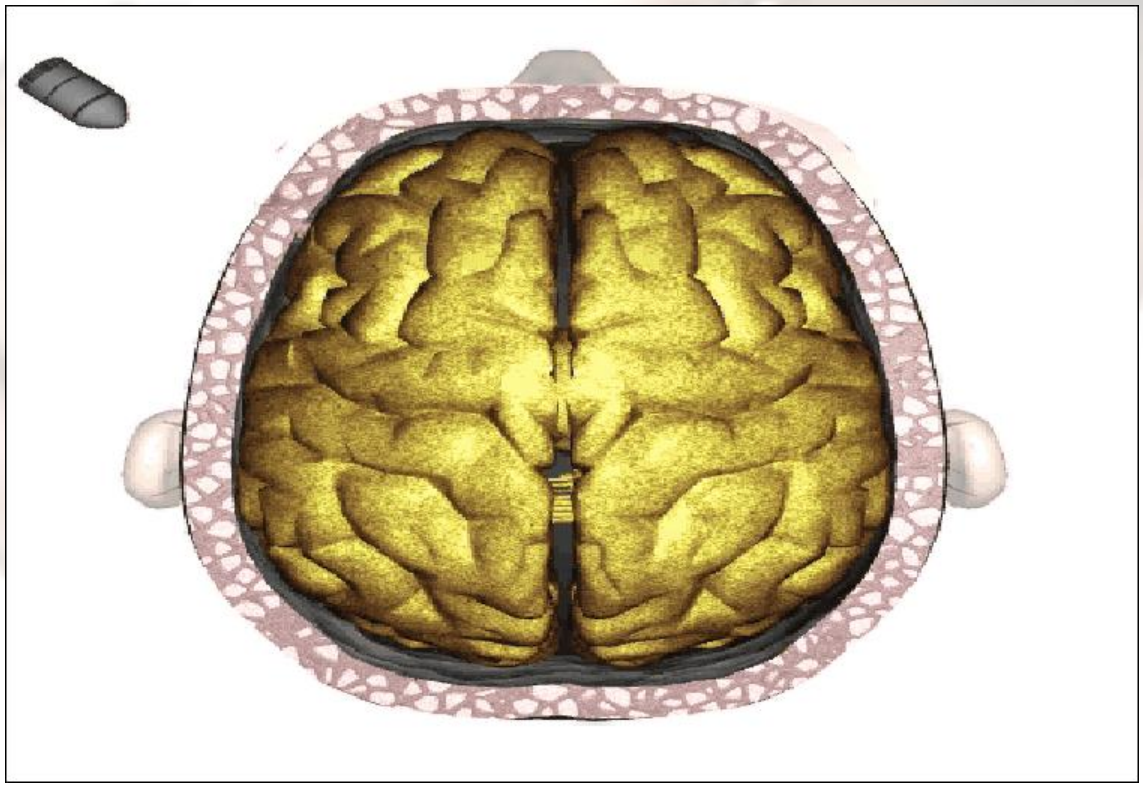
Elementi di Neuropsicologia

Cerebro Lesioni Acquisite



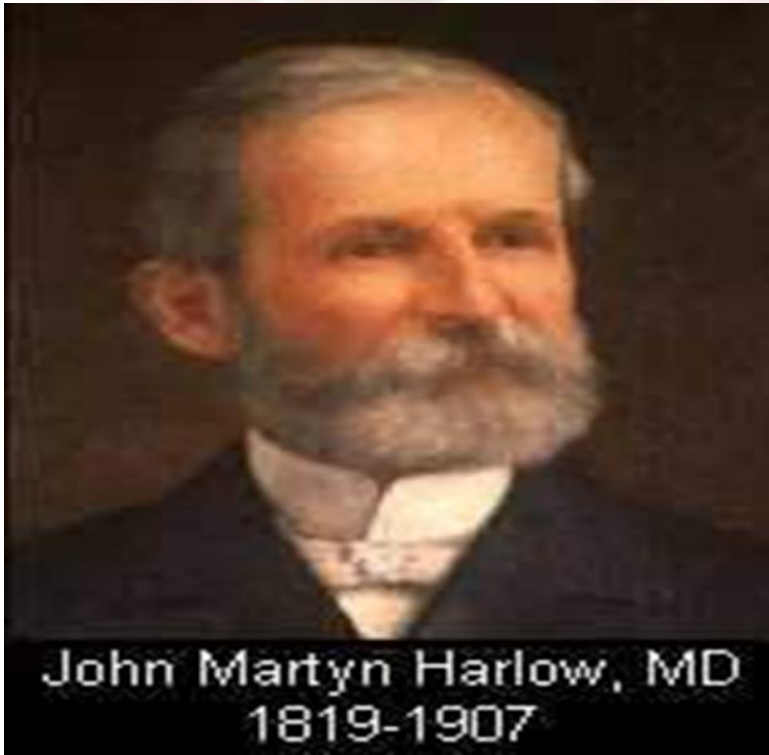
Salvatore Giangrasso – Psicoterapeuta, Neuropsicologo

The Story of Phineas Gage

Phineas Gage was a railroad construction foreman in mid-19th C Cavendish, Vermont.

On September 13, 1848, he was setting explosive charges in holes drilled into large pieces of rock so they could be broken up and removed.

There was an accident. The tamping iron rod ignited the gunpowder and blew clean through Gage's head.



The Story of Phineas Gage

Remarkably, Gage regained consciousness after a few minutes, and eventually was able to make a full recovery.

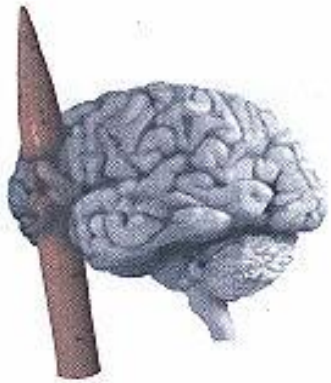
However, it soon became clear that Gage was not the same.

Whereas before he was responsible, jovial, and hard-working; after the accident, he became…

"…scontroso, irreverente, a volte molto sconveniente e sarcastico..."

-- Gage's physicia

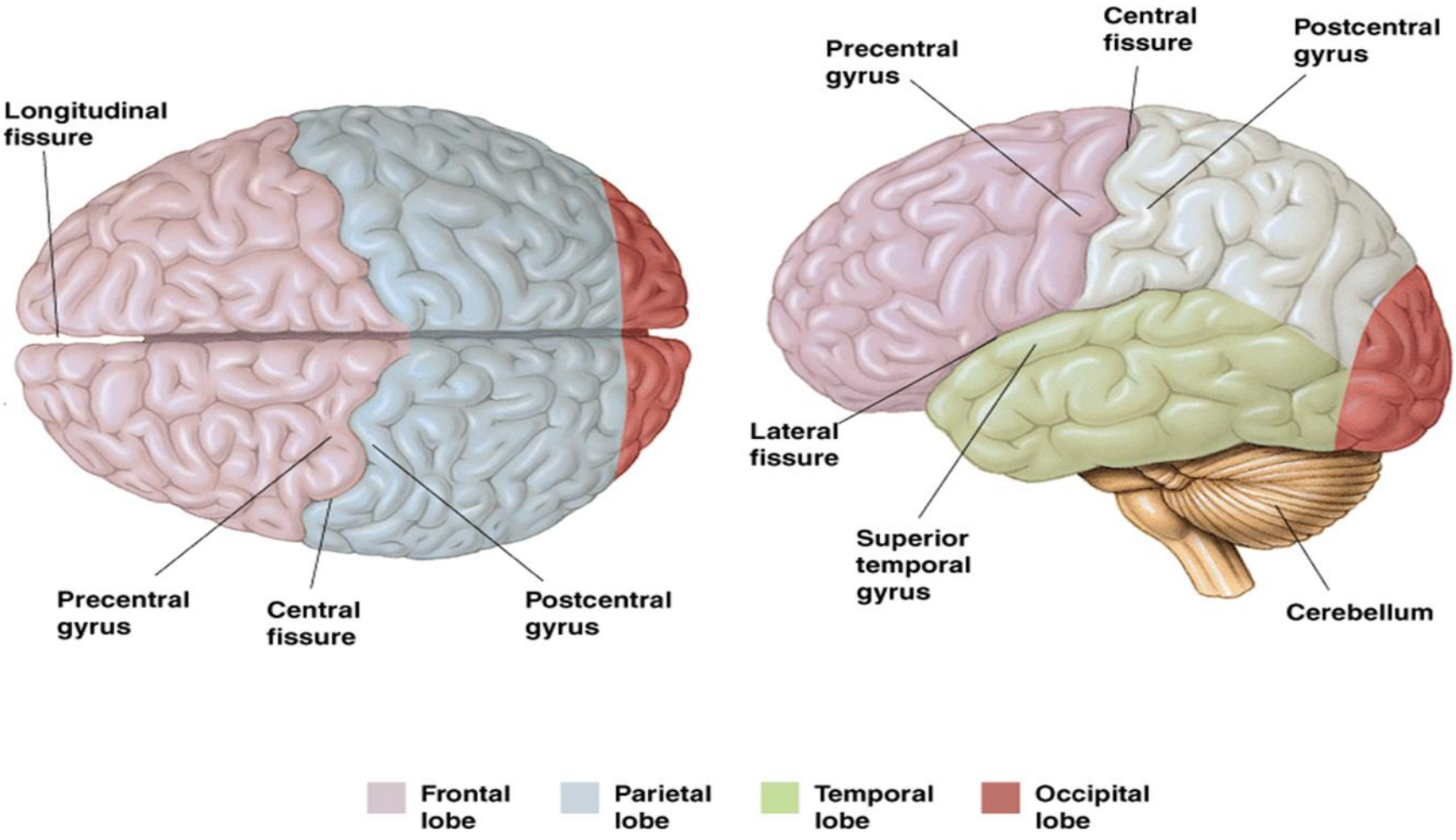
The death mask of Phineas Gage showing the massive injury to the skull.



Reconstruction of the position of the rod which passed through the frontal lobe of Gage's brain.

Elementi Base di Neuroanatomia

► The Lobes of the Cerebral Hemispheres

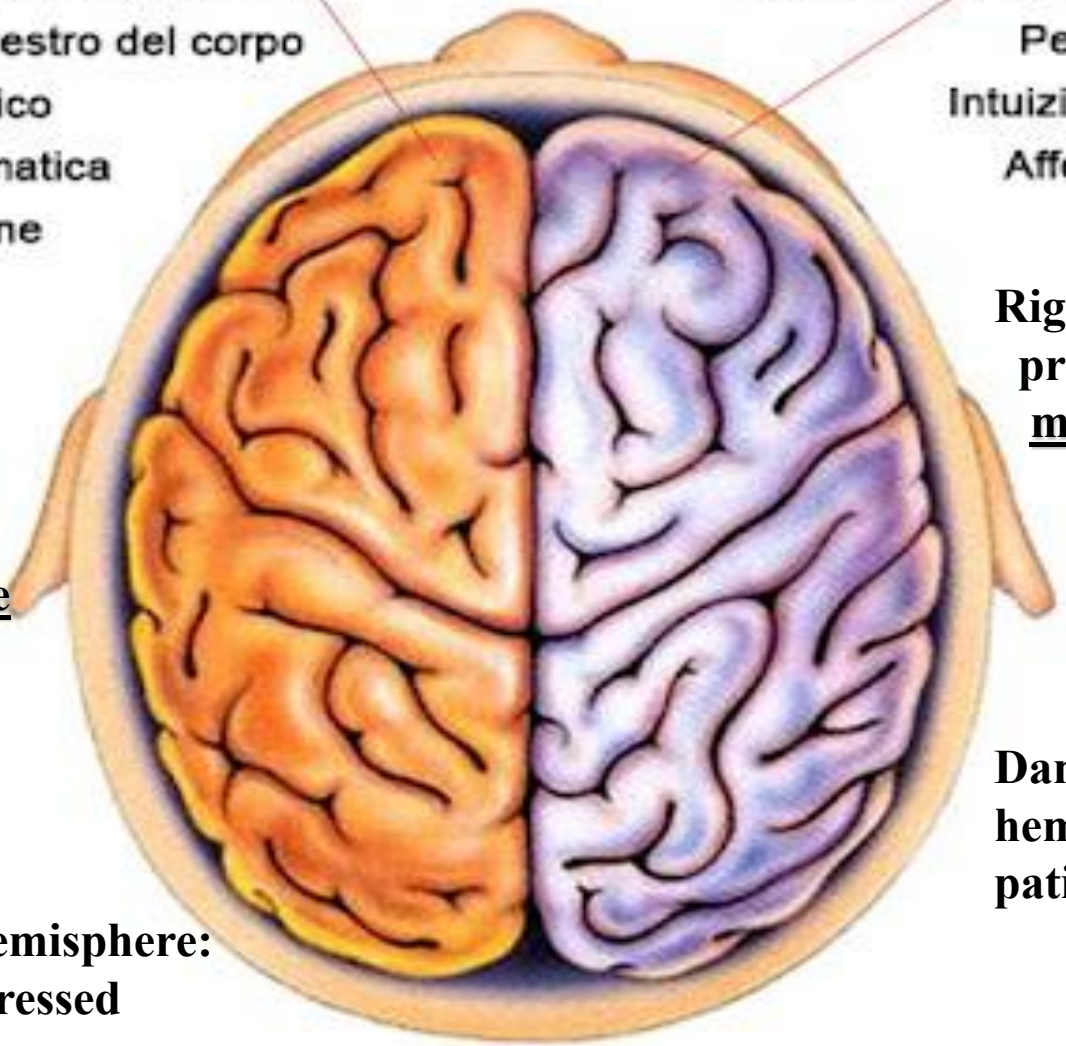


Funzioni dell'emisfero sinistro

Linguaggio, scrittura e calcolo
Controllo lato destro del corpo
Pensiero analitico
Logica e matematica
Categorizzazione

Funzioni dell'emisfero destro

Controllo lato sinistro del corpo
Pensiero sintetico
Intuizione e creatività
Affetti ed emozioni
Arte e musica



Right hemisphere processes <u>negative moods</u>

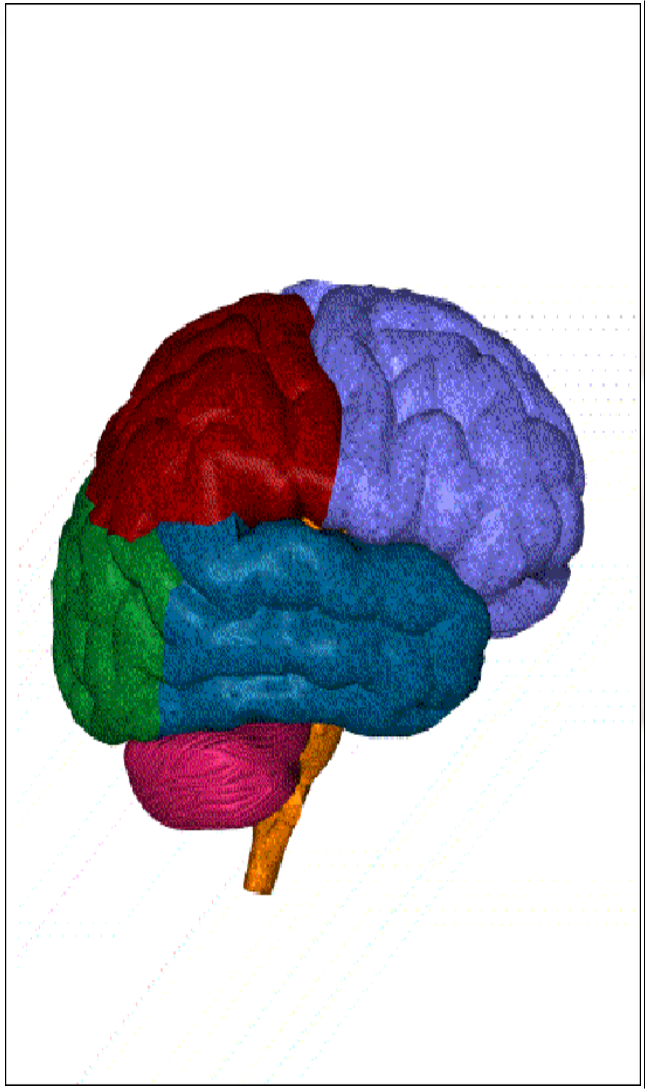
Left hemisphere processes <u>positive moods</u>

Damage right hemisphere: patients eutimico / flat

Damage to left hemisphere: patients sad /depressed

(Sackeim, Heller, Starkstein)

Occipital Lobe



Functions

Primary visual reception area.

Decodes information taken from the eye

Visual association area: allows for visual interpretation.

"La corteccia occipitale scompone ogni immagine nei suoi elementi fondamentali, come forma, colore e movimento."

Temporal Lobe

"Archivio semantico e uditivo" - interpreta suoni, parole, volti e memorie.

Funzioni neuropsicologiche principali della corteccia temporale

1. Elaborazione uditiva

Sede primaria dell'**udito -** Analizza le **frequenze e i pattern sonori**.

•Lesioni - **sordità corticale** o **agnosia uditiva**

2. Linguaggio (emisfero sinistro)

•Area di **Wernicke:** Responsabile della **comprensione del linguaggio parlato e scritto**.

•Lesioni → **afasia di Wernicke** (linguaggio fluente ma privo di senso.

3. Riconoscimento visivo e memoria semantica (emisfero sinistro e destro)

•Lesioni - **agnosia visiva** (incapacità di riconoscere ciò che si vede) o **prosopagnosia** (volti).

4. Memoria episodica e semantica

Lobi temporali mediali (ippocampo, corteccia entorinale e parahippocampale): fondamentali per **l'immagazzinamento e il recupero dei ricordi**.

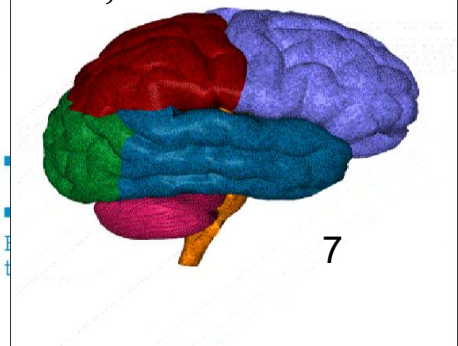
•Lesioni → **amnesie anterograde** o **retrograde**.

5. Elaborazione emotiva

Amigdala e strutture limbiche temporali: analisi del **valore emotivo** degli stimoli, Lesioni - difficoltà nel riconoscere emozioni (es. espressioni facciali tono).

6. Riconoscimento e denominazione (nomia)

•Lesioni - **anomìa** o **afasia anomica.**



Corteccia Parietale: centro integrativo multisensoriale.

Integrazione sensoriale multimodale

- Riceve e combina le informazioni **tattili, propriocettive, visive e uditive**.
- Trasforma le sensazioni grezze in **percezioni spaziali e corporee coerenti**.
- Permette di sapere **"dove"** sono gli oggetti rispetto al corpo e **"dove"** si trovano le parti del corpo rispetto all'ambiente.

2. Rappresentazione corporea (schema corporeo)

- Nella **corteccia parietale posteriore** si costruisce lo schema corporeo
- Lesioni: **anosognosia** (no consapevolezza deficit fisico), **difficoltà nel riconoscere o localizzare parti del corpo**.

3. Orientamento spaziale e attenzione

- Lobo parietale destro = cruciale per **l'attenzione spaziale globale**.
- Lesioni: **neglect spaziale unilaterale**

4. Pianificazione motoria e prassia

- Interagisce con le aree premotorie per **coordinare movimenti complessi**.
- Lesioni: **aprassia** (incapacità di eseguire movimenti **appresi** nonostar comprensione siano intatte).

Cerebellum

Coordinazione motoria e regolazione del movimento

- Controlla **tono muscolare, equilibrio, postura e precisione** dei movimenti.
- Lesioni - **atassia**,

2. Apprendimento motorio

- Coinvolto nei **processi di apprendimento implicito** (es. bicicletta).
- Lesioni - compromissione della capacità di adattare i movimenti agli errori.

3. Cervelletto cognitivo Connessioni con **lobi frontali, parietali e temporali**

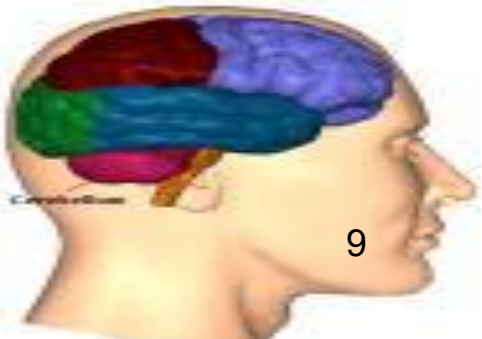
Contribuisce a funzioni **esecutive, linguistiche e visuospaziali**

Fluidità verbale, Attenzione e Organizzazione spaziale

- , difficoltà di pianificazione, deficit visuospaziali, eloquio disprosodico.

4. Regolazione emotiva e affettiva

- Interagisce con le strutture limbiche (amigdala, corteccia orbitofrontale).
- Contribuisce alla **modulazione dell'affettività**, del tono emotivo e della regolazione comportamentale.
- Lesioni - **labilità emotiva**, **comportamenti impulsivi o apatici**, difficoltà di adattamento sociale.

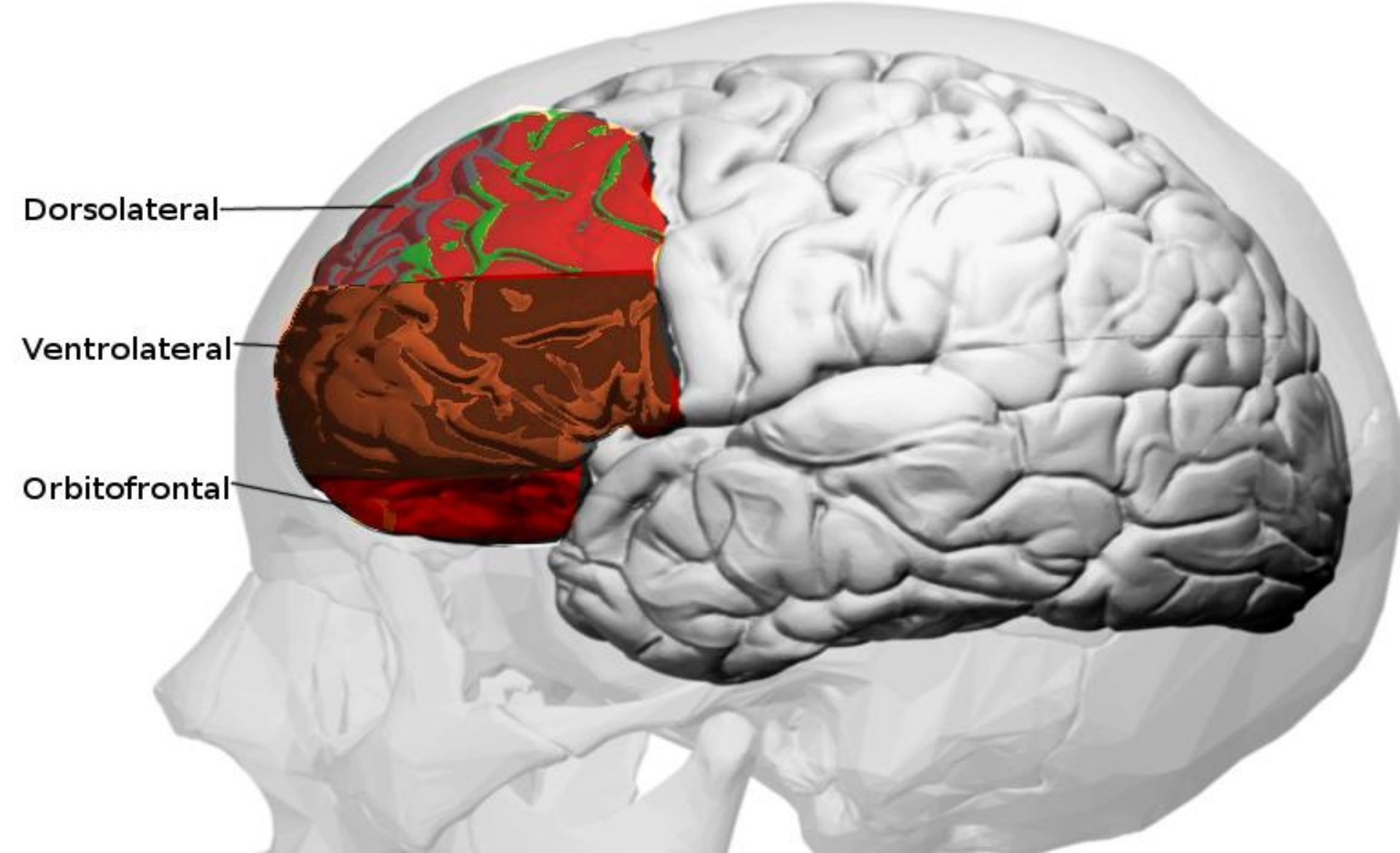


Brain stem

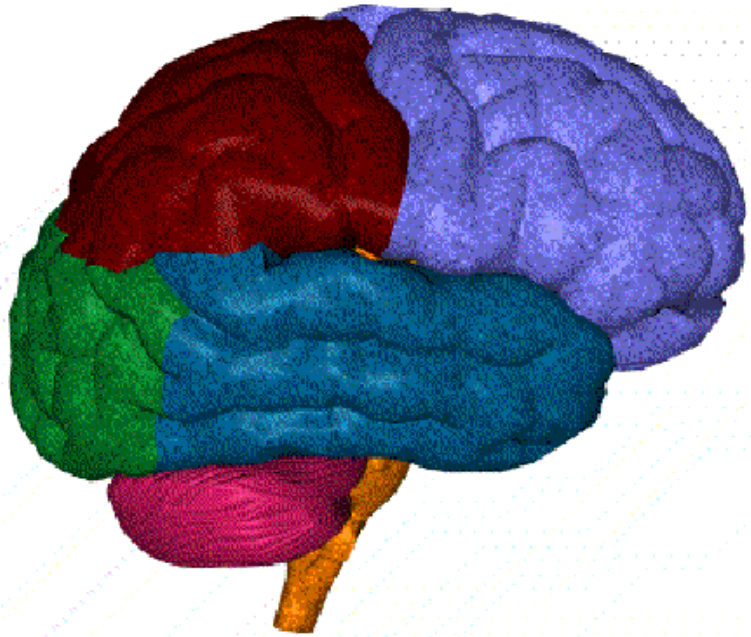
Functions:

- Breathing and Heartbeat
- Alertness
- Swallowing
- Vestibular function
- Anchors the brain to the spinal cord
- Controls ANS
- Ability to sleep
- Startle response

Ruolo della Corteccia Frontale



Frontal Lobe



Functions:

Attenzione Concentrazione

Resistenza all'interferenza

Apprendimento strategico

Working memory

Flessibilità Cognitiva

Formazione di concetti e ipotesi

Pianificazione e pensiero astratto

Controllo risposte impulsive

Motivazione/ iniziativa psicomotoria

Consapevolezza / Coscienza

Modulazione affettiva

Sarcasmo / autoironia / moralità

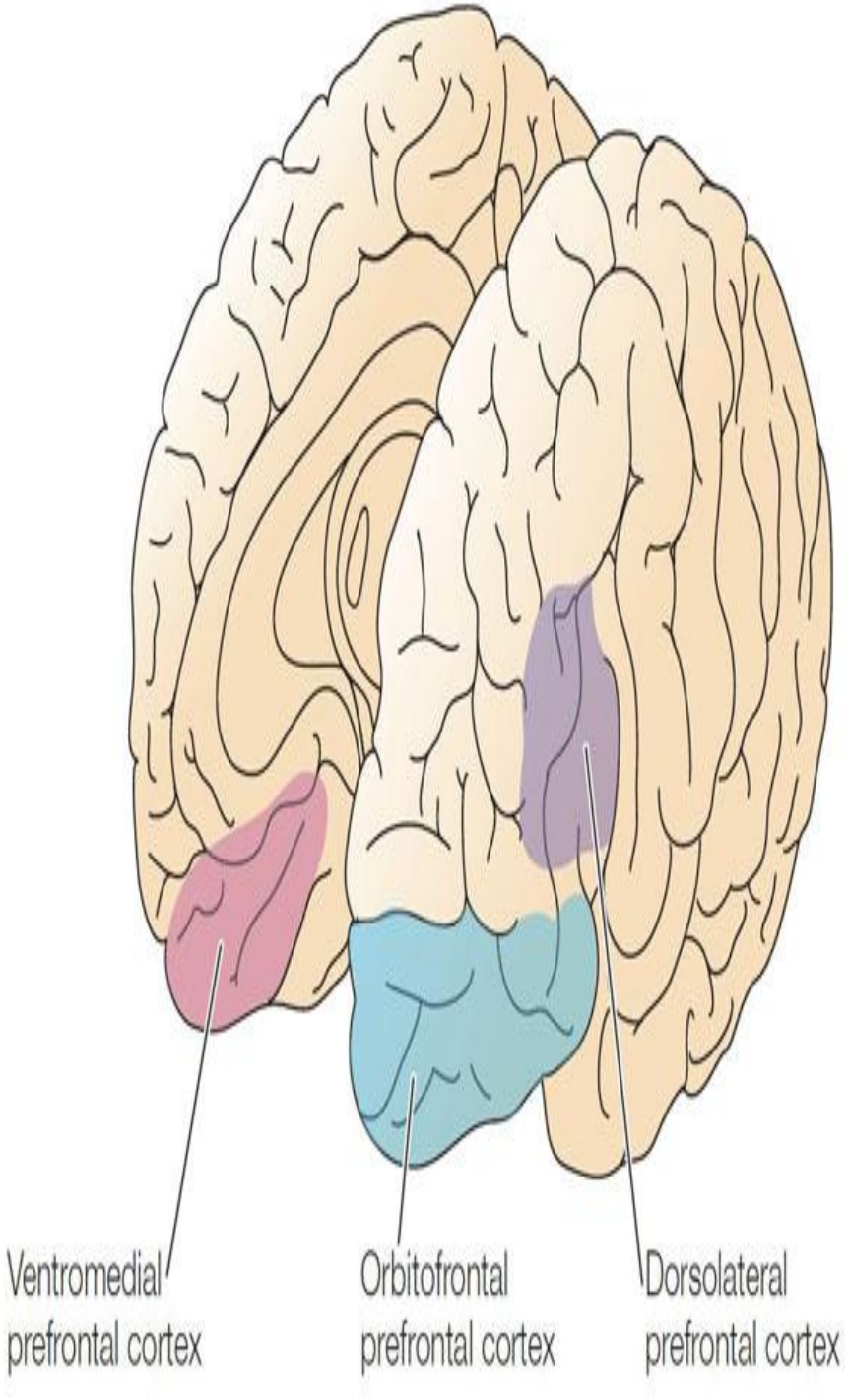
Localisation and Function

Dorsolateral Frontal Syndrome
Dysexecutive syndrome

Cort. Prefontale Ventrolaterale

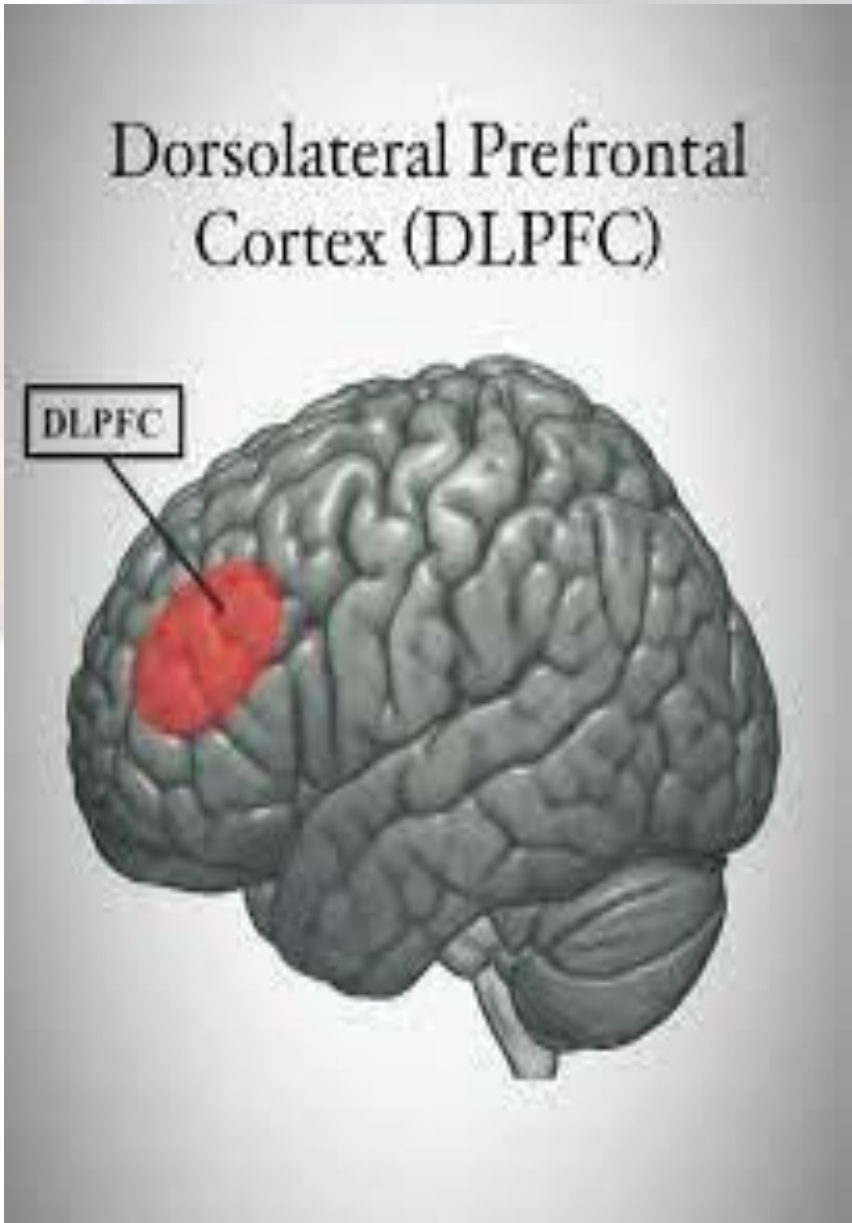
Anterior Cingulate Syndrome

Orbital Frontal Syndrome



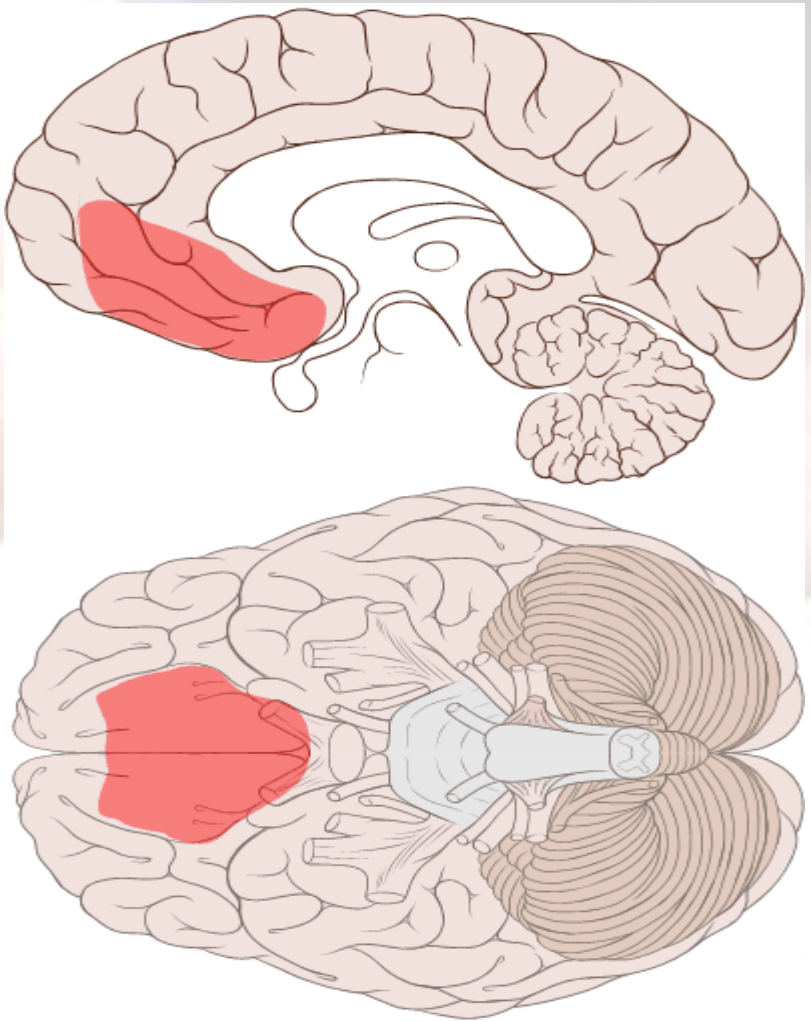
Dysexecutive Syndrome

- **Primarily Cognitive impairments**
- **Problems with Planning and meeting goals**
- **Deficits in cognitive flexibility**
- **Impaired working memory.**
- **Monitoraggio e autocorrezione**
- **Scegliere strategie valutare conseguenze**



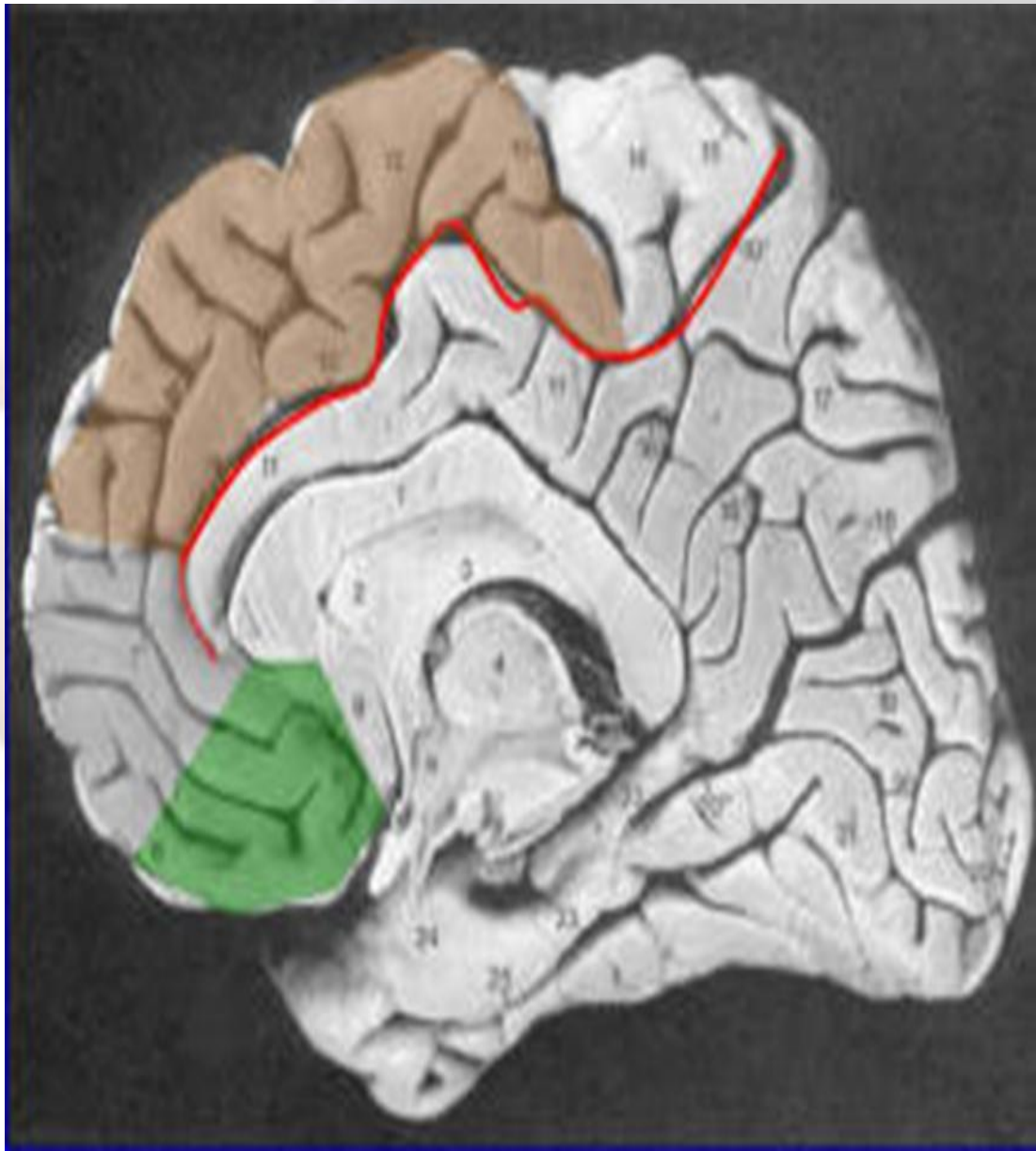
Ventromedial Prefrontal Cortex Anterior Cingulate Syndrome

- Apatia
- Abulia
- Disinteresse
- Depression misdiagnosis
- Can be treated with stimulants

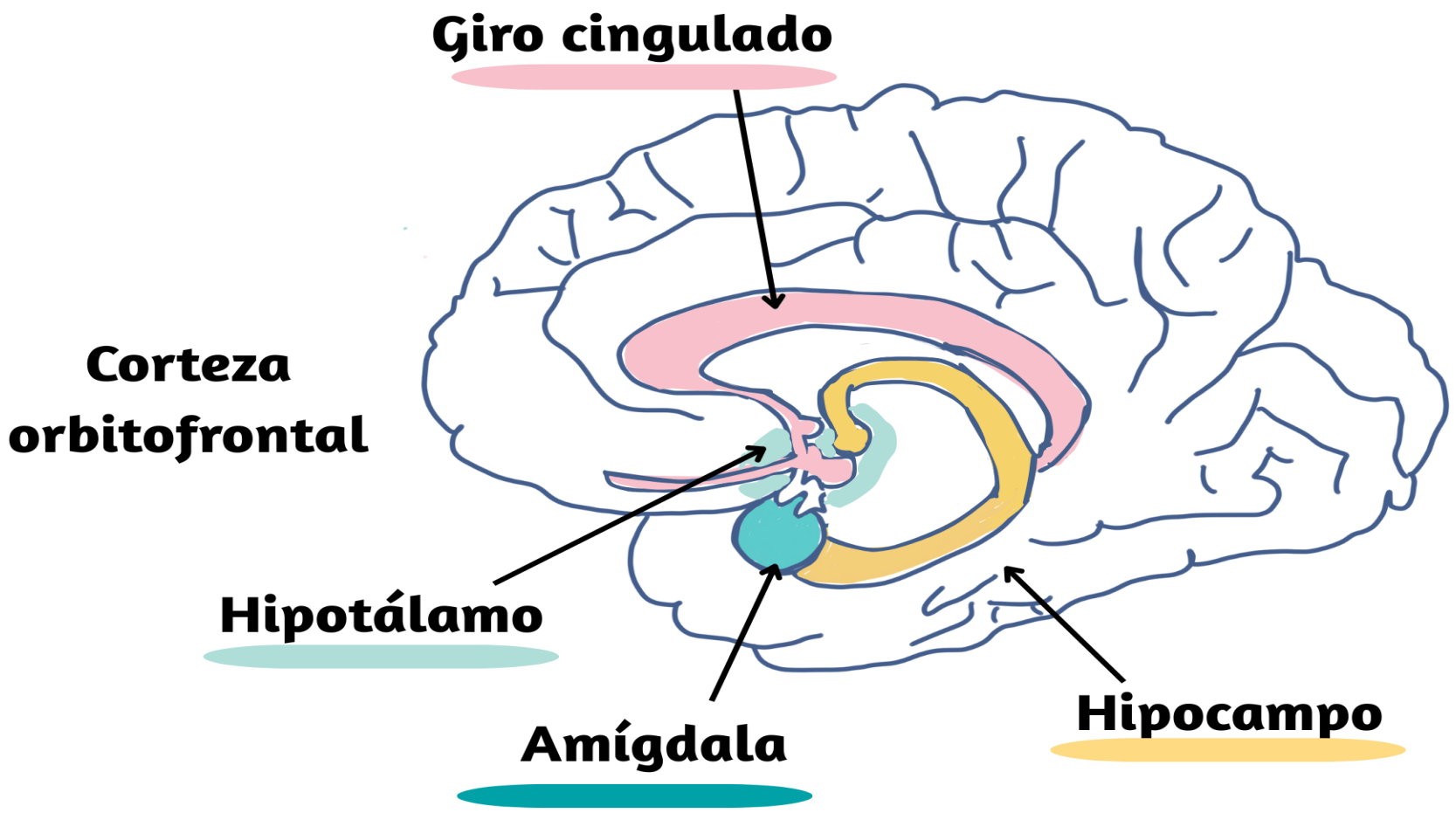


Orbital Frontal Syndrome

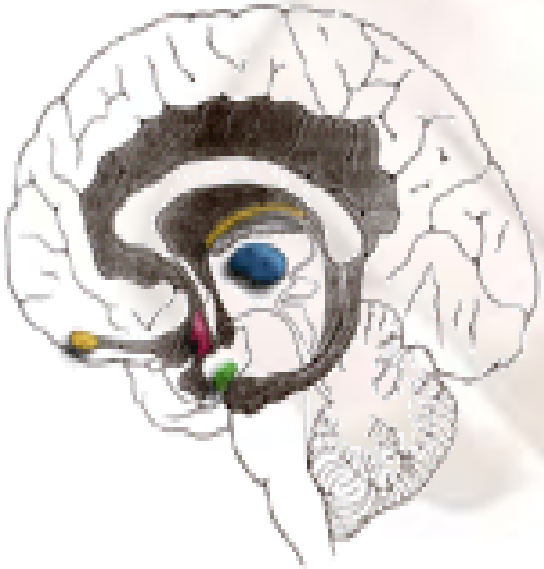
- Primarily behaviour problems
- Disinhibition, poor judgment, inappropriate affect, poor decision-making
- Impulsivity
- Poor self monitoring, lack of concern about deficit



Nesso tra Emozioni e Memoria



Limbic System

Brain Structure	Function	Symptoms of Injury
	•Sense of smell. •Emotions (i.e. rage, fear) •Sexual urge.	•Loss of sense of smell. •Agitation, loss of control over emotion. •Loss of recent memory. •Loss of libido.

ABI Definition

Any injury to the brain received during a person's lifetime and not as a result of a birth trauma

TBI Definition

An insult to the brain caused by an external force that may produce diminished or altered states of consciousness which results in impaired cognitive abilities or physical functioning

Bring
those affected by Acquired Brain Injury

Causes of ABI

- Traumatic Brain injury
- Stroke/ cerebrovascular accident
- Haemorrhage
- Tumour
- Anoxia
- Infection
- Alzheimer

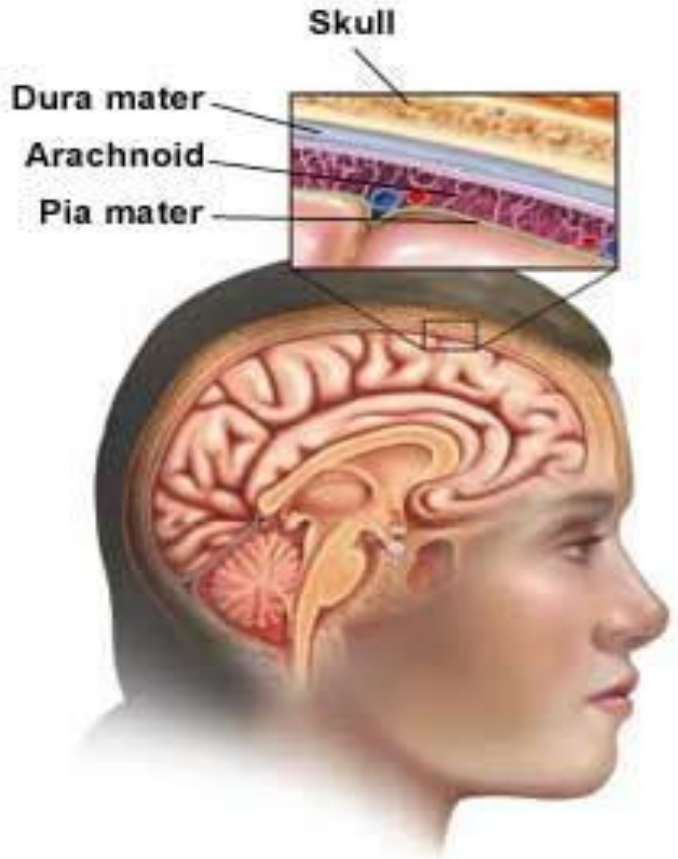
Traumatic Brain Injury

- Road traffic accidents (RTA), falls, assaults and sport accidents most common causes of TBI
- The most common cause of brain damage in children and young adults
- People with TBI often physically intact with a significant impairment in cognitive/emotional functioning

What happens in TBI?

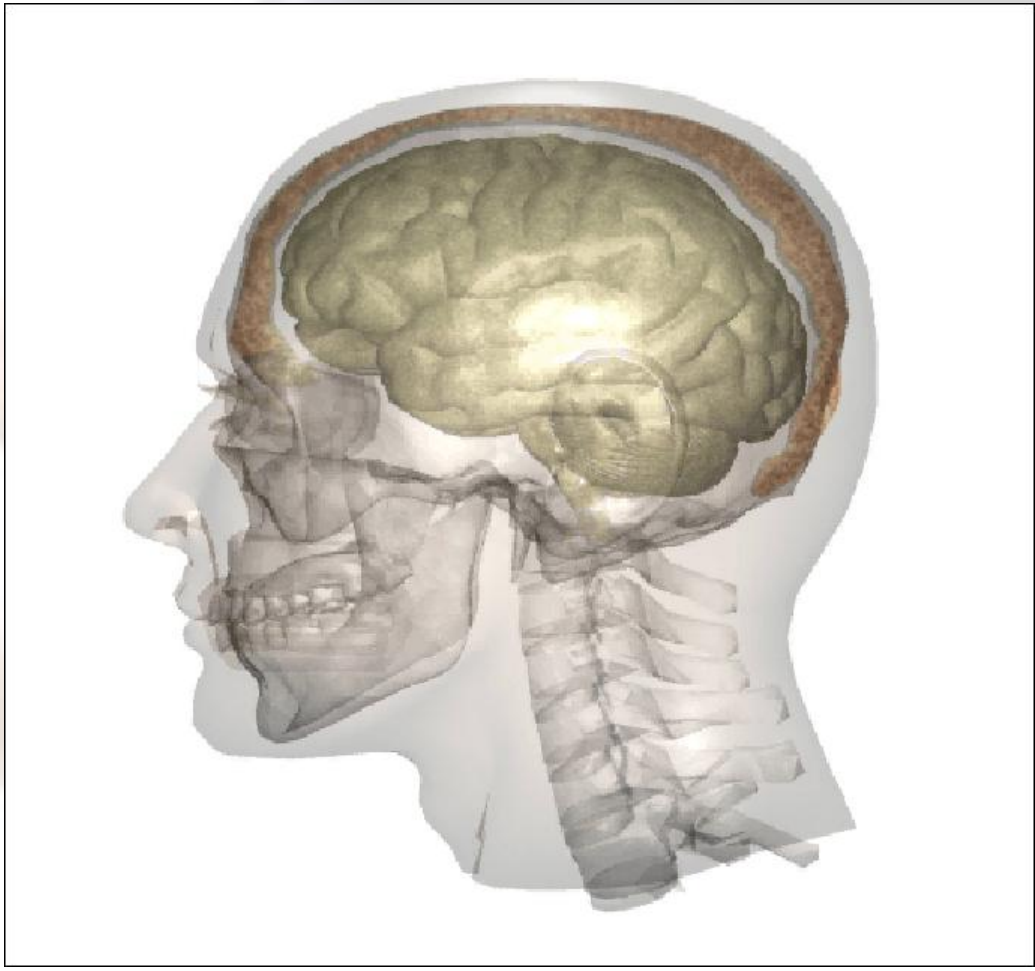
Damage to the brain may occur at the time of impact, or it may develop some time after the injury (e.g. from swelling or bleeding). Bleeding can occur as an

Extradural haemorrhage: between skull and dura
Subdural: between dura and subarachnoid
Subarachnoid: between subarachnoid and brain
Intracerebral: within the brain substance



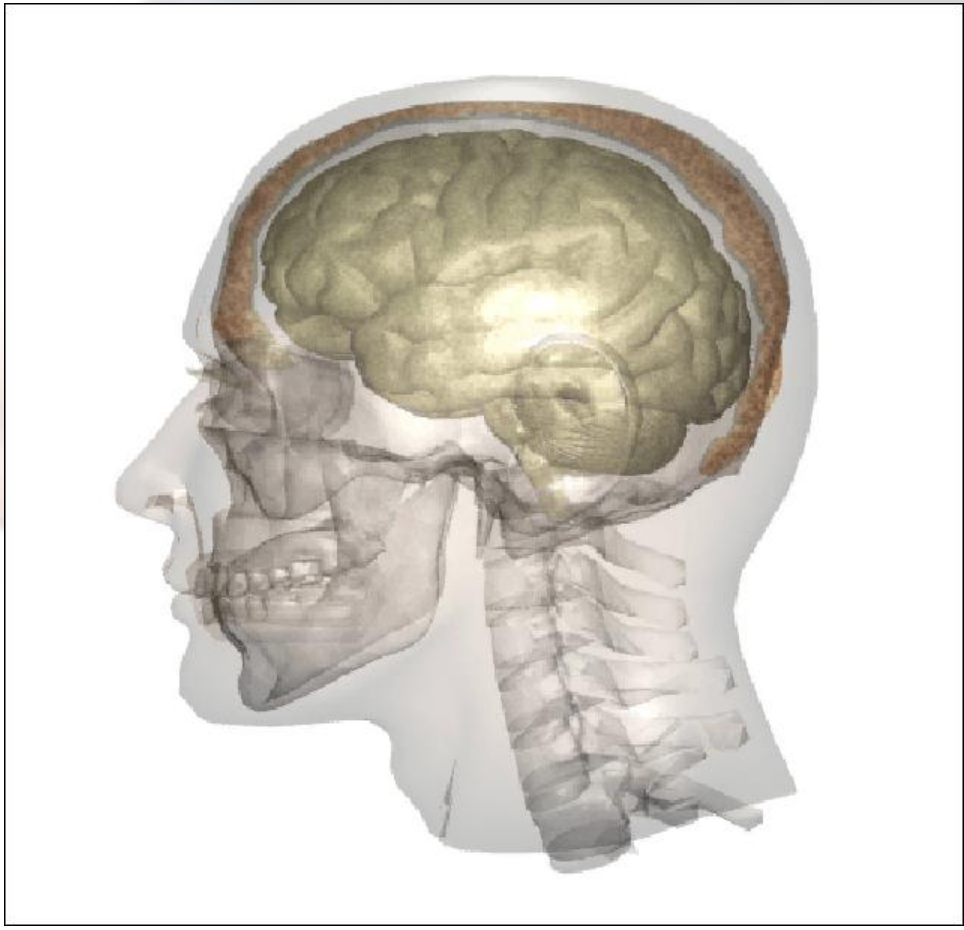
What happens in TBI?

As a result of the impact, In addition to the immediate area of injury **(coup)**, the brain may also rebound against the opposite side of the skull (**contra-coup**)



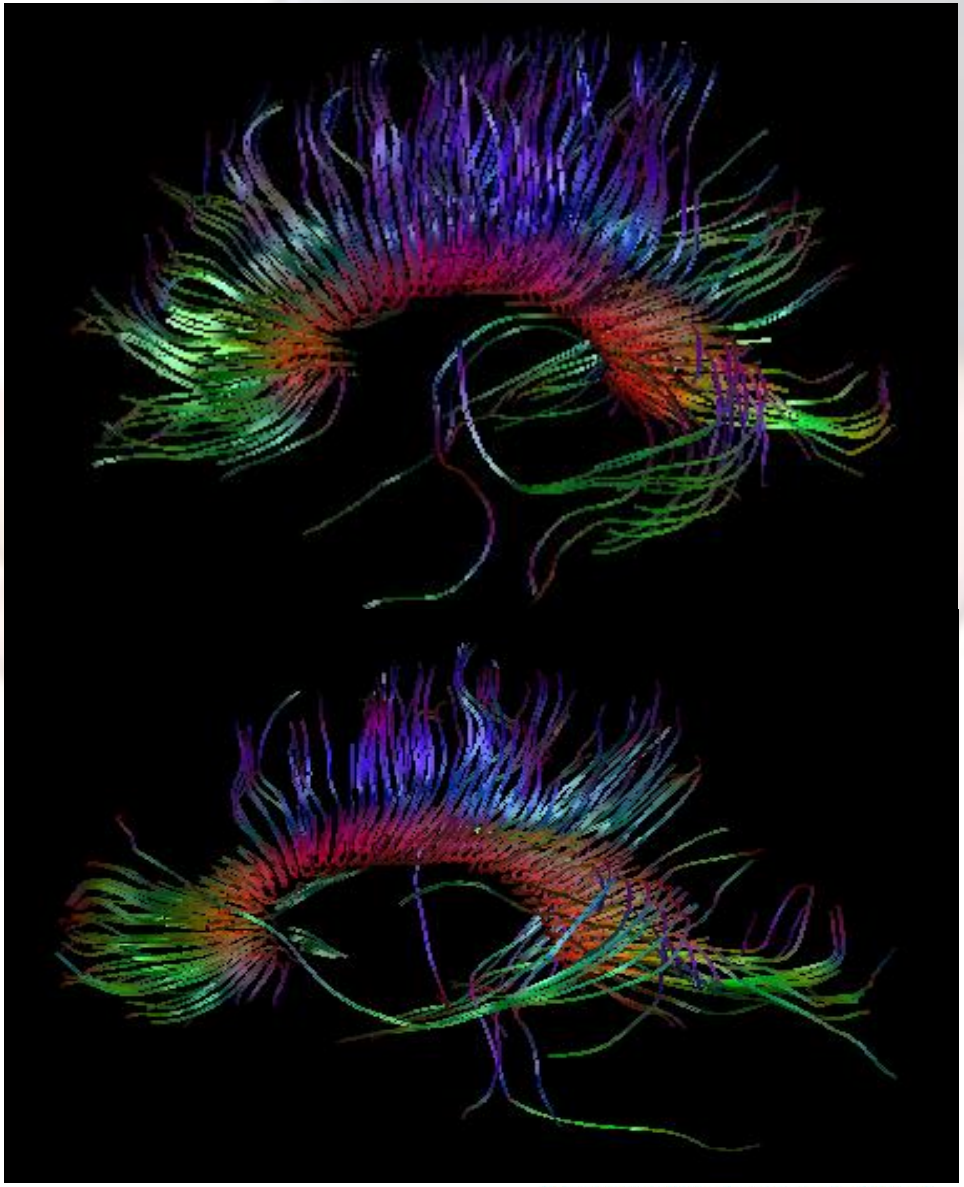
What happens in TBI? Diffuse Brain Damage

Together with a coup and contra coup motion, a torsion motion can effect the movement of the brain in the head which can result in diffuse brain injury.



What happens in TBI?

When the head is hit with force, twisting and rebounding often causes diffuse axonal damage



When the head is hit with force the brain stem turns and twists causing a loss of consciousness;

prolonged consciousness = coma

Levels of Severity of Brain Injury I

Mild	Moderate	Severe
•Altered state of consciousness at onset	•Loss of consciousness	•Coma/loss of consciousness exceeding 24 hours
•Can have a negative CT scan or MRI	•Seizures may occur	•Frequent concern of seizures
•Typically good physical recovery	Frequent headaches	•May often be accompanied by multiple physical injuries
•Frequent headaches	•Motor coordination difficulties	•Limited ability or inability to voluntarily swallow
•Some poor motor coordination	Limited attention span, concentration and/or ability to attend to multiple aspects of the environmen	
•Limited attention span and/or concentration	•Slowed information processing speed	
•Disruption of recall		

The Severity of ABI

- Determined according to the presence, degree and duration of **coma** and/or **Post-Traumatic Amnesia (PTA)**

- Severity scales from very mild (e.g. less than 5 minutes PTA) to profound (over 4 weeks PTA)

Fig. 2

Glasgow Coma Scale for Head Injury

Glasgow Coma Scale,	
Eye opening	
Spontaneous	4
To loud voice	3
To pain	2
None	1
Verbal response	
Oriented	5
Confused, disoriented	4
Inappropriate words	3
Incomprehensible sounds	2
None	1
Best motor response	
Obeys	6
Localizes	5
Withdraws (flexion)	4
Abnormal flexion posturing	3
Extension posturing	2
None	1

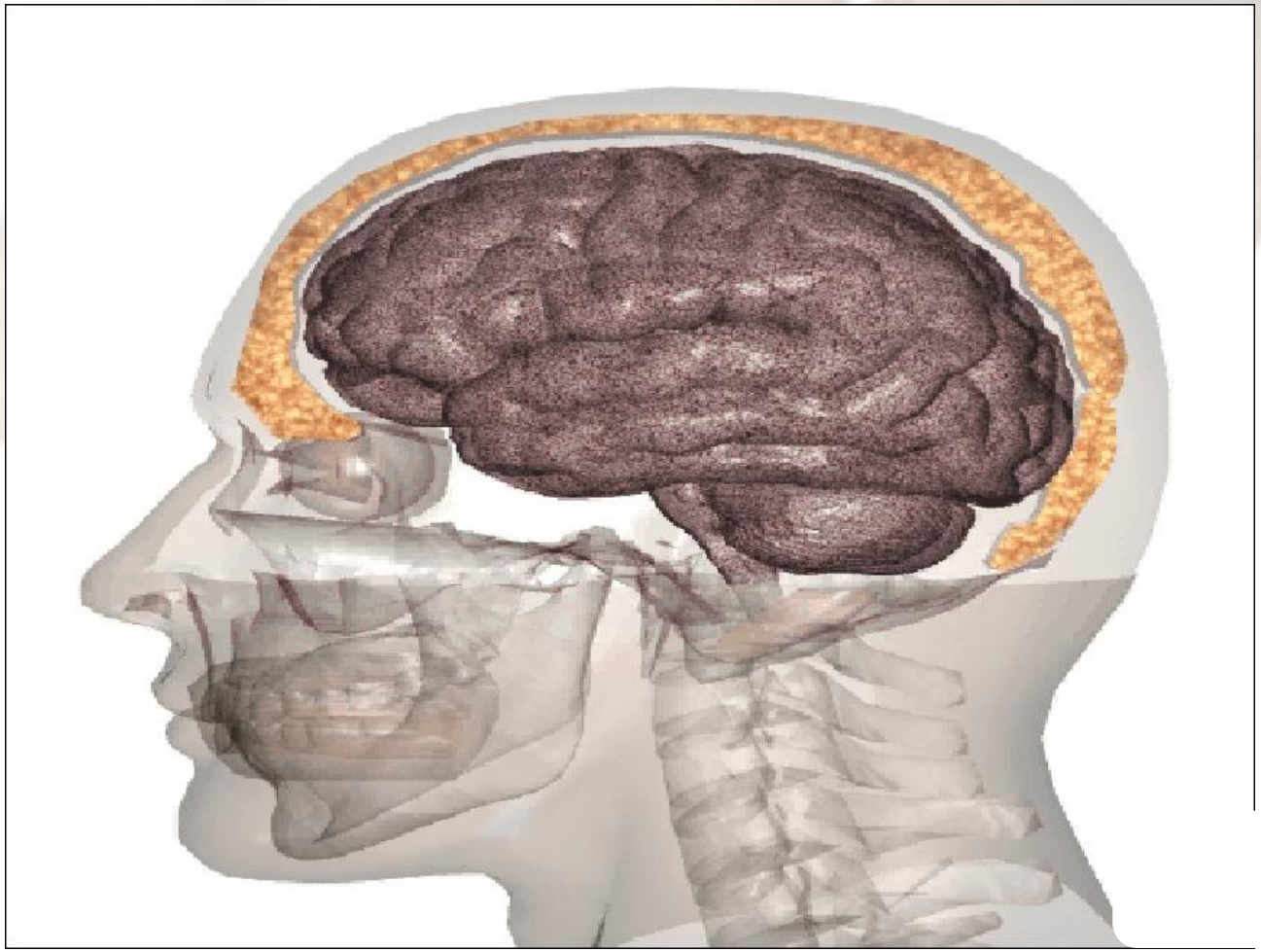
Non-Traumatic Brain Injury

Cause	Example
Anoxic injuries (lack of oxygen to the brain)	•Near drowning •Suffocation •Chocking
Vascular injuries (disruption in blood supply to the brain)	• Stroke (blocked blood vessels in the brain) • Aneurysm (broken blood vessels in the brain

Cause	Example
Inhalation or ingestion of toxic substances	•Sniffing glue, paint or carbon monoxide •Drug use
Infectious diseases	• Meningitis •Encephalitis

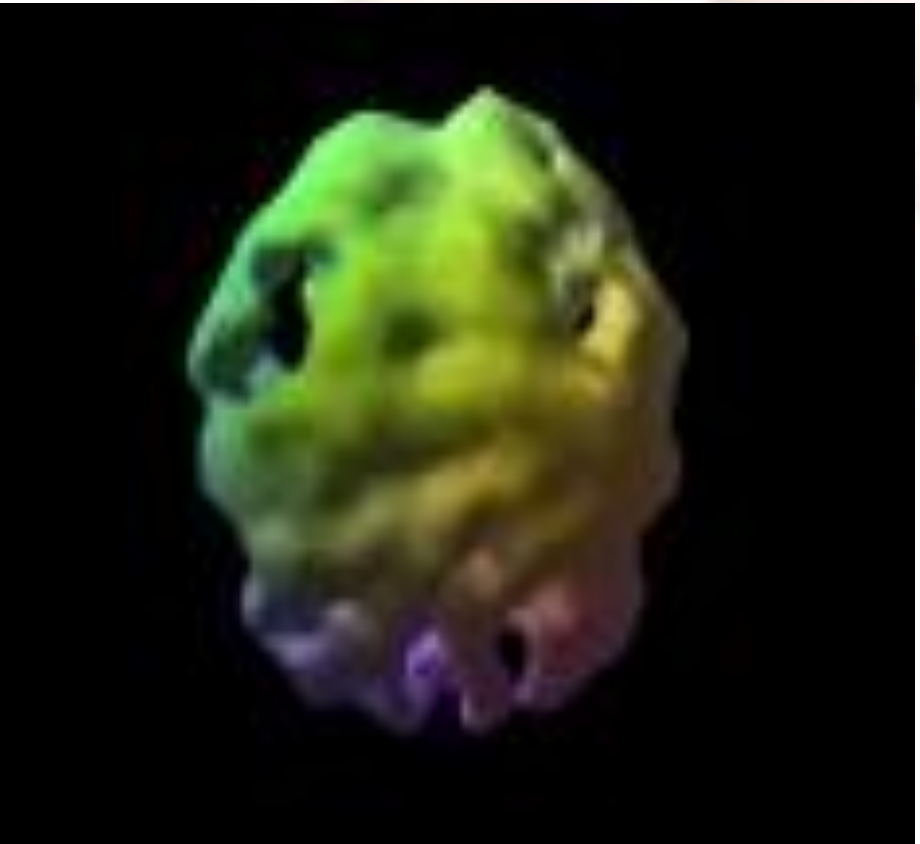
Vascular Disorders – Stroke

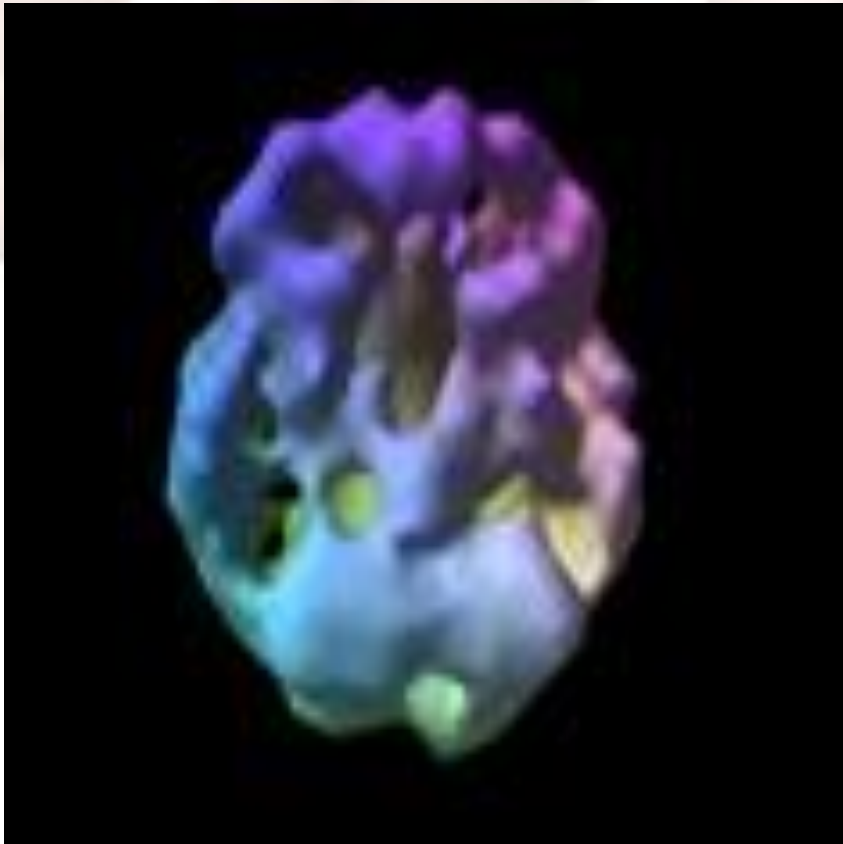
Ictus Emorragico - Ictus Trombotico



92 con Demenza di Alzheimer

Extensive frontal lobe involvement, marked overall suppression, especially in the parietal lobes and temporal lobes



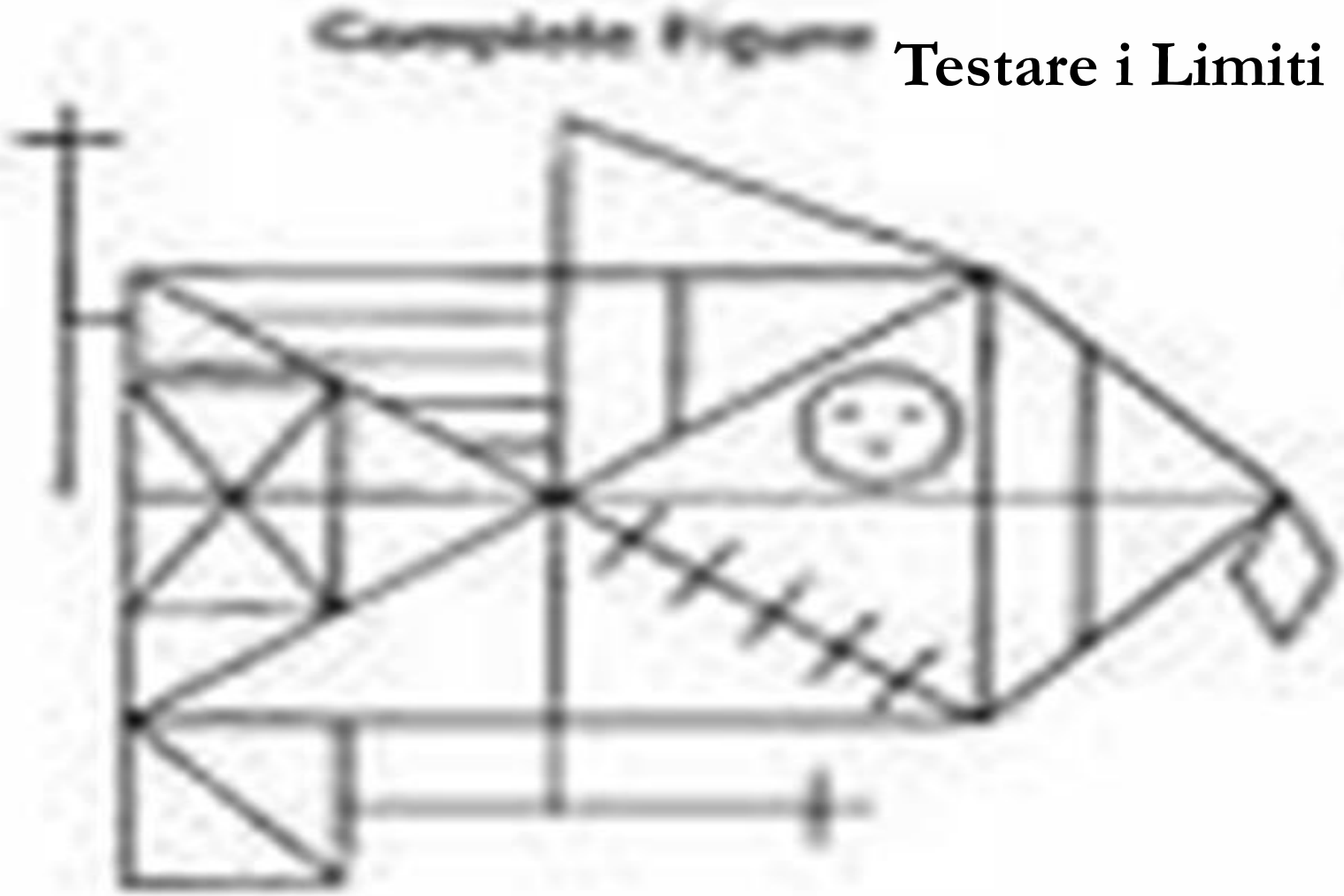


Pseudodemenza

68 years old. appeared to have symptoms of serious dementia.
Results of SPECT (Tomografia computerizata emission fotone singolo) showed full activity in her frontal, parietal and temporal lobes. If she had Alzheimer's Disease, there should have been evidence of decreased blood flow in those areas. Instead, the only abnormal increased activity was in the limbic system at the center of the brain. Often, this is a finding in people suffering from depression.

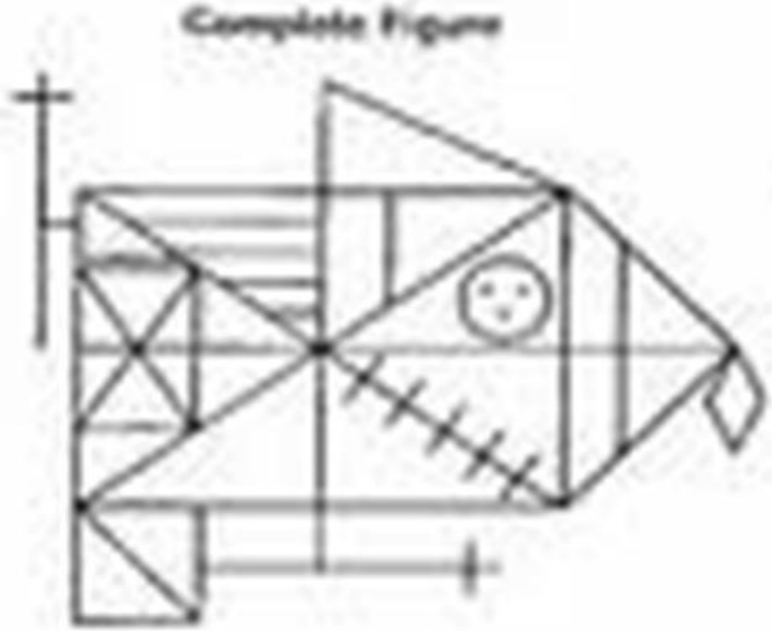
Before treatment notice good overall activity, with increased limbic systemactivity after treatment with antidepressant the limbic system normalizes.

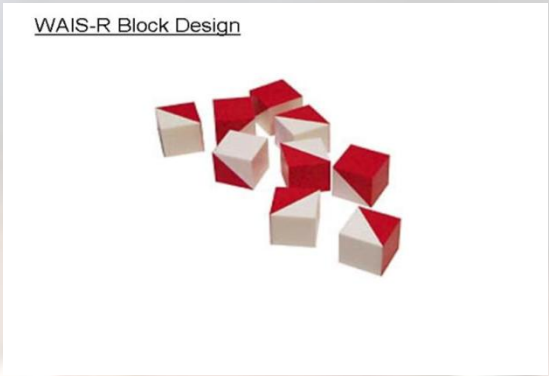
Pseudodemenza



Testare i Limiti

Visuo-Costruzione

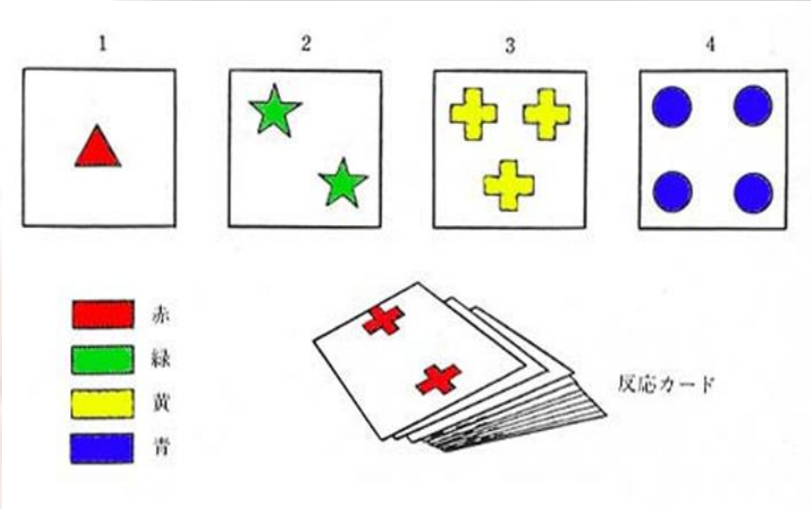




Results form the combination of perceptual activity and motor response

Lobo Frontale e · Funzioni Esecutive

Wisconsin Card Sortin Test



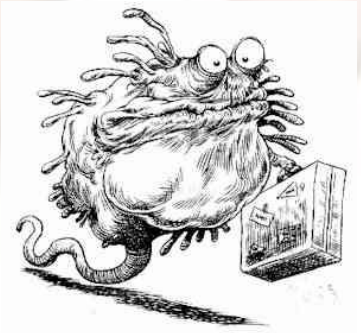
Hayling Section 1: Sensible Completion

1. He posted a letter with a _____
2. In the first space enter your or: In the first blank enter your _____
3. The old house will be torn _____
4. It's hard to admit when one is _____

Bacterial or Viral Infections

Bacterial Infection:

Localised causing an abscess or diffuse causing a cerebritis (Infiammazione **focale o localizzata** del tessuto cerebrale) or encephalitis (Infiammazione diffusa del cervello, spesso **di origine virale**)



Viral Infection:

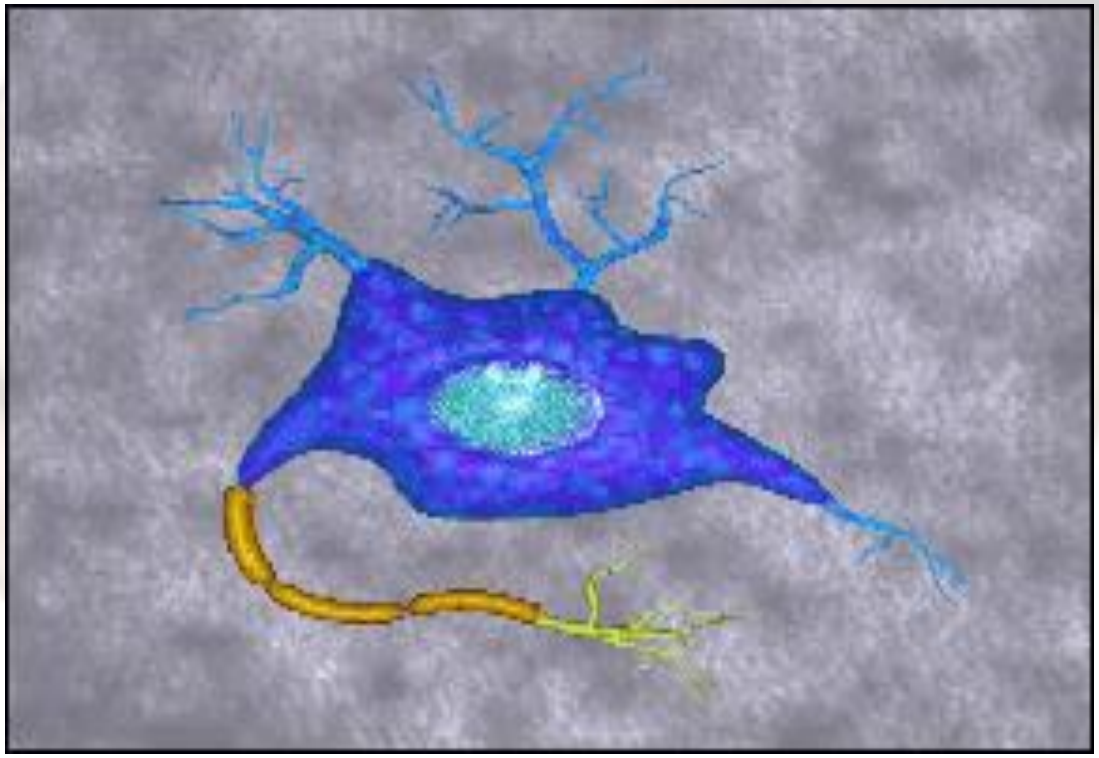
Diffuse causing encephalitis

Meningitis: infection in the covering of the brain

Caso Clinico

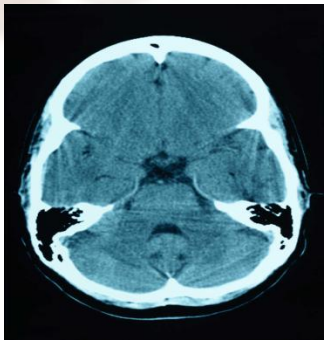
Shay's Hippocampectomy

Neuropsychology Assessment



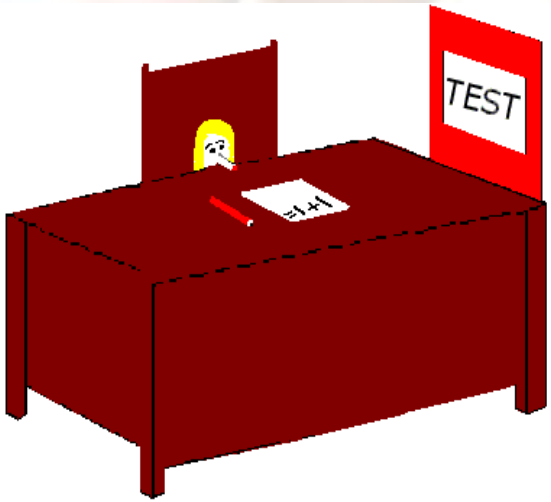
What is Neuropsychology?

- Neuropsychology is a branch of Clinical Psychology.
- Neuropsychologists are specialists trained to assess the effects of various brain injuries and diseases on mental and emotional functioning, that is, on how people think, feel, and act.



Purpose of Neuropsychological Assessment

- Five different purposes of assessment:
  - Diagnosis/Differential Diagnosis
  - Patient Care and Planning
  - Rehabilitation
  - Legal proceedings
  - Research



Neuropsychological Battery

- Assessment techniques and tools can be classified into various domains according to the major activities they elicit

WAIS III	WMS III	RAVLT	RCFT	WCST
Global Cognitive functioning	Types of Memory	Auditory Learning	Visual-spatial construction skills, visual memory	Executive Functioning
Hayling Brixton	BDI	BAI	SCL-90	
Initiation, inhibition, executive functioning	Depression	Anxiety	Axis I symptoms	

WAIS-III UK

Subtests	Raw Score	Scaled Score
Picture Completion	21	11
Vocabulary	50	12
Digit Symbol-Coding	57	7
Similarities	22	9
Block Design	36	9
Arithmetic	9	6
Matrix Reasoning	6	5
Digit Span	12	7
Information	20	12
Picture Arrangement	16	10
Comprehension	17	8
Symbol Search	25	7
Letter-Number Sequencing	-	-
Object Assembly	-	-

Normal Distribution

<69 = extremely low

70-79= borderline

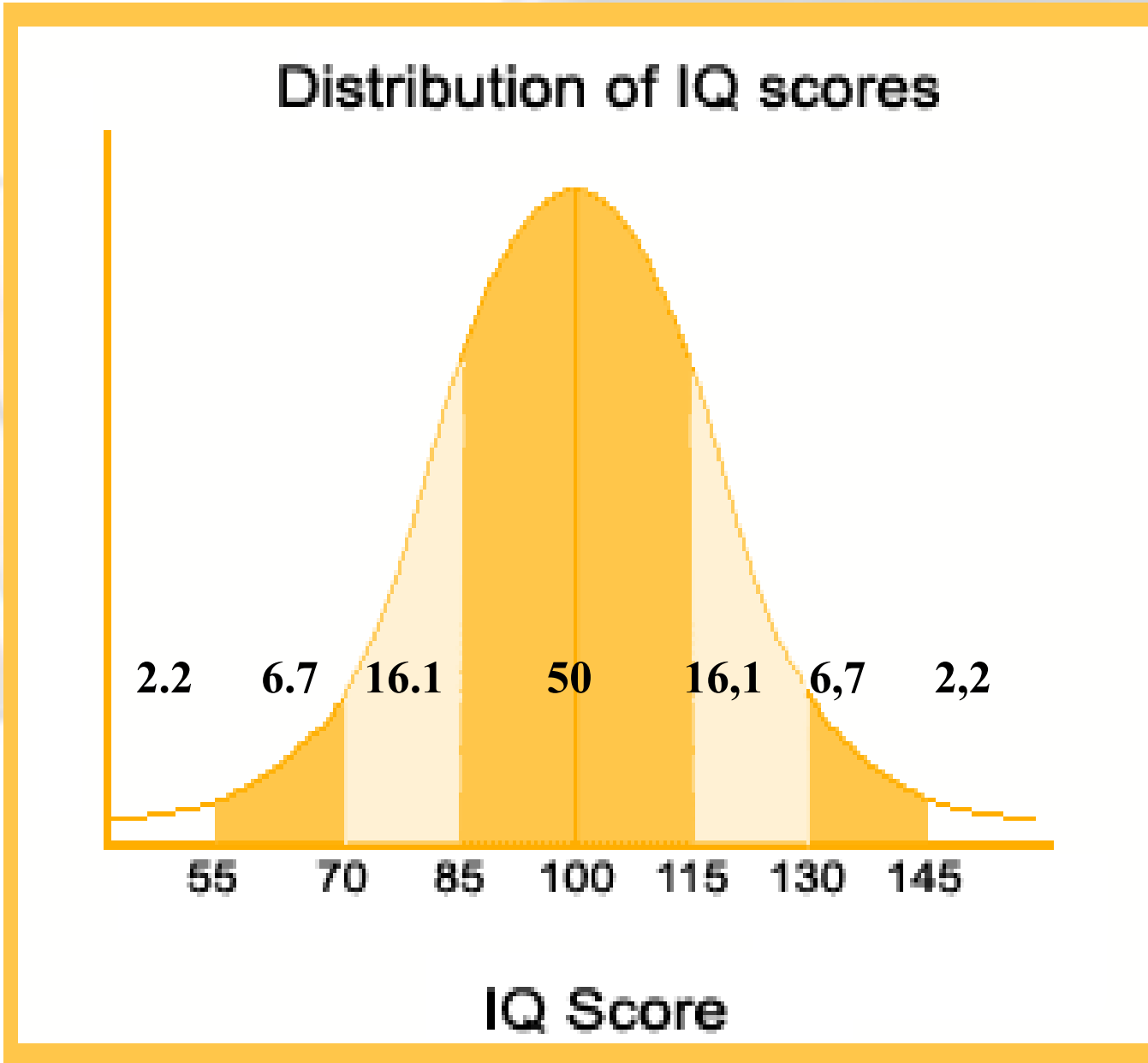
80-89 = low average

90-109 = average

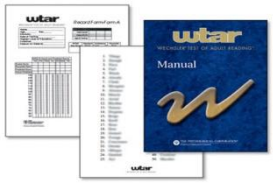
110-119 = high average

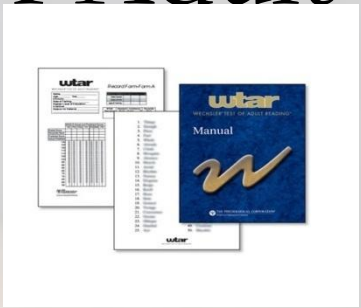
120-129 = superior

>130 = very superior



WTAR – Wechsler Test of Adult Reading





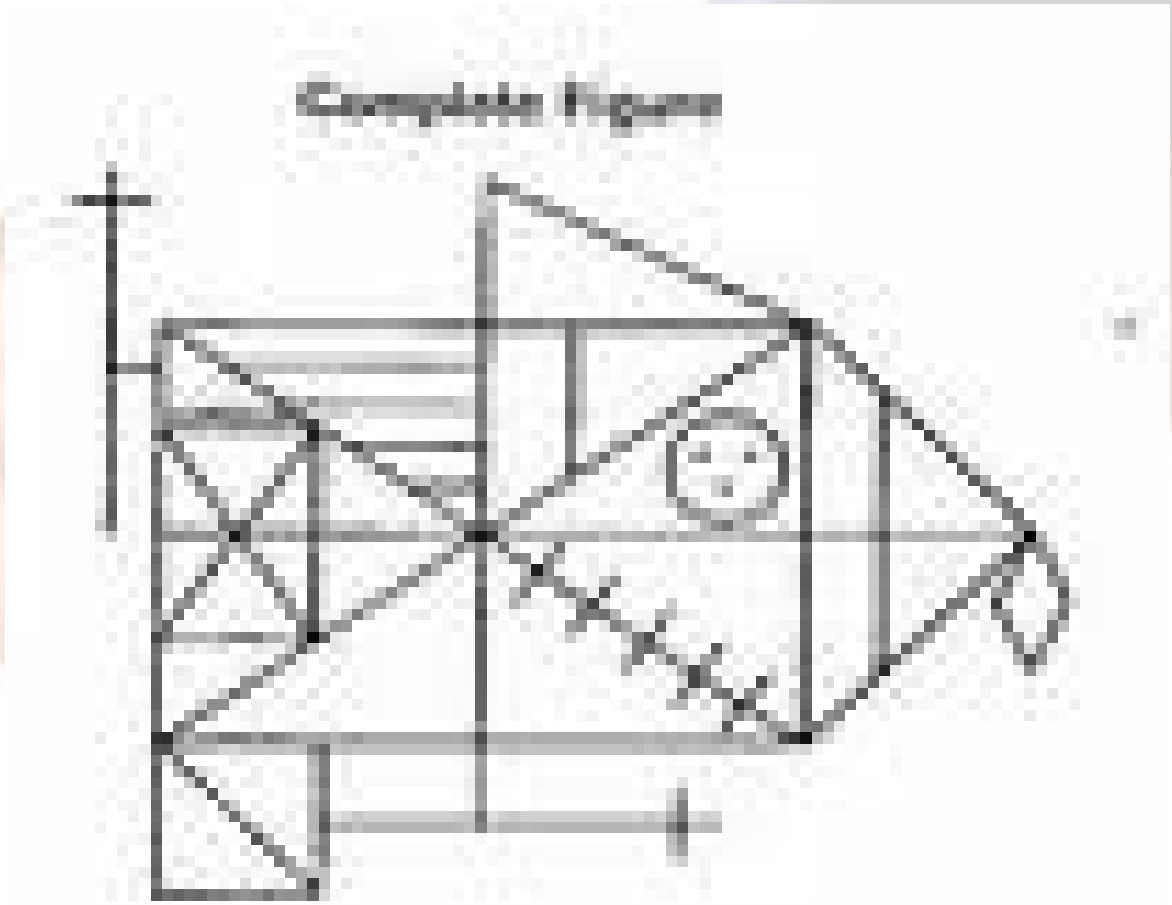
- Used to estimate pre-morbid intellectual and memory abilities
- Essentially a word list the client is asked to read aloud, the administrator notes pronounciation
- Predicated on the fact that reading recognition is relatively stable in the presence of cognitive declines associated with normal aging or brain injury
- Developed and co-normed simultaneously with the WAIS–III and WMS–III

Ray Auditory Verbal Learning Test
RAVLT

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
1.	Violin	Violin	Violin	Violin	Violin
2.	Tree	Tree	Tree	Tree	Tree
3.	Scarf	Scraf	Scarf	Scarf	Scarf
4.	Ham	Ham	Ham	Ham	Ham
5.	Suitcase	Suitcase	Suitcase	Suitcase	Suitcase
6.	Cousin	Cousin	Cousin	Cousin	Cousin
7.	Earth	Earth	Earth	Earth	Earth
8.	Stairs	Stairs	Stairs	Stairs	Stairs
9.	Dog	Dog	Dog	Dog	Dog
10.	Banana	Banana	Banana	Banana	Banana
11.	Town	Town	Town	Town	Town
12.	Radio	Radio	Radio	Radio	Radio
13.	Hunter	Hunter	Hunter	Hunter	Hunter
14.	Bucket	Bucket	Bucket	Bucket	Bucker
15.	Field	Field	Field	Field	Field
Total	_____	_____	_____	_____	_____

Total Score _____

Ray Figure Copy

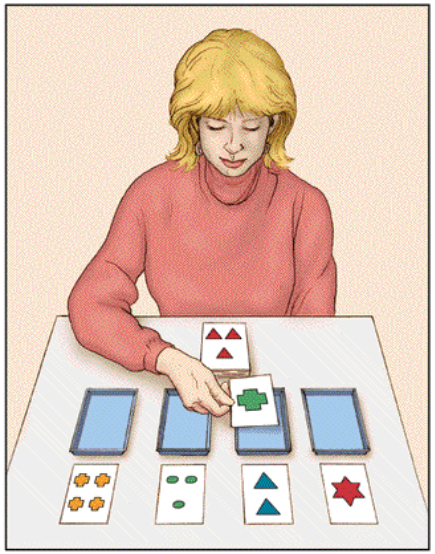


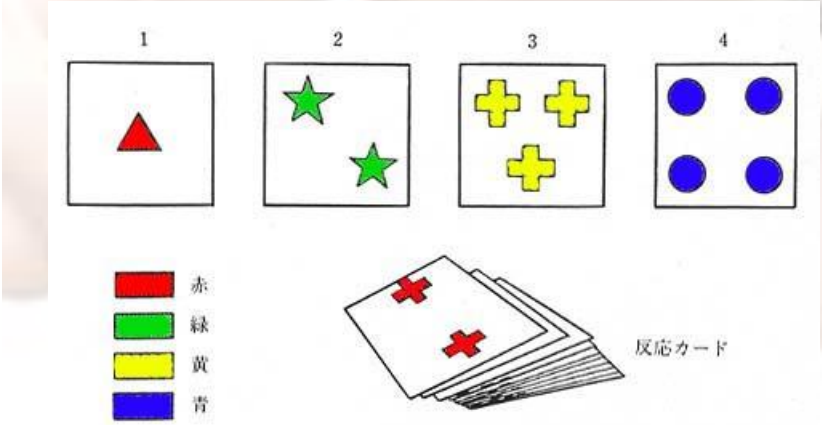
WMS-III UK
Logical Memory I

Story A: Anna Thompson of South London, employed as a cook in a school canteen, reported at the police station that she had been help up on the High Street the night before and robbed of fifty-six pounds. She had four small children, the rent was due and they had not eaten for two days. The police, touched by the woman's story, made up a collection for her.

WCST Executive functioning

► Wisconsin Card Sorting Test





Hayling Initiation

Hayling Section 1: Sensible Completion

1. He posted a letter with a _____
2. In the first space enter your or: In the first blank enter your _____
3. The old house will be torn _____
4. It's hard to admit when one is _____
5. The job was easy most of the _____
6. When you go to bed, turn off the _____
7. The game was stopped when it started to _____
8. He scraped the cold food from his _____
9. The Dispute was settled by a third _____
10. Three people were killed by a major _____
11. The baby cried and upset her _____

Hayling Inhibition

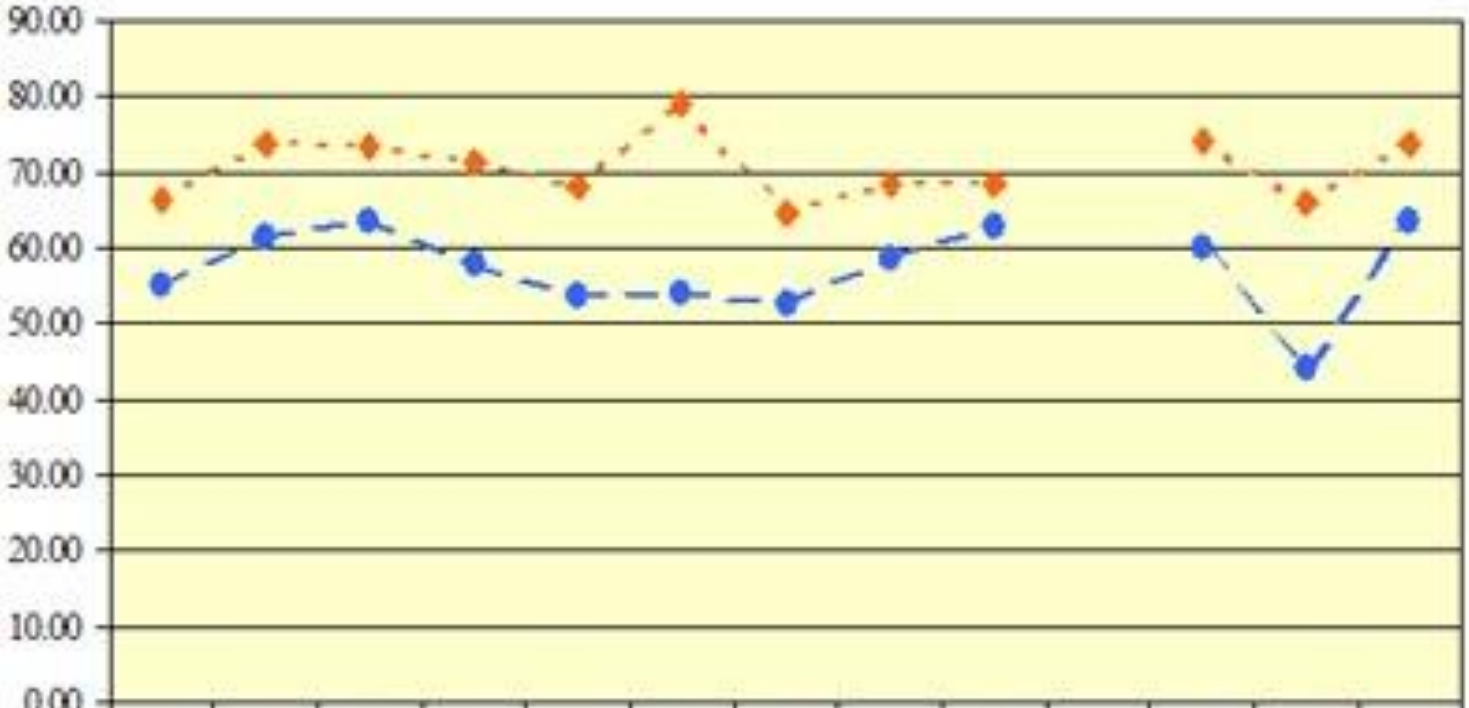
Hayling Section 2: Unconnected Completion

1. The captain wanted to stay with the sinking _____
2. They went as far as they _____
3. Most cats see very well at _____
4. Jean was glad the affair was _____
5. The whole town came to hear the mayor _____
6. Most sharks attack very close to _____
7. None of the books made any _____
8. The dough was out in hot _____
9. She called the husband at his _____
10. All the guests had a very good _____

Emotion

- It is important to assess the emotional impact of any neuropsychological disorders
- Anxiety, depression, apathy, euphoria etc.
- A number of tools exist for this purpose including the SCL-90, which examines 9 areas of symptoms and complaints that are common to medical and psychiatric patients
- BDI and BAI, which measure levels of depression and anxiety, respectively

SCL-90



	Som	O-C	I-S	Dep	Anx	Hos	Phob	Par	Psy		GSI	PSDI	PST
Baseline	66.33	73.67	73.33	71.33	68	79	64.67	68.33	68.33		74	66	73.67
PostTX	55	61.5	63.5	58	53.5	54	52.5	58.5	63		60	44	63.5

Lets put it all together…

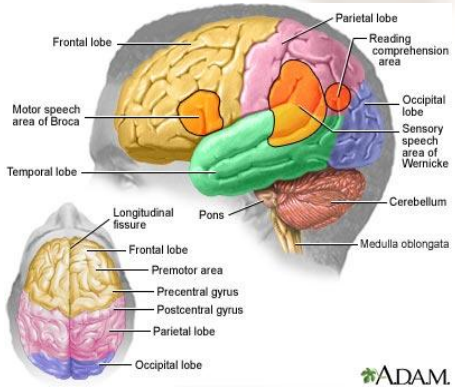
A Neuropsychological Profile

WAIS III	WMS III (LM I &II)	RAVLT	Ray Figure	BAI BDI	Hayling	WCST
FSIQ 80	**Immediate** Scaled score 6 Percentile 9th	**Learning** Total score 34 >2 SD below ave	**Copy:**>16 Time 172 s	Minim	**Initiat.** Preserved	**Pr. Sol** **Cog Fl** 37th Perc.
VIQ 77	**Delayed** Scaled score 3 Percentile 1st	**Trial 6&7** T6 → 4 (1SD below) T7→ 5 (> 2 SD below)	**Immediate** T-score <20 Percentile <1	Mild BDI: 15 BAI: 10	**Inhib** Impaired	**Attent.** **Track.** **Set Man** 2.5th Perc.
PIQ 87	**Recognition** Scaled score 9 Percentile 37th	**Delayed** Score 5 (2 SD below)	**Delayed** T-score <20 Percentile <1	Mod		**Persev** **Frust** 2.5th Perc.
		Recognition Score 12 (2 SD below)	**Recog.** T-score 28 Percentile 1	Severe		

Conclusions

- A basic neuropsychological battery should include most of the tests mentioned above

- Interpretation should be the outcome of cross-analysing each single result within the context of the overall neuropsychological profile



Rehabilitation Strategies

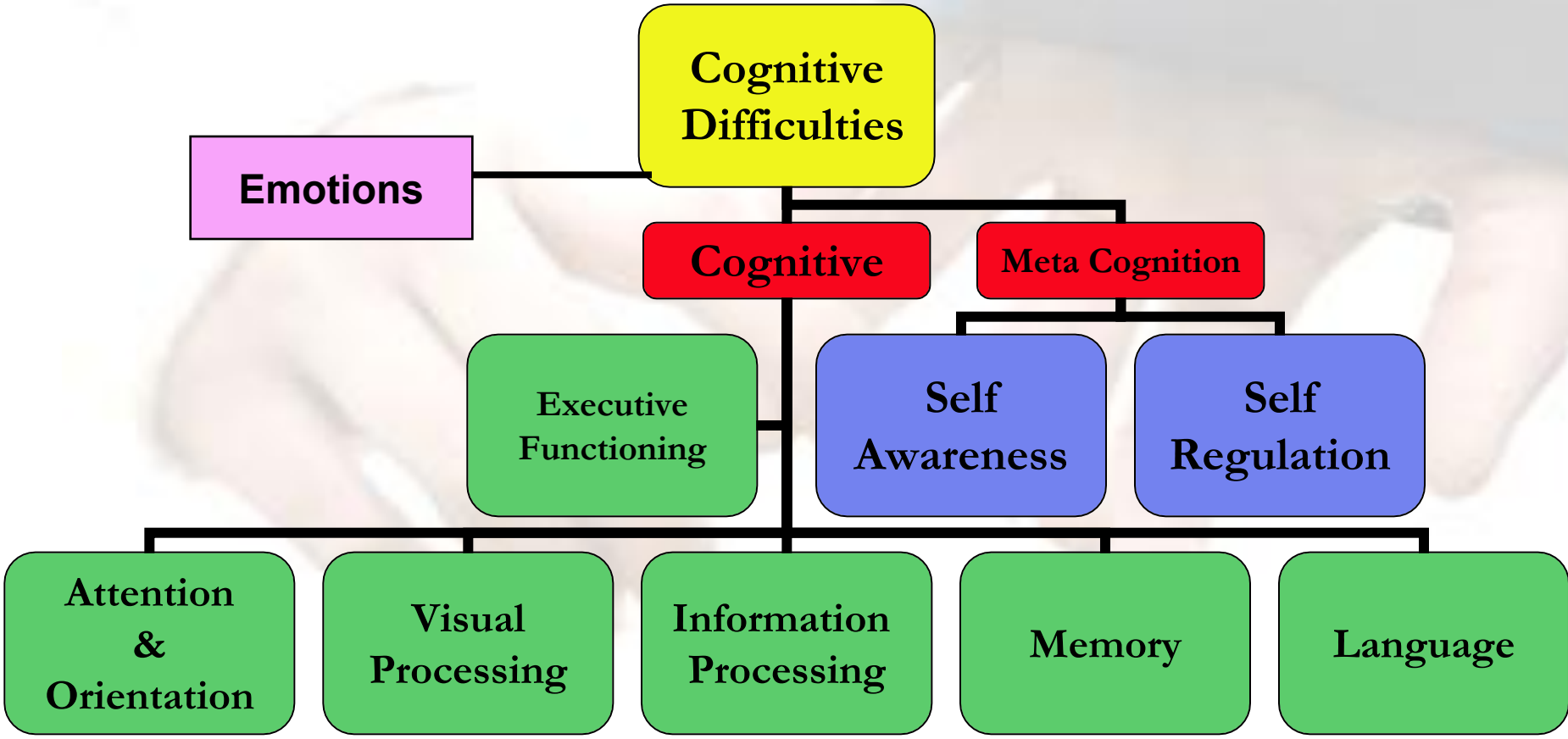
Consequences of Brain Injury

- Physical
- Cognitive
- Psychological/Emotional
- Behavioural
- Social
- Financial
- Family

Consequences of ABI

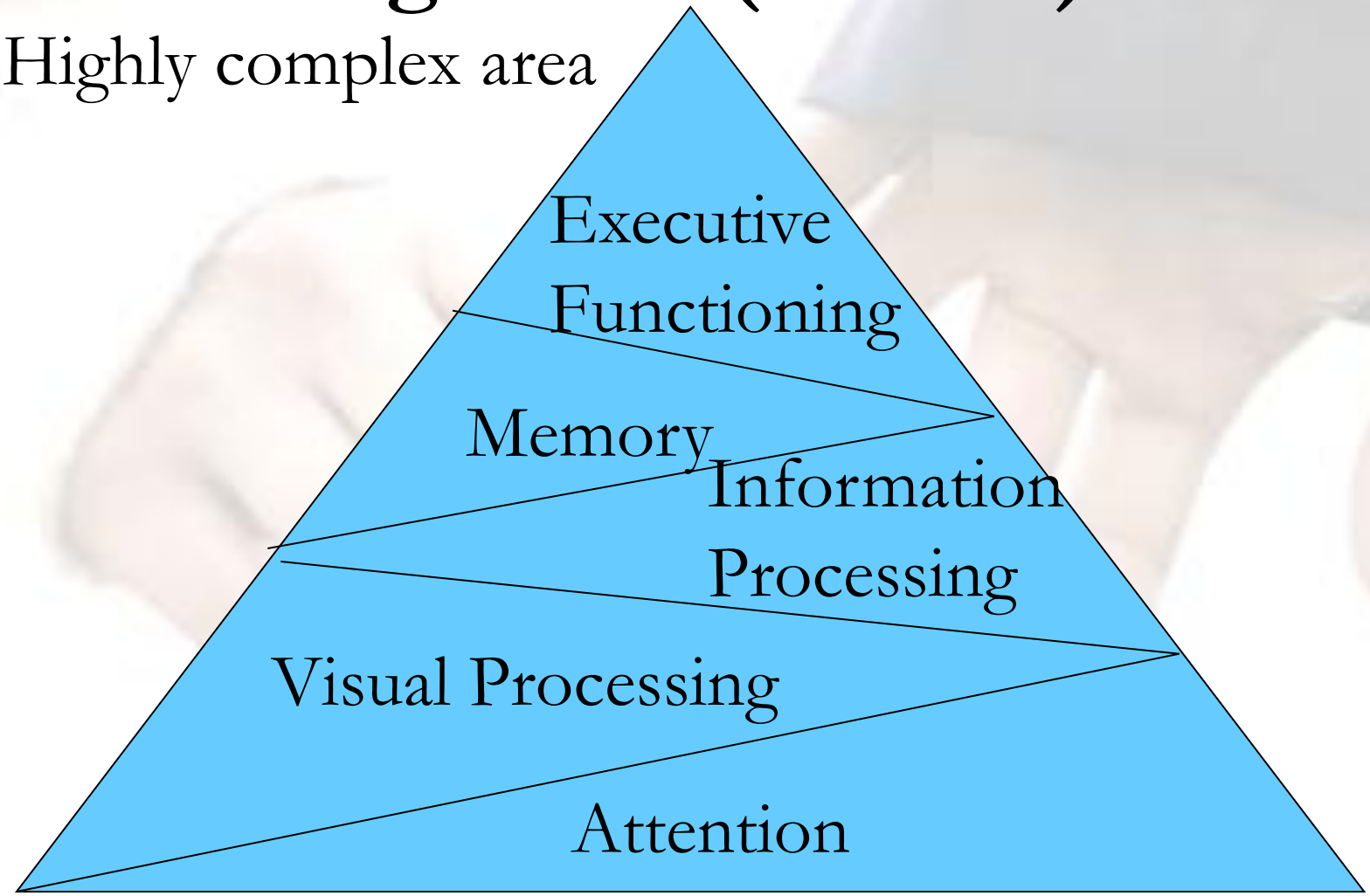
- **Vary greatly**, depending on:
  - the extent of the injury
  - the site of the injury
  - pre-morbid factors

Cognitive Consequences

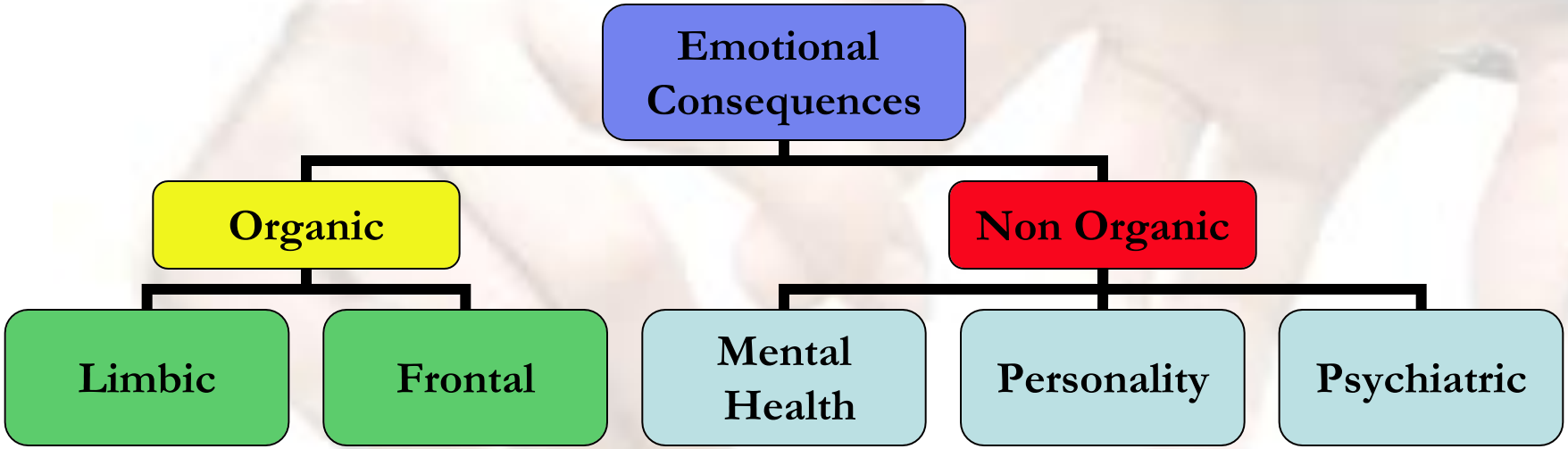


Cognition (Contd.)

- Highly complex area



Emotional Consequences



Emotional Impact on the Family

- Panic/Chaos
- Denial
- Anxiety
- Fear
- Stress
- Anger
- Frustration
- Irritability
- Shame
- Embarrassment
- Guilt
- Grief / Loss
- Isolation/Loneliness
- Depression
- Helplessness
- Hopelessness

Financial consequences

- Financial worries
- Disruption to employment
- Reduced leisure time
- Reduced social network

Social Consequences

- Isolation
- Unemployment
- Relationship difficulties
- Family conflict
- Caregiver stress

Rehabilitation

- Rehabilitation programs use neuropsychological assessment information as an aid to tailor treatments based on their potential
- Application of treatments leads to the need for further assessments – evaluation and efficacy for the benefit of the client, and for rehabilitation, and improving treatment
- Examines a client's relative strengths and weaknesses, ability for rehabilitation, and monitors progress

ABI and Rehabilitation

- Spontaneous Recovery can occur following stabilization of the initial brain injury
- Therapeutic intervention is believed to complement or enhance the natural recovery process
- Restitution and Amelioration

Restitution

- "The process of trying to remedy the defective function itself in an attempt to attain a level of function that closely resembles the client's premorbid capacity" (Miller, 1980)
- Aim is to restore old skills, which involves challenging damaged parts of the brain, and teach new skills, which stimulates the unaffected areas.

Amelioration

- This involves the acceptance that the specific deficits, or difficulties, that are caused by an ABI will be ongoing.
- The aim of amelioration is to teach the client how to minimise the extent to which these problems impact on their daily lives.

Compensation Strategies

- Use these strategies to cope with the effects of an ABI
- Psychosocial rehabilitation strategies
- Neurorehabilitation strategies

Neurorehabilitation

- This is a complex multidisciplinary process aimed at recovering from, minimising and/or compensating for functional alterations in a person who has suffered from a nervous system injury.
- Effective and high quality neurorehabilitation must be: holistic; client-focused; inclusive; participatory; allow for independence; resolve problems; and allow for integration into the larger community

Neurorehabilitation (Contd.)

- Should be used to deal with cognitive problems that clients are experiencing.

- These can include problems with insight, memory, executive functions, attention, and information processing

Psychosocial Rehabiliation

- Psychosocial rehabilitation, is the process of restoration of community functioning and wellbeing of an individual who has been diagnosed with a psychological disorder
- Can be seen as consisting of eight main areas: psychiatric/psychological; social; vocational/educational; basic living skills; financial; community/legal; health/medical; and housing

Cognitive Rehabilitation

- Focuses on the development of cognitive skills, which have been lost or altered as a result of neurological trauma.
- Aim of treatment is to improve the ability to carry out everyday tasks.
- Process includes reattainment of skills through direct retraining, use of compensatory strategies, education and application into everyday life activities.

Strategies to Improve Insight

- Point out the person's difficulties to them as they arise, in a non-judgemental way
- Encourage the person to meet with other people with ABI where possible
- Be gentle, awareness can improve, however denial can be a protective factor
- Only in safe and supervised situations allow the person, where possible to attempt things that you feel they are no longer capable of. Sometimes the experience of failure can help foster awareness

Strategies to Improve Attention

- Minimise distraction
- Time management – planning a programme of activities ahead of time.
- Give warning for preparation time before making a transition to a different activity or place
- Pacing – distribute the activity over a period of time, including frequent breaks
- Rehearsal – Encourage the person to repeat what someone has said in their own words ie ‘ let me repeat this to you to see if I have it’

Strategies to Improve Information Processing

- Pacing - Slow down when giving instructions, or during conversation
- Timing - Develop awareness of the best times to complete more complex activities.
- Write lists or notes, encourage the person with the ABI to do the same
- Encourage the person to check and re-check work

Strategies for Improving Executive Functioning

- STRUCTURE

- Encourage the person with brain injury to set goals, then break these down into small tasks.

- Encourage them to use checklists

- Help the person to structure their day by writing a plan of tasks they need to do and the time frame. Include all activities

Internal Strategies to Improve Memory

- Encourage internal repetition
- Introduce the idea of verbal association
- Encourage the use of imagery – sometimes pictures can be helpful cues to memory
- Chunking - break down information into small and relevant "chunks" or categories, rather than long streams of information.

External Strategies to Improve Memory

- Structure
- Central Information Point
- Folder for Correspondence
- Notepads and notice boards
- Place items strategically
- Diary
- Mobile Phones
- Lists and notes
- Wall charts/planners

Managing Emotional Difficulties after ABI

- Structure and Routine
- Exercise
- Diet
- Medication (where appropriate)
- Psychological Intervention/ therapy (where appropriate)
- Encourage the person to seek support from family/friends when necessary

A Drop in the Ocean of Knowledge

Any Questions?

Bibliografia

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- *Textbook of Clinical Neuropsychology* - Joel E. Morgan e Joseph H. Ricker

- *APA Handbook of Neuropsychology* - American Psychological Association

- *Neuropsicologia cognitiva* di N. G. Martin & Michela Balconi

- Neurotorium 3D Atlas https://neurotorium.org/tool/brain-atlas/