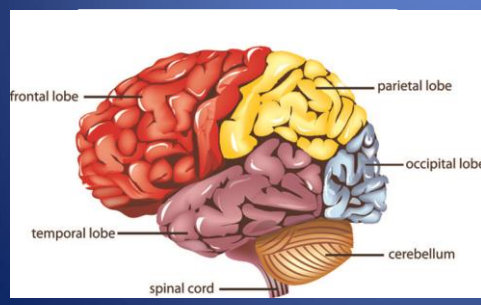
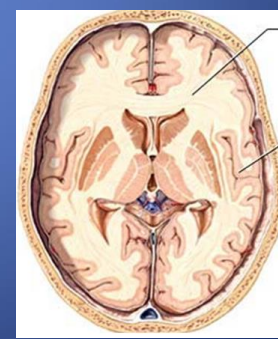
Executive Functions

- Rely on the integrity of the whole brain, particularly the frontal lobes
- Frontal lobes vastly interconnected with all other brain regions via white matter tracts





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Executive Dysfunction

- Generating new ideas, e.g. how to solve a problem, what to talk about, what to do
- Planning ahead and organising/prioritising what will be done
- Thinking flexibly, i.e. not getting stuck on one idea or approach if it is not working
- Decision making, i.e. being able to weigh up different options, considering other points of view
- Inhibiting unwanted responses to a trigger, i.e. not 'blurting something out'
- Having insight or awareness, i.e. the ability to accurately weigh up your performance as others would see it

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Other Factors Affect Cognition

- Fatigue
  - Possibly the most common symptom of MS, i.e. reported in over 90% of people
  - Decreased performance seen over time, i.e. harder to sustain effort
- Mood and Anxiety
  - Well known in studies of non-MS populations to be associated with reduced attention and memory
  - Symptom improvement can lead to cognitive improvement

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Functional Impact

- Effects on daily living have been seen in studies of many different neurological problems, e.g. traumatic brain injury, stroke
- Subtle cognitive problems tend to only be noticed in more demanding situations (e.g. work) and not more basic activities
- Problems with more basic activities can be seen when environmental factors place pressure on attention, processing speed, etc.

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Personality versus cognitive dysfunction

- Behavioural/social problems can be seen in people with MS
- Difficult to determine relative contribution of personality and cognitive impairment to behaviours
- Changes to executive function can resemble personality dysfunction, e.g.:
  - lack of awareness
  - lack of empathy
  - impulsivity
  - mental concreteness
  - poor initiation

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Personality versus cognitive dysfunction

- Important not to jump to conclusions
- Labels, such as 'manipulative' not helpful and can result in negative consequences
- Importance of taking a collateral history looking at previous functioning and personality style
- Often executive dysfunction can serve to amplify premorbid personality traits through reduced inhibition and awareness
- Look for potential social or situational triggers
- Neuropsychological assessment can offer insights into the relative contribution by personality and cognition in regard to difficult behaviour
- Importance of providing support, understanding and reassurance to an individual
- Problems secondary to cognitive impairment may require a behavioural management and limit-setting approach

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MS-Related Cognitive Change versus Dementia

- An issue that commonly concerns people with MS, particularly those in older age groups
- The term "dementia" is poorly understood in the community and even in the health workforce
- DSM-IV-TR criteria:
  - Multiple cognitive deficits, which include memory impairment and at least one of the following: aphasia, apraxia, agnosia or disturbance in executive functioning
  - Social or occupational function is also impaired
  - A diagnosis of dementia should not be made during the course of a delirium. (A dementia and a delirium may both be diagnosed if the dementia is present at times when the delirium is not present)
- These diagnostic criteria do not specify cause – this is clinically determined
- “Dementia” has now been superseded by “Major Neurocognitive Disorder" in DSM-V but this will be even less well known

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MS-Related Cognitive Change versus Dementia

- Severe cognitive impairment in MS is rare but likely to present at an increased incidence to hospital services
- In some cases, MS will present as a secondary progressive or primary progressive disorder. As such, it can meet criteria for being a progressive condition associated with cognitive impairment. When cognitive deficits reach a certain level of severity and are associated with functional compromise, it may be appropriate to use the term "dementia“
- Confusion secondary to synonymous use of the terms “dementia” and “Alzheimer’s disease”
- Alzheimer's disease is just one cause (albeit the most common) of dementia
- People with MS who are in later life and whose MS is associated with cognitive change, may worry that they are developing Alzheimer's disease

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MS-Related Cognitive Change versus Dementia

- I am not aware of any studies linking presence of MS to an increased likelihood of AD diagnosis in later life
- Common cognitive sequelae of MS:
  - Processing speed
  - Attention
  - Executive function
- Common cognitive sequelae of AD:
  - Memory (possibly with rapid forgetting)
  - Language
  - Visuoperceptual
- The difference between a cortical and subcortical process

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Cognitive Reserve

- Stems from observation that individuals may demonstrate variable cognitive impairment in the context of comparable neuropathology
- Regarding the brain, "reserve" is the capacity to withstand external stresses and it is revealed by individual differences in the functional and behavioural response to disease or injury
- Relates to theory of cognitive plasticity of aging, whereby there is continual adaptation to the environment at both the neuronal level (e.g. neurogenesis, synaptic connections) and cognitive level (i.e. acquisition of new skills)
- Reserve is related to premorbid factors such as education, occupational achievement and intelligence

See: Jones et al. (2011) *J Int Neuropsychol Soc,* 17(4): 593-601

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Cognitive Reserve

- Many previous studies demonstrating the effects of cognitive reserve in Alzheimer's disease and is seen clinically quite often
- In MS, it is increasingly known that grey matter atrophy is associated with progressive cognitive decline
- Several recent articles have shown that indicators of reserve (e.g. vocabulary, word reading, years of education) mediate the relationship between brain atrophy and performances on measures of processing speed in people with MS
- For example:
  - On measures of complex (but not simple) processing speed and verbal learning and retention, MS patients had deficits compared to control participants at lower but not at higher levels of reserve (Sumowski et al. (2009) *J. Clin. Exp. Neuropsychol.* 31(8), pp 913-926)
- Cognitive reserve is interesting but in a patient with MS, not necessarily clinically useful because it refers to premorbid factors that cannot be altered

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Neuroplasticity

- **Neuroplasticity:** the brain's ability to reorganise itself by forming new connections.
- Synaptogenesis results in new or strengthened pathways
- Important for normal learning
- Allows the brain to compensate for injury
- Success seen in other causes of neurological injury, e.g. stroke
  - spontaneous, e.g. activation of surrounding or contralateral neural regions to perform task
  - Motor imagery practice post-stroke can promote improved arm function and changes to brain activation pattern because the movement and imagery share an overlap of neural substrate

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Neuroplasticity and MS

- Strong evidence this occurs spontaneously:
  - after an initial presenting event, patients show more widespread recruitment of sensorimotor networks compared to controls
  - As disease progresses, patterns of reorganisation show increasing bilateral distribution and involve higher-control areas
  - In patients with normal motor function, greater lesion volume and microstructural damage are associated with more widespread activation of brain areas
  - Same pattern of increased bilateral involvement seen on experiments using cognitive tasks of memory, processing speed, attention and executive functions
- Limits:
  - Extent of brain damage limits available regions in which reorganisation can occur
  - Widespread damage affects multiple networks which reduces scope for successful reorganisation

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Neuroplasticity and MS

- Research is happening in relation to physical and cognitive therapies that can promote plasticity in MS
- Early days and will likely depend on both the technique and patient factors
- Generalising gains has consistently been a problem
- Neuroplasticity offers a substrate for interventions that promote functional recovery
- See: Tomassini et al. (2012) *Nat Rev Neurol.* 8(11): 635-646

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Neuropsychological Assessment and Intervention

- Assessments vary from brief to extensive. Average times for a patient with MS would range from 3 to 4 hours of total client contact. This involves interview, collateral history taking and formal cognitive assessment.
- Interventions can take place over a number of sessions and aim to incorporate knowledge of a patient's individual strengths and weaknesses to improve function
- Neuropsychology input can be found in a number of public hospital settings, frequently rehabilitation units, geriatric wards, and outpatient clinics, e.g. neurology, CDAMS, movement disorders, psychiatry

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Neuropsychological Assessment and Intervention

- It can be difficult for people with MS to access neuropsychology under these programs, either because they are not eligible for the service or the service may be directed towards more acute problems, such as diagnosis or decision making capacity
- MS Australia provide some limited funding for neuropsychological assessment and intervention
- Private referral options are available but expensive because of lengthy assessment and report writing demands

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MSL Services

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MSL Services - MS Practice

MS Practice is a free, online education series designed to support allied health professionals in the symptom management of people with MS.

https://www.msaustralia.org.au/about-ms/ms-practice

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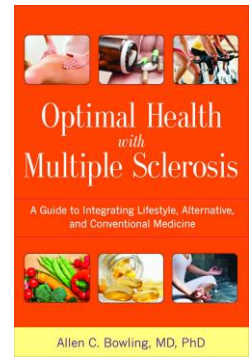

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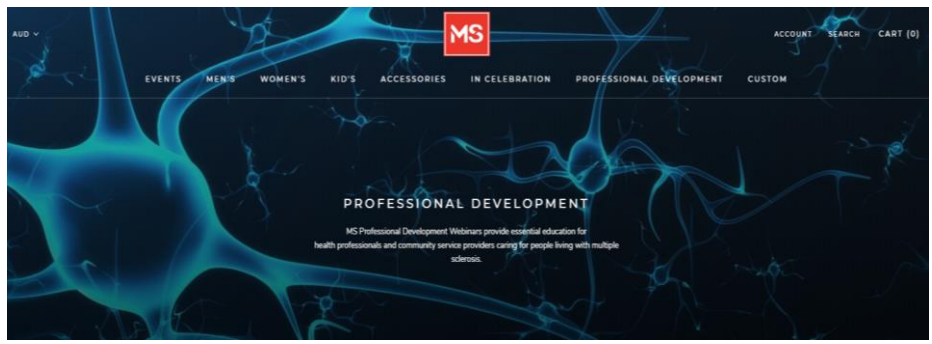

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