

# An Objective Assessment of Psychological Injuries in the 21<sup>st</sup> Century

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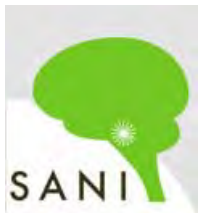
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Professor Alexander C. McFarlane

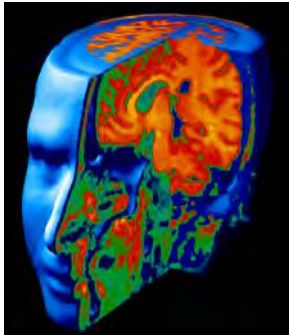
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# THE HUMAN BRAIN

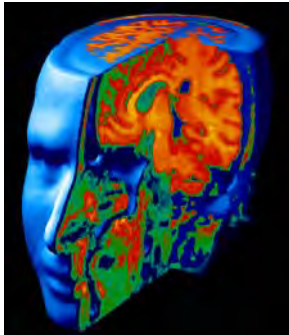


1 in 4 people will have a brain disorder in their lifetime

	<u>Number affected</u>	<u>Annual cost</u>
Brain injury	1 million	\$35 billion
Alzheimer's	4 million	\$90 billion
Depression	17 million	\$4 billion
Schizophrenia	2 million	\$30 billion
Developmental	9 million	\$10 billion
Epilepsy	2.5 million	\$3 billion
Drug addiction	15 million	\$240 billion

US figures

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# THE HUMAN BRAIN



Complex, highly interconnected system leading to conscious awareness.

Not easily understood through behaviour - the *end product* of brain activity.

Yet much assessment of brain disorder is heavily dependent on office-based psychiatric, psychological and behavioural measurement.



The advent of an array of neuroscience tools for imaging of structure and higher function, allied with advances in information technology



Exponential growth in research and knowledge.



# Skull X-Ray



# CT Scan





normal Ct scan



subdural  
haematoma

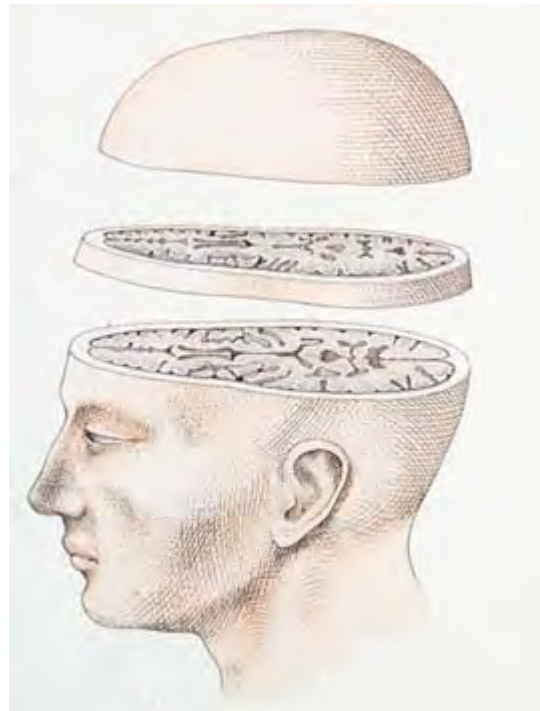


stroke

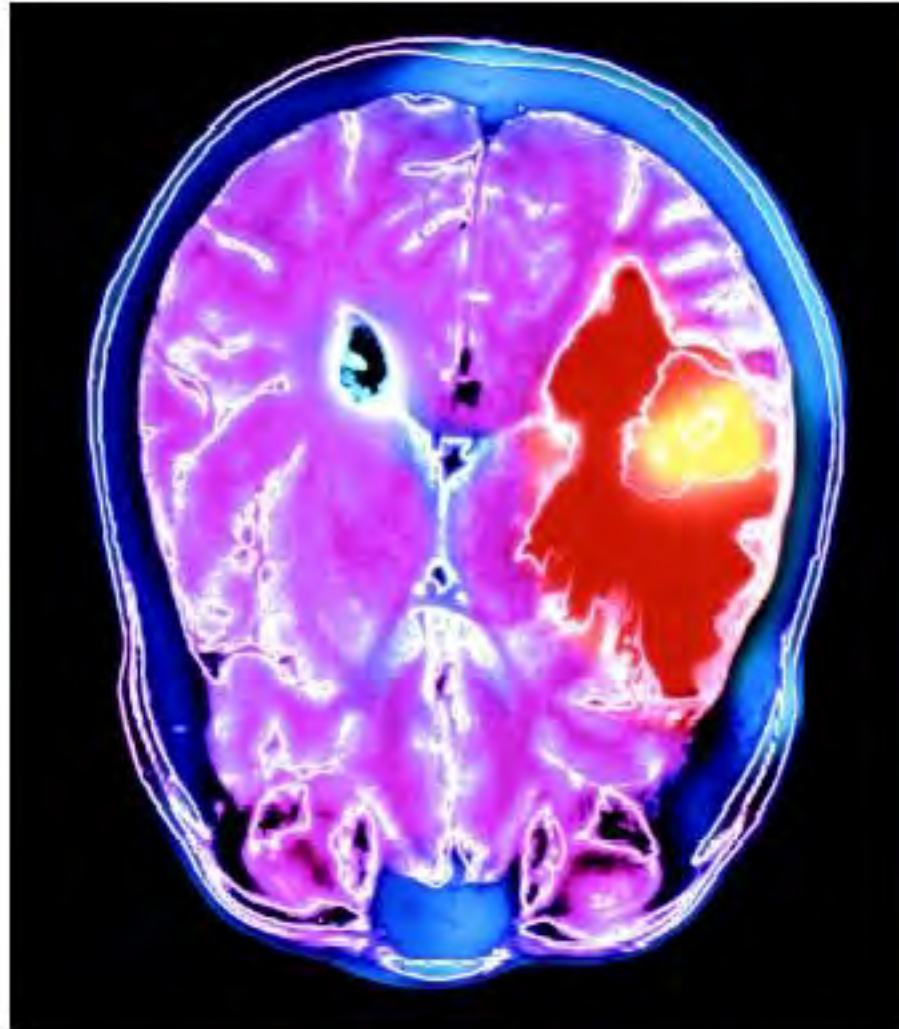
# Structural Magnetic Resonance Imaging (MRI)

Shows structural abnormalities – location, nature

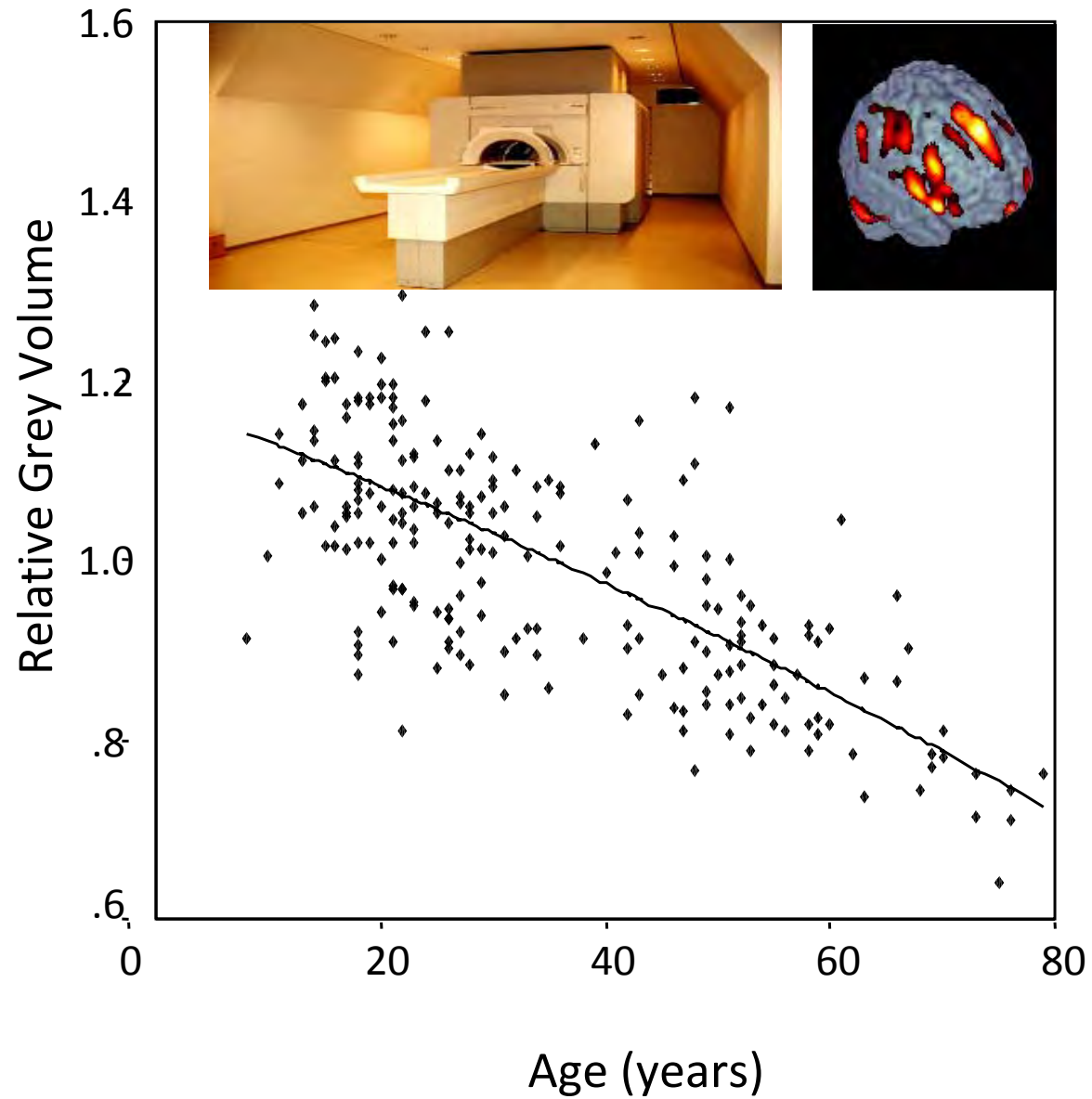
Uses a magnetic field acting on water molecules.





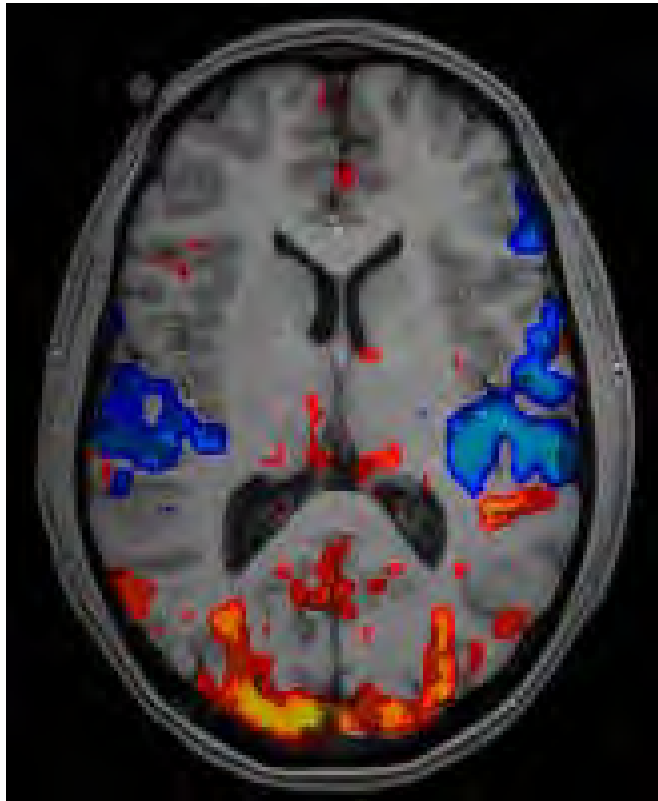


# Frontal Cortex and normal ageing



# Functional Magnetic Resonance Imaging (fMRI)

shows brain activity at rest or during performance of various tasks

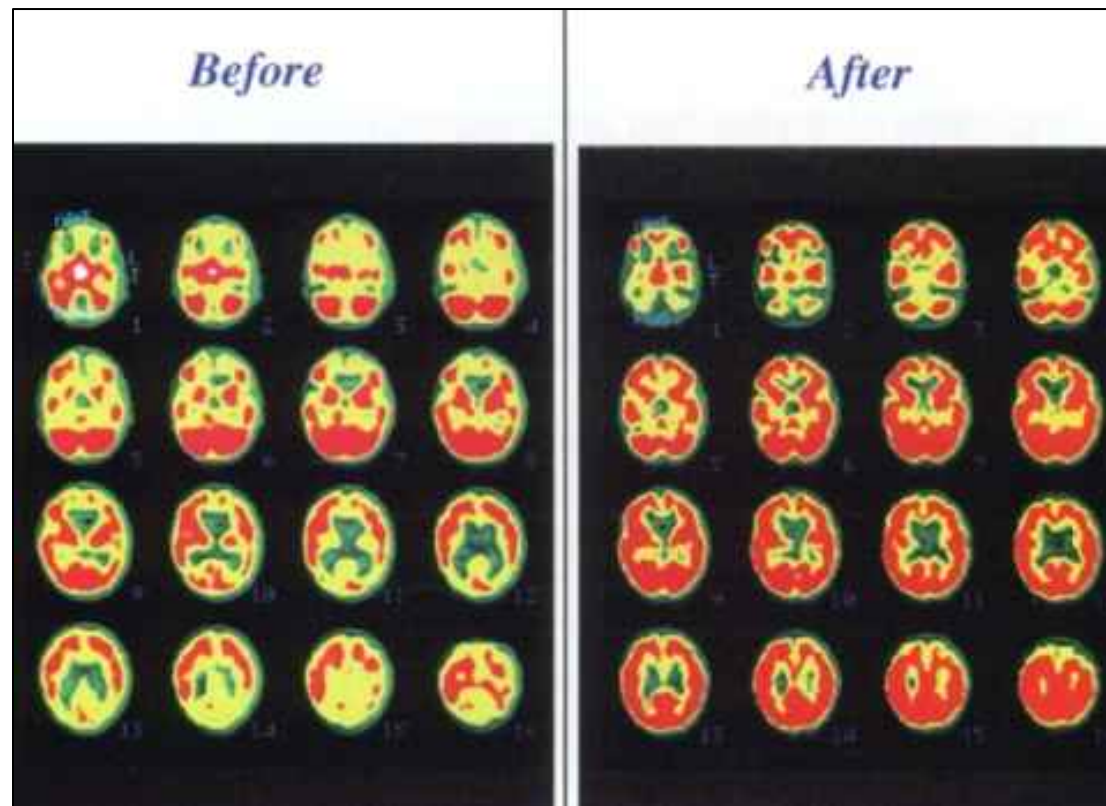


fMRI shows up areas of the brain with an increased oxygen supply (more active brain tissue uses more oxygen).

# Imaging Brain Function – SPECT

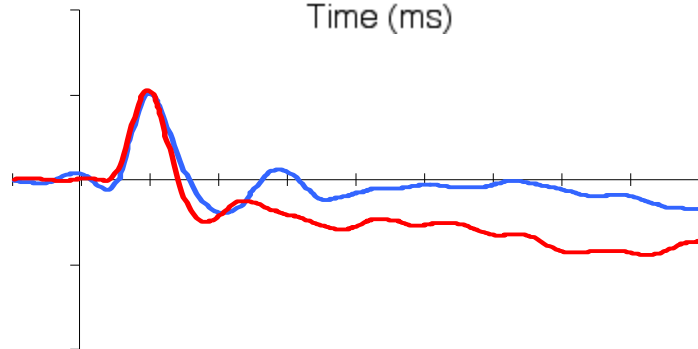
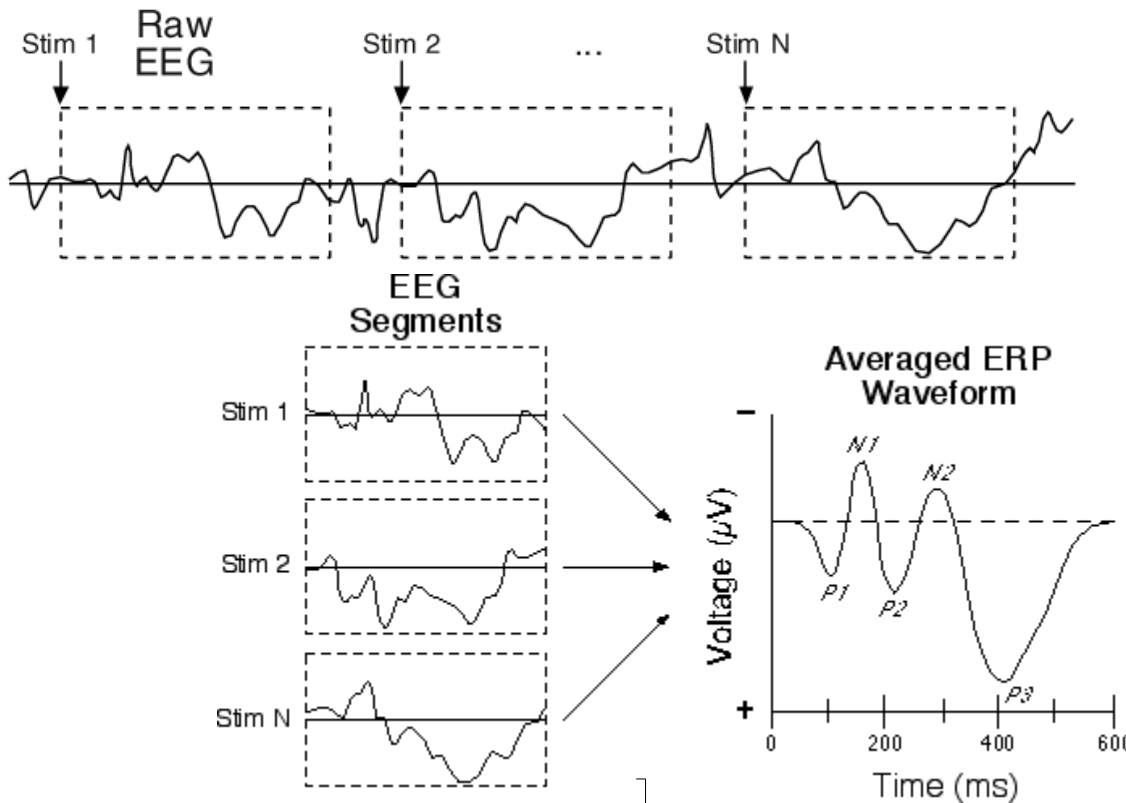
## Single Photon Emission Computed Tomography

Measures blood flow to various parts of the brain, at rest or performing various tasks, using a radioactive isotope.

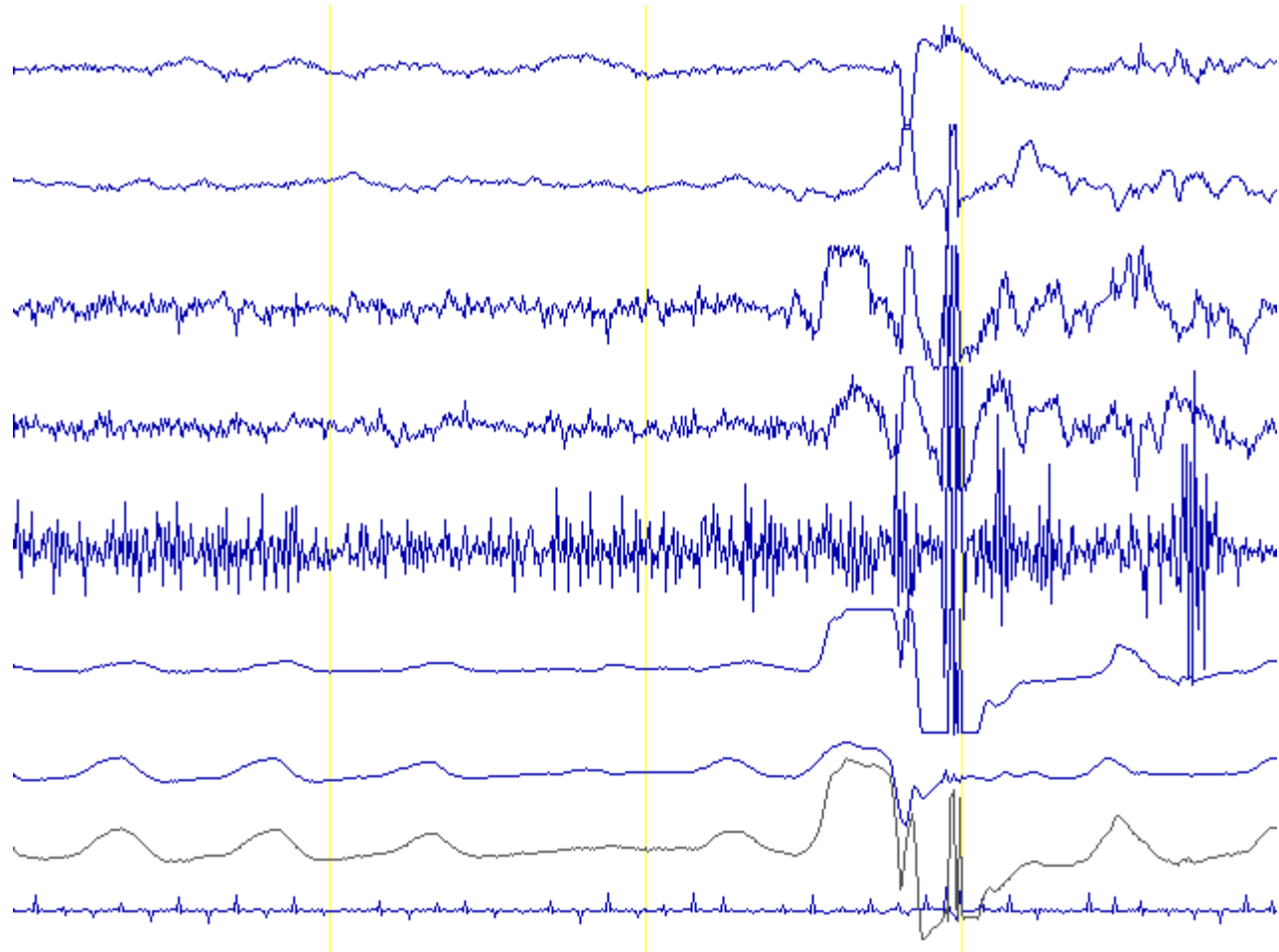




# Event Related Potentials



PTSD ■  
controls ■



EEG at rest – EEG rhythms show the underlying stability of brain function

# Neuropsychological Assessment

Uses standardised tests.

Can be administered by a psychologist or by using a computerised touchscreen.



# Neuropsychological tests can measure:

IQ

Attention

Motor speed

Information processing speed

Verbal fluency

Verbal memory

Visuospatial ability

Complex reasoning

Problem solving.....etc

Need to adjust for age, gender,  
years of education..and culture.



# AUDIENCE PARTICIPATION



# The NART

(National Adult Reading Test)

This test estimates premorbid intelligence, working on the assumption that once you know how a word is pronounced correctly, you will to remember this.

**READ EACH WORD OUT LOUD**

**CHORD**

**GOUGE**

NAIVE

# CELLIST

INDICT

# HYPERBOLE

**DEMESNE**

# CAMPANILE

The next task (based on the Stroop Task) is a psychological test of attention and mental flexibility.

Read out loud the word on each of  
the following slides:

GREEN

**BLUE**

**FROG**

**BLUE**

POPE

**GREEN**

RED

Say out loud the **colour** of the  
following words:

GREEN

**BLUE**

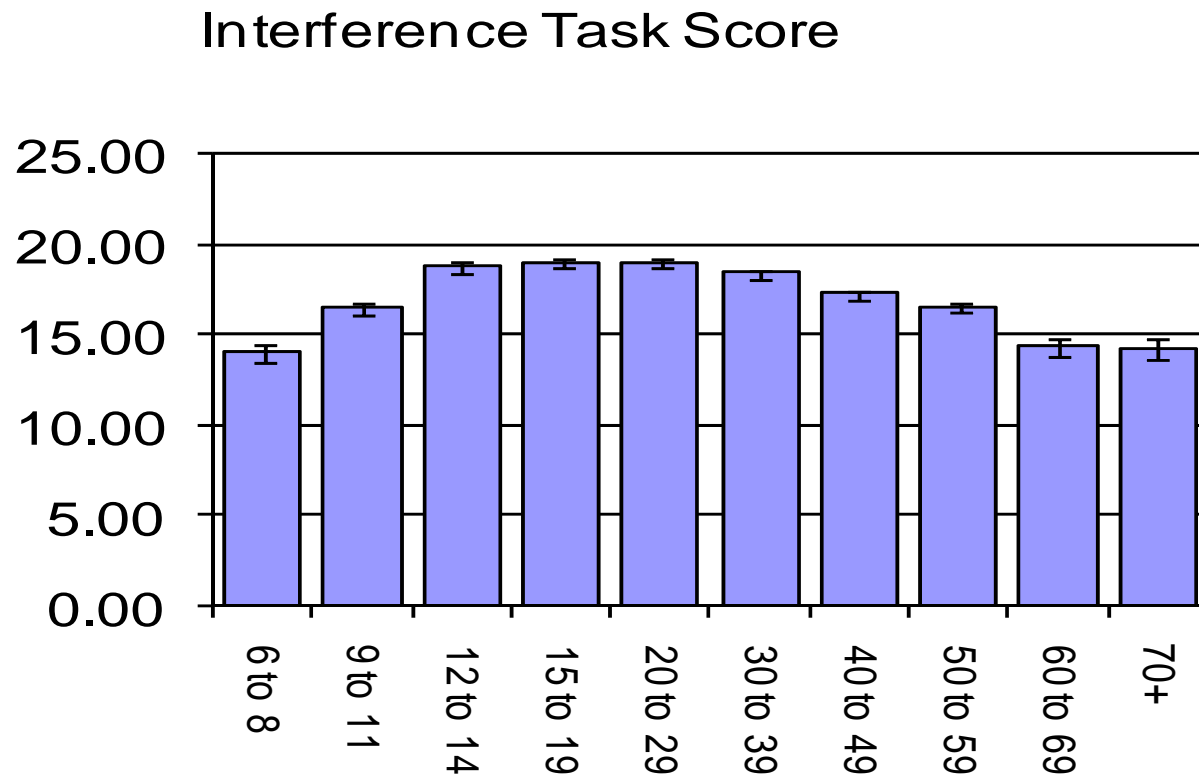
**RUDD**

**GREEN**

RED

**BLUE**

# Neuropsychological function and age



# Objective Assessment of Psychiatric Diagnoses

1: [Neuropsychologia](#). 2008 May 28. [Epub ahead of print]

Altered reward processing in the nucleus accumbens and mesial prefrontal cortex of patients with posttraumatic stress disorder.

[Sailer U](#), [Robinson S](#), [Fischmeister FP](#), [König D](#), [Oppenauer C](#), [Lueger-Schuster B](#), [Moser E](#), [Kryspin-Exner I](#), [Bauer H](#).

1: [Br J Psychiatry](#). 2008 Jun;192(6):472-3.

Hippocampal volume and 2-year outcome in depression.

[Kronmüller KT](#), [Pantel J](#), [Köhler S](#), [Victor D](#), [Giesel F](#), [Magnotta VA](#), [Mundt C](#), [Essig M](#), [Schröder J](#).

These studies require large numbers of subjects and the findings are averaged to detect differences – not useful for assessing the individual person.

# Assessing the Individual



# Complex Injuries Can Include...

Acquired brain injury (physical, cognitive, emotional, personality deficits)

Pain disorders

Depression

Anxiety (specific or generalised)

Posttraumatic stress disorder

Substance abuse – alcohol

analgesics, benzodiazepines

cannabis etc

Comorbidity is common

Secondary problems:

Relationship breakdown

Financial hardship

Loss of identity, self esteem

Weight gain, unhealthy lifestyle



# Psychiatric Assessment

- Psychiatrists are trained in general medicine (7 yrs), then psychiatry (5 yrs).
- Integrate the medical and psychological aspects of the person's presentation.
- Undertake a comprehensive assessment (including risk assessment).
- Attempt to understand how the person's past history, personality and vulnerabilities contribute to the current situation.
- Arrange further tests.
- Make a diagnosis (using DSM-IV-TR).
- Make treatment recommendations.
- Provide treatment (in collaboration with the other treating professionals).

	<i>BUSHFIRE</i>	<i>CONTROL</i>
	n=530	n=466
Direct Combat in a War	4 ( 0.8)	1 ( 0.2)
Life Threatening Accident	127 (24.0)	103 (22.1)
Fire, Flood or Other Natural Disaster	494 (93.2)	74 (15.9)
Witness Someone being Badly Injured or Killed	145 (27.4)	105 (22.5)
Rape	31 ( 5.8)	13 ( 2.8)
Sexual Molestation	48 ( 9.1)	31 ( 6.7)
Serious Physical Attack or Assault	53 (10.0)	39 ( 8.4)
Threatened With Weapon, Held Captive or Kidnapped	56 (10.6)	50 (10.7)
Tortured or Victim of Terrorists	2 ( 0.4)	1 ( 0.2)
Number of Lifetime Traumas		
0 or 1 Traumas	256 (48.3)	351 (75.3)
2 or more Traumas	274 (51.7)	115 (24.7)

# Brain Resource Company (BRC) International Database



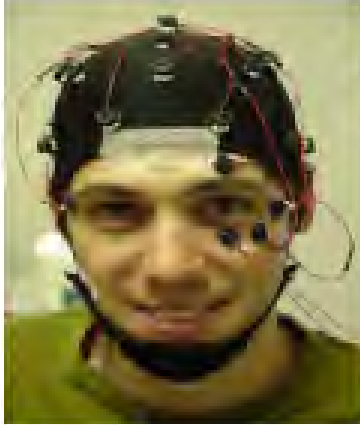
International initiative originating Australia in 2001

120 labs and 200+ scientists - USA, Europe, South Africa and Australia.

Uses standardized assessment of brain function.

Compares the subject's brain function with matched control subjects.

# BRC Assessment



**LabNeuro - bringing together state and trait measures of brain function in the Lab**

EEG and event related potentials



**IntegNeuro - high quality automated cognitive test battery delivered via IBM Touch screen**

Neuropsychological tests

Interview and interpretation of tests by a psychologist experienced in BRC testing

# A Case of Depression

54 year old man (Bill)

Off work 8 years with back injury

Diagnosed with chronic pain and depression

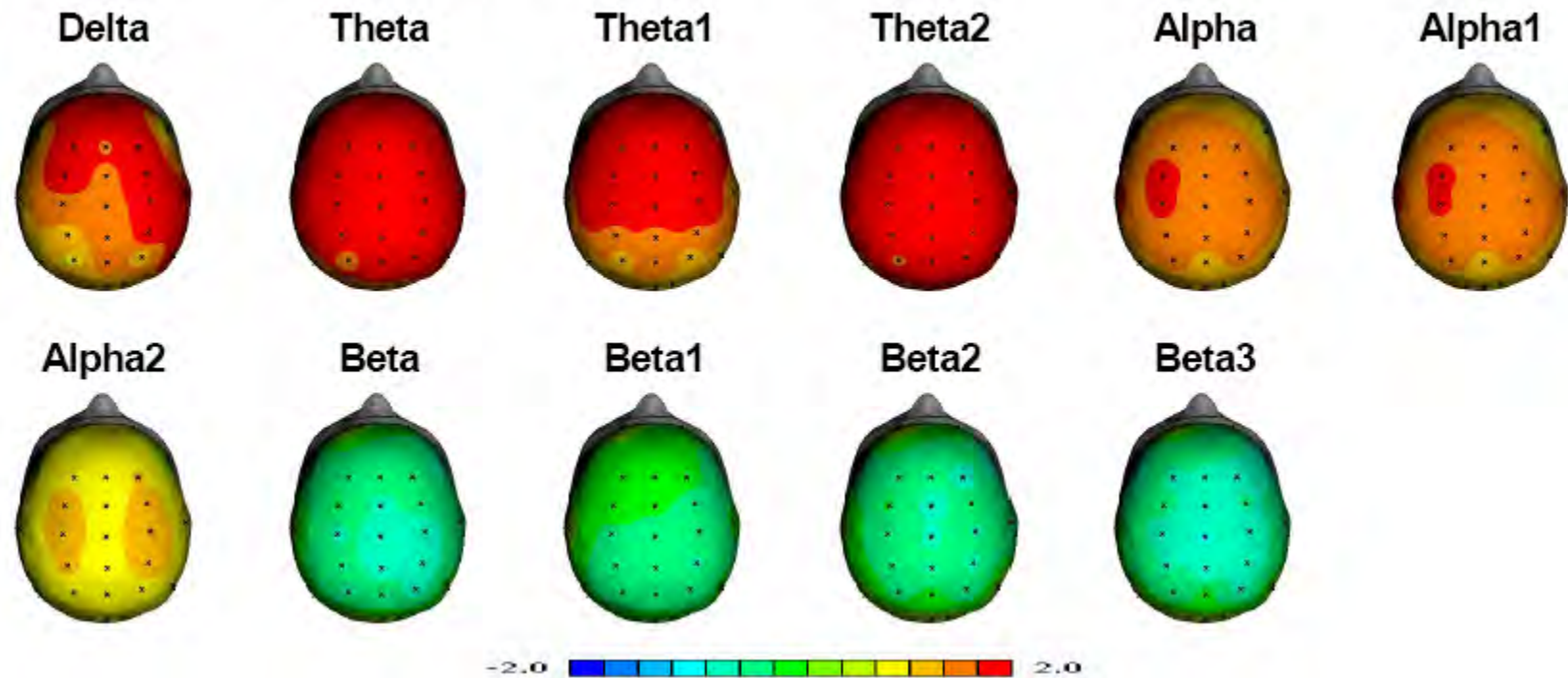
Substantial doses of analgesics and benzodiazepines

Reports impaired memory, concentration

Spends his day resting and watching TV

Can't "get to the paperwork", in trouble with the tax office

## 1.4 Power Z Scores - Eyes Closed



These results strongly indicate abnormalities in underlying brain stability and difficulties with memory and attention. The EEG indicates impairment in the brain's ability to activate metabolic resources associated with cortical operations, such that Mr. X would have considerable difficulty with the everyday processing of information.

#### **4.4 Malingering score**

Measures possible deliberate underperformance by the subject.

Details are withheld for reasons of confidentiality.

On a test designed to investigate the validity of responding, there was no suggestion of sub-optimal effort or any deliberate attempt to feign impairment.

### ERP Oddball Target (Site=Pz)



## Neuropsychological Test Battery

Test	Deficit
1. Memory Recall and Recognition	●
2. Digit Span	
3. Span of Visual Memory	
4. Sustained Attention (CPT)	●
5. Switching of Attention	
6. Motor Tapping	●
7. Choice Reaction Time	●
8. Time Estimation	
9. Verbal Interference	
10. Spot the Real Word	●
11. Word Generation	
12. Maze	

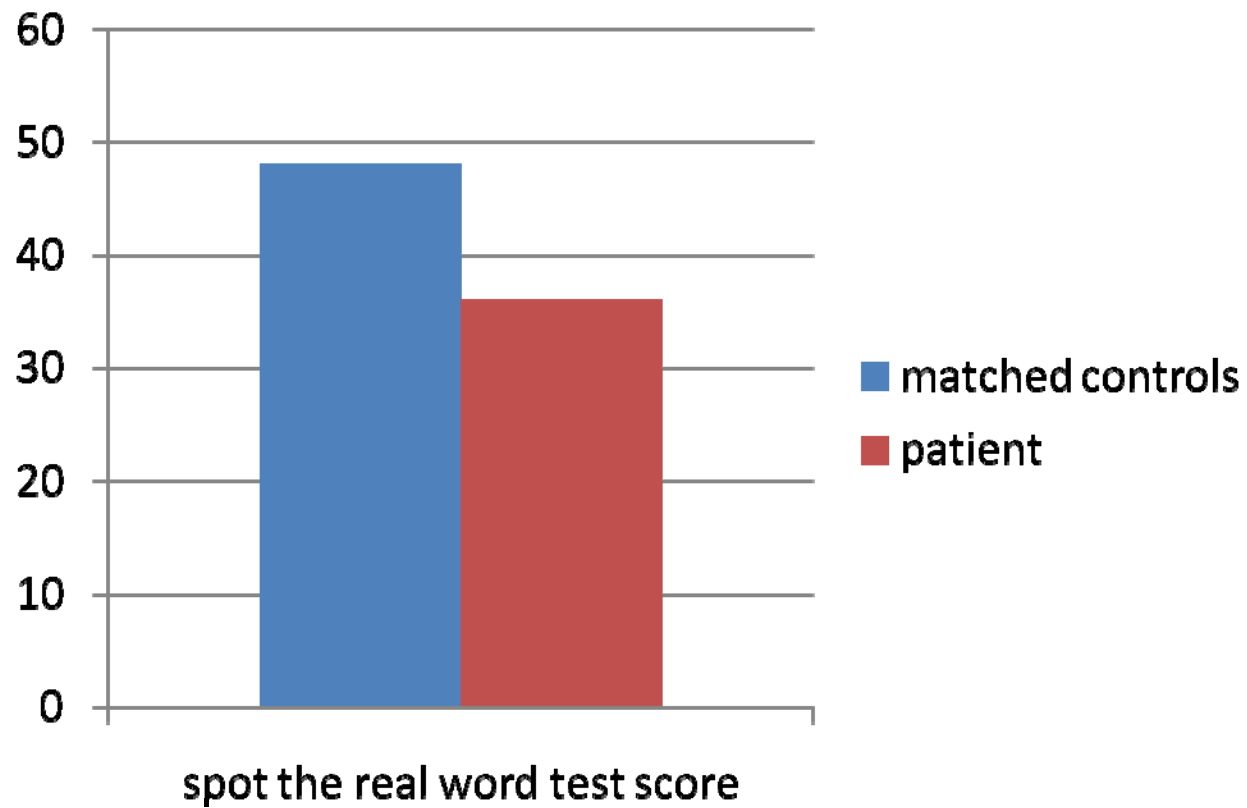
● = deficit compared to matched controls

The table above shows deficits found in each test (1–12).

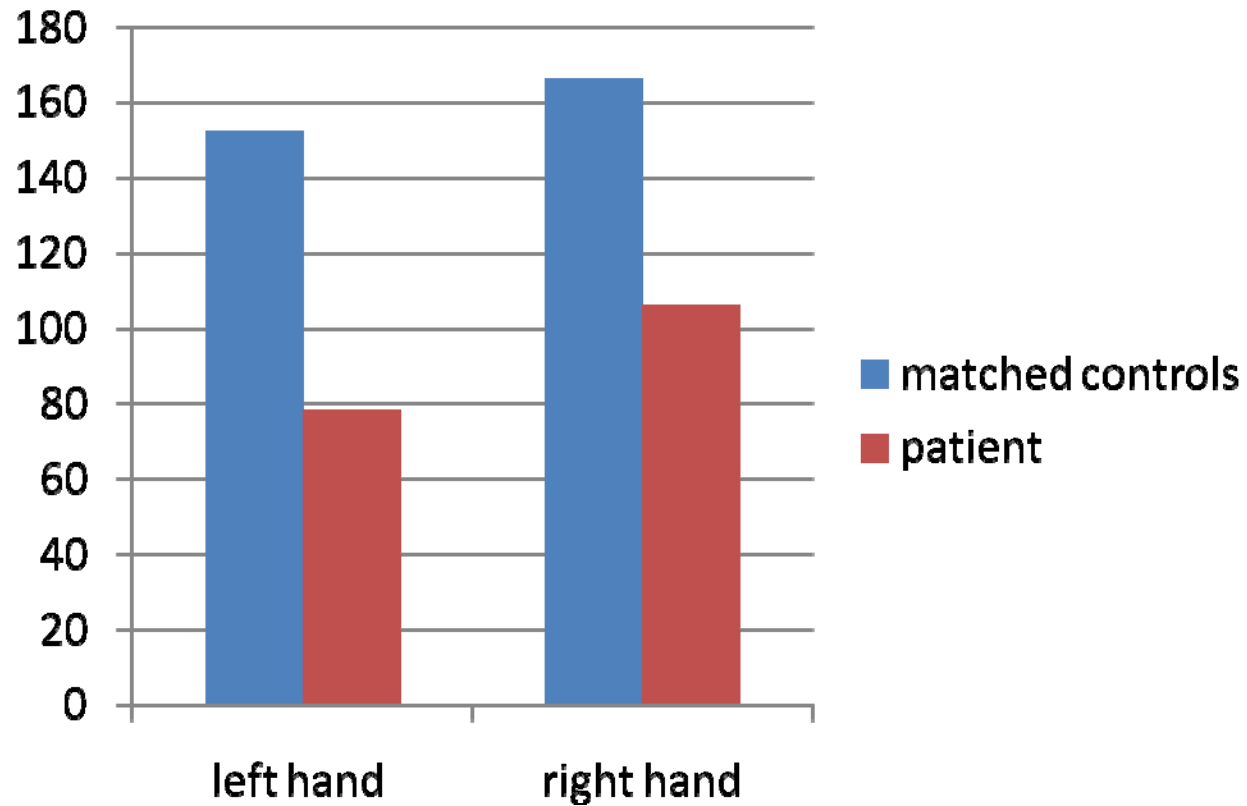
The list below summaries what the practical significance of that deficit is considered to be:

1. Ability to learn and remember new tasks based on verbal information. Critical, central everyday skill.
4. Ability to detect and respond to significant change under conditions requiring vigilance. Fundamental everyday skills e.g. train, plane, automobile, computer and equivalent machine operations.
6. Everyday motor skills such as typing and machine operation.
7. Visual discriminative judgment and response. Examples: visual monitoring tasks requiring choice and reaction such as air traffic control, driving judgement.
10. Language skill; correlates with premorbid intelligence.

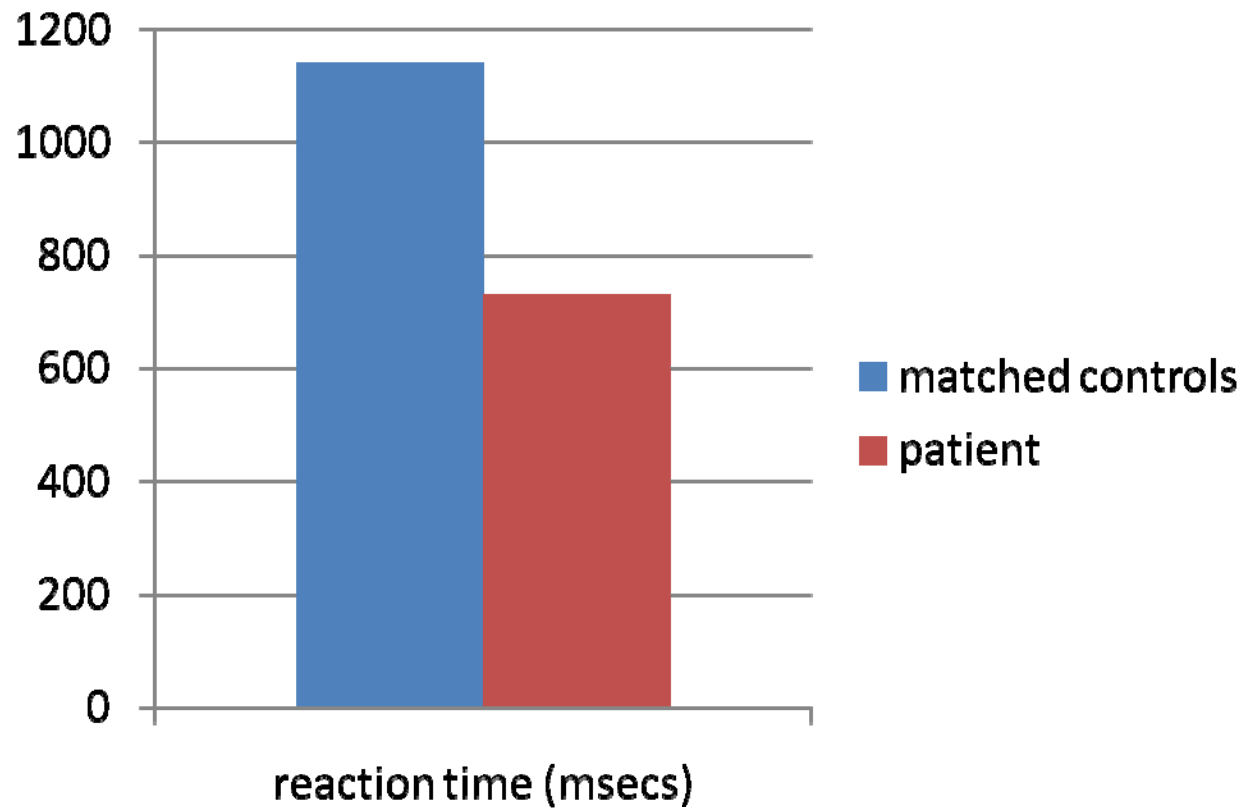
# Indication of Premorbid IQ



# Motor Tapping Task



# Reaction Time



# Conclusion

His self-reports of his problems with memory and concentration are reasonably accurate.

He is not deliberately malingering on assessments.

His depression is not adequately treated – he requires a change of antidepressant medication plus CBT.

The EEG abnormalities may well be medication related - he needs a review of his analgesic and benzodiazepine medication with a view to reducing the use of these medications and developing alternative pain management strategies.

Lifestyle (lack of exercise, very poor diet) and social issues (marital conflict, lack of social engagement) became apparent during the psychiatric assessment and should be addressed.

His premorbid IQ is well below average and this need to be taken into account with finding new work placements. His motor skills are also well below average.

BRC Assessments:

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# Where to now...

We can expect more improvements in the technology to objectively evaluate the structure and function of the brain.

These scans, tests etc help us assess deficits in attention, cognitive function etc.

We still do not have objective measures (other than rating scales) for the presence or severity of psychiatric disorders such as depression, anxiety and PTSD.



