

Neuropsychology and intellectual disabilities

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www.neuro-cog.com
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Selección y actualización de diapositivas para
las clases impartidas en el curso

**NEUROBIOLOGIA DE LA CONDUCTA,
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Neuropsychology and intellectual disabilities

- **Objective:** To discuss issues on neuropsychology & behavioral neurology in the field of NDD & ID
- **Development:**
 - From molecules to behavior...
 - Neuropsychological studies...
 - Cognitive perspectives...
 - Ontogenesis & Retrogenesis...
- **Discussion:** Future directions. Projects.

Ontogenesis – Development

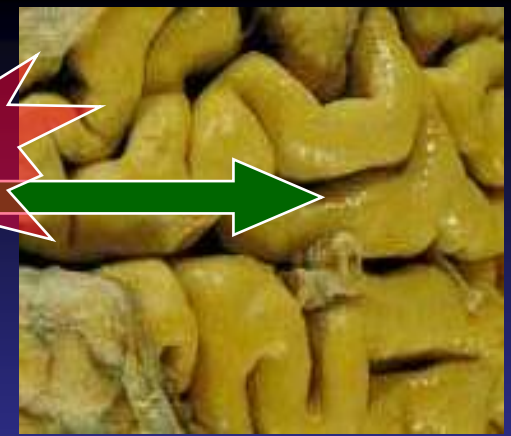
- Development of a normal adult structure (species)
- Development of a normal adult functional capacity
 - Integration of external influences (learning)
- Maintaining health

Pulsifer 1996

Five major causes of mental retardation

1. Fetal alcohol syndrome
2. Down's syndrome
3. Fragile X syndrome
4. Prader Willy syndrome
5. Angelman syndrome

ETIOLOGIES



Mental retardation
/intellectual disability
Behavioral disturbances
“focal impairments”

NIH PubMed

Date: 6 oct 2005 (Limit: from 1990 to 2005)

Syndrome	Papers	Review	Cog	Cog Review	Neurops	Neurops Review
<i>Down</i>	6580	756	210	24	5	1
<i>Fragile X</i>	1868	344	98	22	7	2
<i>Turner</i>	1634	232	47	11	2	1
<i>Prader Willi</i>	1045	180	23	4	1	1
<i>Williams</i>	605	84	92	18	4	2
<i>Angelman</i>	534	111	8	2	1	1
<i>Sotos</i>	122	15	4	1	0	0

Genetic disorders

- (2003) unique opportunity to investigate the neuromolecular basis of complex cognitive behaviour, and develop integrated approaches to study gene function and genotype-phenotype correlations. *Tassabehji. Hum Mol Genet. 2003*
- (2002) Mutated genes - syndromes of mental retardation or cognitive defects - placing gene products within signaling networks - how learning occurs and how memories are formed and sustained. *Weeber, Levenson, Sweatt. Mol Interv. 2002, 2:376-391*

Williams syndrome

- *Characteristic cardiac defect*
- *Typical facial appearance*
- **Cognitive profile**
 - Severe visuospatial cognitive deficits
 - » Deficient visuoconstructive abilities
 - Relative sparing of language, face recognition
 - Emotional affinity for music
 - Attentional deficits and hyperactivity

Deletion on chromosome 7

Williams syndrome. Neuropsychology, 1

■ Cognitive heterogeneity

- Porter et al 2005: Not all individuals show the profile of strength in verbal abilities and weakness in spatial functions

■ Evolution

- Vicari et al, 2004: The profile of younger children is different in respect to those of the older children (Lexical, grammatical, semantic, phonologic, visuospatial..)

■ Object perception and naming

- Landau et al, 2005: Selective sparing of basic mechanisms of object recognition. Delay or arrest in recognition of objects from unusual views (selective impairment of parietal areas)

■ Neural basis of visuospatial construction deficits

- Meyer-Lindenberg et al, 2004: Hypoactivation in the parietal portion of the dorsal stream. Parietal gray matter volume reduction

■ Interaction between domains (spatial – language)

- Phillips et al, 2004: Comprehension of spatial language terms

Williams syndrome. Neuropsychology, 2

■ Characterization of the musical phenotypes

- Levitin et al 2004: Great emotional responses to music, interest in music at an earlier age, more hours per week listening music
- Derouelle et al 2005: Global and local music perception

■ Emotion and face processing. Hipersociality...

- Reis et al 2004: Volumetric analysis: disproportionate increases in volume & density in several areas known to participate in emotion & face procession: amigdala, anterior cingulate, orbital-medial prefrontal...
- Meyer-Linderberger et al 2005: Hipersociality combined with increased non-social anxiety. Reduced amygdale activation for threatening faces vs increased activation for threatening scenes
 - Suggest a genetically controlled neural circuitry regulating human social behavior.

Basic neurobiological principles

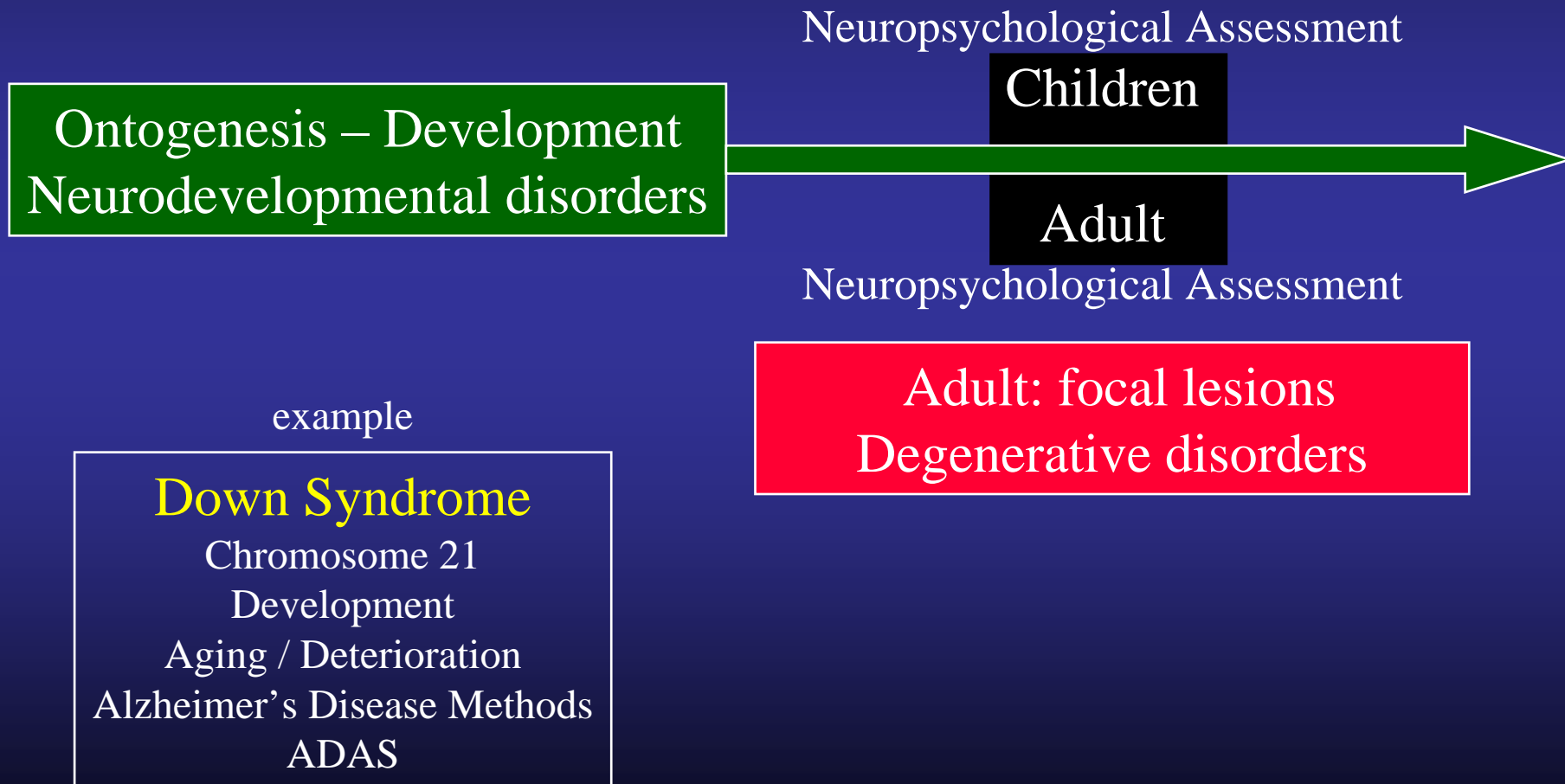
Neurodevelopmental Disorders = Neurodegenerative Disorders

1. **Selective loss** of specific populations of neurones
2. The neuronal loss **involves nuclei that are anatomically related to functional systems** such as...
Extrapyramidal, pyramidal, limbic, cognitive
3. The **particular population/s** of neurones that are vulnerable in each disorder determines the clinical presentation.
4. **The distribution of the pathology is more predicative of the clinical presentation than the molecular nature of the pathology**

Classification of neurodevelopmental & neurodegenerative diseases

- Clinical syndromes or anatomical distribution of pathology
 - **CLINICAL PATTERN** = Clinical Terms
- Basic mechanisms of neuronal loss & the basis for the selective vulnerability.
 - **MOLECULAR PATTERN** = Molecular terms
 - » Molecular genetics
 - » Biochemical and immunochemical studies
 - » Major molecules

Neuropsychological Assessment Tools... (norms)



Genetic disorders... modularity

- “...neurocognitive architecture follows the same principles in typical and atypical development” Tager-Flusberg. *Neuron*, 2004; 43:595-6.
- “.../... challenges the use of adult neuropsychological models for explaining developmental disorders of genetic origin” Paterson et al. *Science* 1999,286: 2283-4
 - Numerosity judgments: well in infancy but poorly in adulthood
 - Language: poorly in infancy but well in adulthood
- Molecular Genetics: “Genetic disorders provide clues to the constraints on plasticity that shape the outcome of development” “Cognitive modules are the outcome of development, not its starting point” (*Challenge to the view of cognitive modules specified in the infant brain*) Karniloff-Smith, Thomas. *Dev Psychopatol.* 2003, 14:969-90.

Neuropsychological issues, 4

Ontogenesis *versus* Retrogenesis

AD as a model

The case of the MMSE

Developmental ages

	Capacities	Developmental ages
	No deficit	Adult
	Demanding settings	13 - 19 years: Adolescence
	Complex tasks	8 - 12 years
	Choosing proper attire	5 - 7 years
	a. Dressing	a. 5 years
	b. Bathing	b. 4 years
	c. Toileting	c. 4 years
	d. Urinary incontinence	d. 3 - 4½ years
	e. Fecal incontinence	e. 2 - 3 years
	a - f. Speech - Hold head up	a - f. 15 - 1 months



Dementia stages – Developmental ages

Dementia Stages	Deficits / Capacities	Developmental ages
1 & 2: Normal	No deficit	Adult
3: MCI	Demanding settings	13 - 19 years: Adolescence
4: Mild	Complex tasks	8 – 12 years
5: Moderate	Choosing proper attire	5 – 7 years
6: Moderately Severe	<ul style="list-style-type: none"> a. Dressing b. Bathing c. Toileting d. Urinary incontinence e. Fecal incontinence 	<ul style="list-style-type: none"> a. 5 years b. 4 years c. 4 years d. 3 - 4½ years e. 2 – 3 years
7: Severe	a – f. Speech - Hold head up	a – f. 15 – 1 months



Ontogenesis – Development
Neurodevelopmental disorders

Mental retardation – intellectual disability

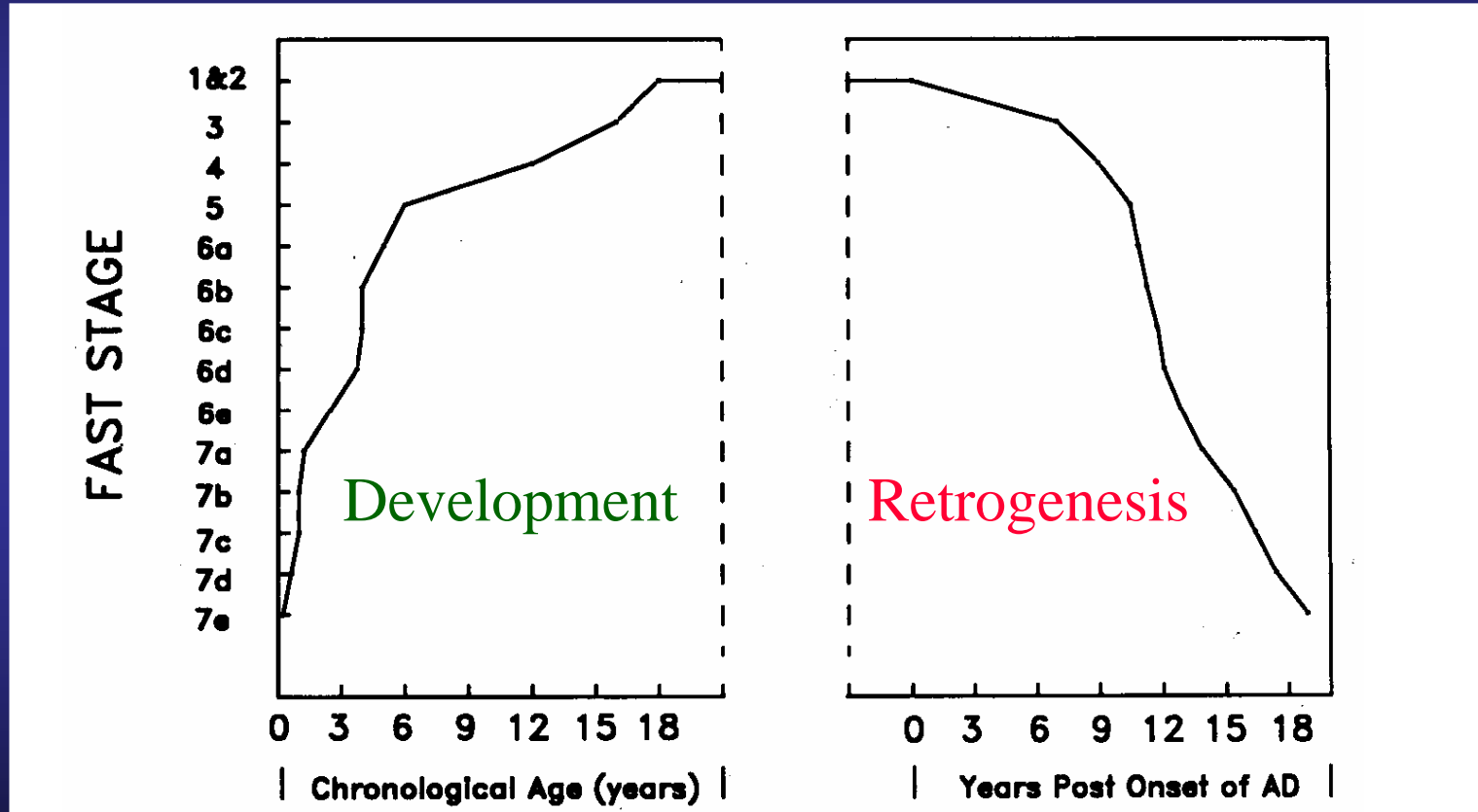
“focal impairments”

Dementia – intellectual deficits

“focal impairments”

Retrogenesis
Degenerative disorders

Retrogenesis



Chronological Age (years)

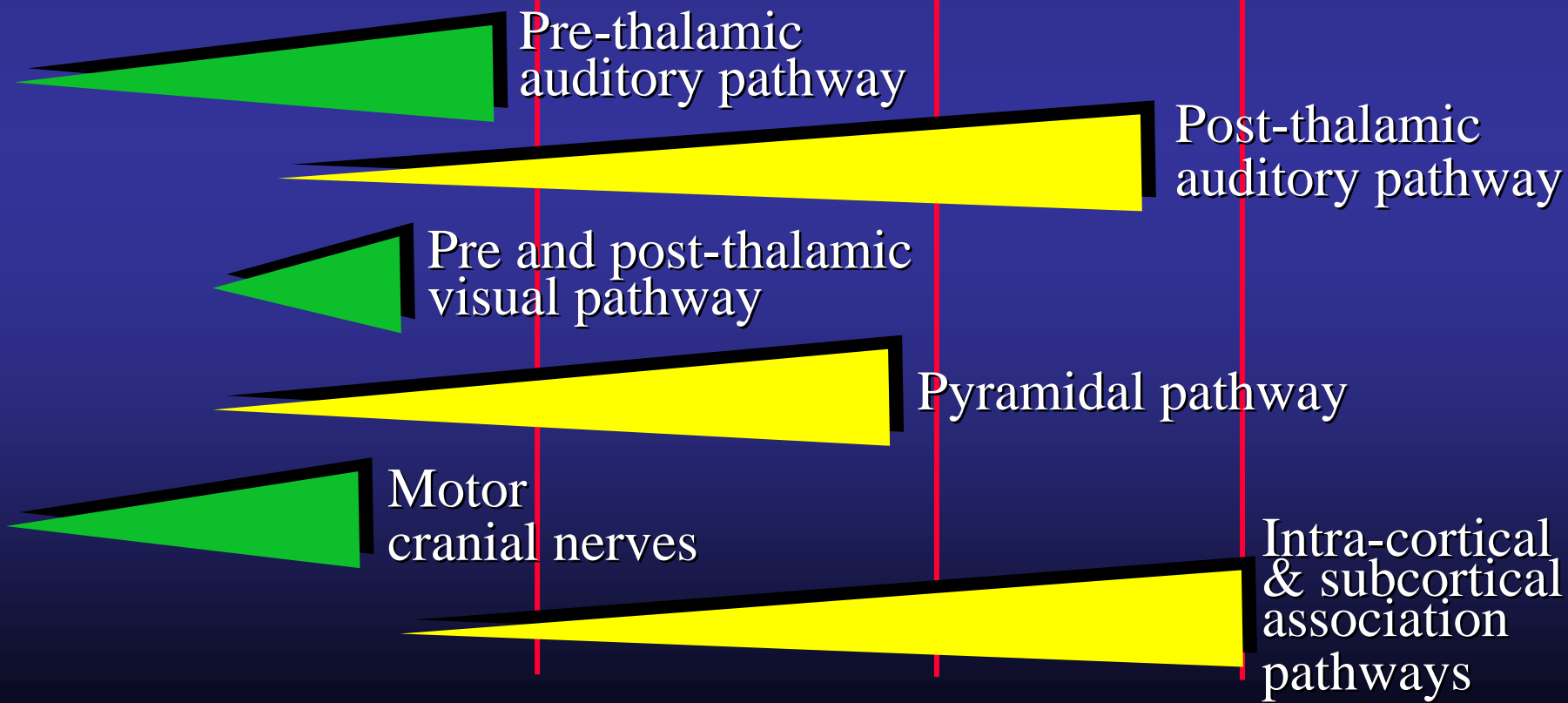
Years Post Onset AD

Myelination (Yakovlev & Lecours, 1967)

GDS:



Prenatal (m)	First year (months)	years 2 - 7	
4 5 6 7 8 9	1 2 3 4 5 6 7 8 9 10 11 12	2 3 4 5 6 7	8 9 10 12 15





PERGAMON

Neuropsychologia 39 (2001) 1150–1157

NEUROPSYCHOLOGIA

www.elsevier.com/locate/neuropsychologia

Clinical validity of the ‘mini-mental state’ for Spanish speaking communities

Rafael Blesa ^{a,*}, Montse Pujol ^a, Miguel Aguilar ^b, Pilar Santacruz ^a,
Imma Bertran-Serra ^c, Gonzalo Hernández ^d, José M. Sol ^d, Jordi Peña-Casanova ^e,
NORMACODEM Group ^e

Neuropsychologia, 39 (2001) 1150-1157

Normative study of the Mini Mental Status Examination in Spanish child population

S Rubial-Álvarez, MC Machado, E Sintas, S de Sola,
P Böhm, J Peña-Casanova.

Submitted

Discussion / Future directions

Basic neuropsychological profiles

Barcelona test

From adults to neurodevelopmental
disorders

Barcelona-test II-ID... in context

- Need of Npsych Test developed and validated for adults with ID (Bellugi et al, 2000; Haxby et al 2004)
- Current tools are IC based. Heterogeneity
- Multicenter project
 - Asociacion Catalana Prader Willi
 - Fundacio Catalana per a la síndrome de Down
 - Servicio de Endocrinología. CH Parc Taulí
 - Secció de Neurologia de la Conducta. Hospital del Mar
 - AMPANS
 - FUPAR
 - Fundació Ramón Noguera
 - ALTEM

Barcelona-test II-ID... in context

■ Subjects

- Age 18-65 y old
- ID: discrete – moderate
- Caregiver

■ Diagnosis

- Down syndrome, Prader Willi Syndrome, Fragile X syndrome, (Sturge Weber)

■ Tools

- BRIEF (Behavior Rating Inventory of Executive Function). IDDD, MMSE... .. /... **Barcelona Test II - ID**

BT-II-ID development

(Peña-Casanova, Esteba, Novell)

- Critical Review... ID subject needs
- Pilot assesment of subjects
- Adaptation: modifications, additions...
- FIELD STUDY (Current task)
 - Recruitment: October 2005: 63 subjects
(Susanna Esteba)

Adult version (BT-II): Current recruitment 198 subjects
(Coordinator: Sonia Quiñones)

Barcelona-test II – ID... in context

- Recruitment: Current status october 2005
- Total subjects: 63
 - Down S: 30
 - Prader Willi S: 17
 - Fragile X S: 11
 - (Sturge Weber: 5)
- Mean age: 28.1 years (SD 7.7. Range 18-46)
- ID: mild 57%, moderate: 43%

Practicality, suitability

- Mean assessment time (all test included in the project): 5.30 hours (3.5 to 7)
 - Different days (2 or 3)
- Barcelona test II-ID: Mean Time 3 hours (!)
- Practicality. Barcelona test II-ID: 91.6%

Intellectual Disability Profile

- Research
- Experimental
- Provisional

Floating profile

Lenguaje: Fluencia y Cont.inf.	0 1 2	3 4	5	6					
Orientación en persona	0 14 19	20 23 24							25
Orientación en espacio	0 6 12	13 15 17	22						23
Orientación en tiempo	0 10 24	38	48 62	65					67
Orientación total	0 35 59	72 86 100	104 113						115
Repetición de dígitos directos span	0 1	2 3	4	5	6	7	8	9	
Repetición dígitos directos eficiencia	0 1	2 3 4	5	6	7	8	9	10	11
Repetición de dígitos inversos span	0	2	3	4	5	6	7	8	9
Repetición dígitos inversos eficiencia	0	2	3	4	5	6	7	8	9
Series automáticas orden directo	0 3 4 5	6 7 8	9	10	11	12	13	14	15
Series automáticas orden directo T	0	1 2	3 4	5 6	7 8	9 10	11 12	13 14	15 16
Series automáticas orden inverso	0	2 3	4 5	6 7	8 9	10 11	12 13	14 15	16 17
Series automáticas orden inverso T	0	1 2	3 4	5 6	7 8	9 10	11 12	13 14	15 16
Series automáticas total	0 9 13 15	17 18 20 21 22	24 28 30 33 35	36	39	42			
Comprensión verbal	0 7 8	9 10	11	12	13	14	15	16	17
Comprensión escrita	0 1 2	3 4 5	6 7 8	9 10	11 12	13 14	15 16	17 18	19 20
Denominación visual	0 14	16 17 18	19	20	21	22	23	24	25
Denominación visual T	0 36 43	47 49 51	53 54 57	58	60	63	64	66	68
Repetición de logotomos	0 1	2 3 4	5	6	7	8	9	10	11
Repetición de palabras	0 4	5	6 7	8 9	10 11	12 13	14 15	16 17	18 19
Lectura de números	0 2 4	5 6 7	8 9	10 11	12 13	14 15	16 17	18 19	20 21
Lectura de números T	0 9 12 14	15 18 19	21 24 27	28	30	33	36	39	42
Lectura de logotomos	0 3	4 5	6 7	8 9	10 11	12 13	14 15	16 17	18 19
Lectura de logotomos T	0 3 6 7	8 10 13 15	16 17	18 19	20 21	22 23	24 25	26 27	28 29
Lectura de palabras	0 4	5 6 7	8 9	10 11	12 13	14 15	16 17	18 19	20 21
Lectura de palabras T	0 8 13	15 17	18 19	20 21	22 23	24 25	26 27	28 29	30 31
Lectura Total	0 15	16 17 18	19 20	21 22	23 24	25 26	27 28	29 30	31 32
Lectura Total T	0 25 42	45 48 50 51	54 55 58 60	63	64	66			
Mecánica de la escritura: (D) - (I)	0	3 4	5	6	7	8	9	10	11
Denominación escrita	0	3 4	5 6	7 8	9 10	11 12	13 14	15 16	17 18
Denominación escrita T	0 3 4	5 6 7 8	9 10 11 12	13 14	15 16	17 18	19 20	21 22	23 24
Dictado de números	0 4	5 6 7	8 9	10 11	12 13	14 15	16 17	18 19	20 21
Dictado de números T	0 12 14	15 17 18 19	20 21 22 24	26 28 29	30				
Dictado de logotomos	0	1 2 3	4 5	6 7	8 9	10 11	12 13	14 15	16 17
Dictado de logotomos T	0	1 2 4 5	6 7 8 9	10 11 12 13	14 15 16 17	18 19 20 21	22 23 24 25	26 27 28 29	30 31 32
Dictado de palabras	0 1	2 3 4 5	6 7 8 9	10 11 12 13	14 15 16 17	18 19 20 21	22 23 24 25	26 27 28 29	30 31 32
Dictado de palabras T	0 2 5	8 9 10 12 13	14 16	17 18	19 20	21 22	23 24	25 26	27 28
Escritura dictado total	0 8	11 13 14 15 16 17	18 20 22	24 25 26	28				
Escritura dictado total T	0 18 21 25	30 31 33 37 39 42	46 48 51 54	58 65 67	84				
Ejecución motora series	0 1	2 3 4 5	6	7	8	9	10	11	12
Ejecución motora gráfica	0	1 2 3	4 5	6 7	8 9	10 11	12 13	14 15	16 17
Gesto simbólico - orden (MD)	0 6 7 8	9 10 11	12	13	14	15	16	17	18
Gesto simbólico - imitación (MD)	0 8 10 12	13 14	15	16	17	18	19	20	21
Gesto simbólico - imitación (MND)	0 9 10 11	12 13	14	15	16	17	18	19	20
Gesto simbólico total	0 27 28 29	30 34 36 37	39 40 41	42 43 45					
Praxitomos	0 6 8	9 10 11	12 13	14 15	16 17	18 19	20 21	22 23	24 25
Praxis orofonatoria	0 7 8 10	11 12 13 14	15 16	17 18 19	22				
Curva aprendizaje E5	0 2 3	4 5 6	7 8 9	10 11 12					
Curva aprendizaje diferida E6	0 1	2 4 5 6	7 8 9	10 11 12					
Reconocimiento diferido curva	0 5 7	8 9 10 11	12 13	14 15	16 17	18 19	20 21	22 23	24 25
Memoria de textos inmediata	0 1 2 4	6 7 8	9 10 11	12 14 21					
Memoria textos inmediata claves	0 1 2 4	6 7 8	9 10 11	12 14 21					
Memoria textos inmediata total	0 2 4 6	7 11 13 134 15 17	18 19 21 22 23	24 26 28 42					
Memoria de textos diferida	0	2 3 4 6	7 8 9	10 12 14 21					
Memoria textos diferida claves	0 1 2 3	5 6 7 9	10 11 12 13	15 17 18 21					
Memoria textos diferida total	0 2 3 8	10 13 15 17 18	19 22 25 31	34 36 40 42					
Memoria Prospectiva	0	1 2 3	4 5	6 7	8 9	10 11	12 13	14 15	16 17
Memoria visual diferida	0	1 2 3	4 5	6 7	8 9	10 11	12 13	14 15	16 17
Memoria visual reconocimiento	0 3 5	6 7 9 10	11	12	13	14	15	16	17
Planificación-Organización	0 2 3	4 5 6 7	8	9	10	11	12	13	14
Resistencia Interferencia	0 3	4 8 9 12	15 19 26 32 37	42	47	48			

Conclusions, 1

From molecules to behavior: Distributed networks

Lesions: basic neurobiological principle

Clinical pattern vs. Molecular pattern

Neurodevelopmental vs Neurodegenerative

Neuropsychology in context

Modular neuropsychological assessment

Normality & Norms

Neuropsychological patterns: co-norming

Conclusions, 2

Cognitive approaches

Modules... the outcome of development

The mereological fallacy

Retrogenesis as a model

Neuropsychological profiles... patterns (Barcelona II)

'Floating' norms based on patients

Conforming: NEURONORMA.ES (MOANS project)

The Mental Retardation / Intellectual Disabilities project

(Barcelona II – ID)