PRINCIPLES OF TYPICAL AND ATYPICAL MOTOR DEVELOPMENT

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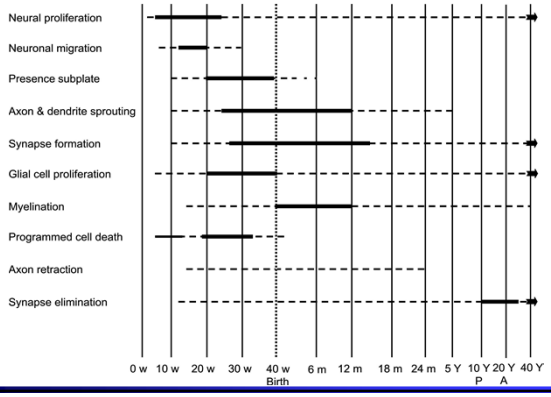
Neurodevelopmental processes during human ontogeny

(De Graaf-Peters & Hadders-Algra, Early Hum Dev 2006; 82: 257-66)



CLINICAL CONSEQUENCES OF THE DEVELOPMENTAL CHANGES OF THE NERVOUS SYSTEM (1)

- **A neurological examination should be age-specific**

CLINICAL CONSEQUENCES OF THE DEVELOPMENTAL CHANGES OF THE NERVOUS SYSTEM (2)

Consequences for prognosis:

- Neurological dysfunction at early age may disappear ⟶ normalization
- Infant with a normal neurological function may grow into dysfunction

CLINICAL CONSEQUENCES OF THE DEVELOPMENTAL CHANGES OF THE NERVOUS SYSTEM (3)

Consequences for expression of dysfunction

Neurological dysfunction

- adulthood : localized, specific signs
- early infancy : generalized, diffuse dysfunction

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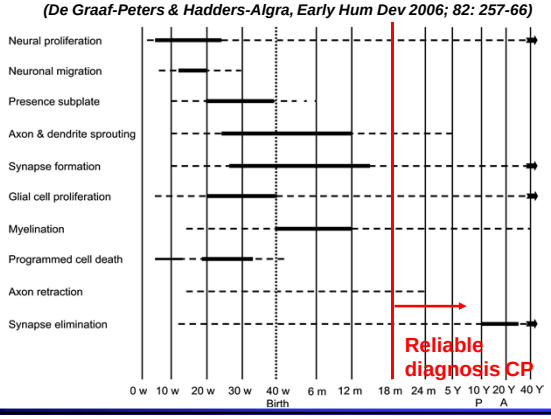

CPG-MODEL OF MOTOR CONTROL

SUPRASPINAL MODULATION
by (sub)cortical networks

CPGs
in
brainstem
&
spinal cord

SEGMENTAL MODULATION
by afferent information

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MOTOR DEVELOPMENT

NATURE OR NURTURE?

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MOTOR DEVELOPMENT

NATURE
AND
NURTURE

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THE NATURE – NURTURE DEBATE

Arnold Gesell

Esther Thelen

Neuronal Group Selection Theory

Neuromaturationalist Theories

Dynamic Systems Theory

Nature ⟷ Nurture

MOTOR DEVELOPMENT
in the light of EDELMAN'S
NEURONAL GROUP SELECTION THEORY

PRIMARY VARIABILITY

↓

SECONDARY OR ADAPTIVE VARIABILITY

↓ ↓ ↓ ↓

SELECTION | SELECTION | SELECTION | SELECTION

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PRIMARY VARIABILITY

- Activity of epigenetically determined, grossly specified primary neural repertoires
- Exploration of all motor possibilities by means of self-generated activity
- Abundant variation in motor behaviour - not geared to environmental constraints
- Especially during fetal life and infancy

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PRIMARY VARIABILITY
EXAMPLE GENERAL MOVEMENTS (GMs)

- **Movements of head, trunk, arms and legs**
- **Typical GMs characterized by movement complexity and variation which may be regarded as two forms of variation**
- **Present from fetal week 9-10 until about 4 months post-term → coinciding with presence of cortical subplate**

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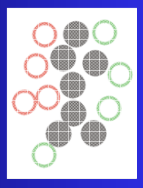
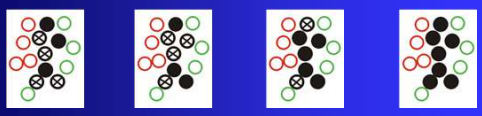
SECONDARY VARIABILITY





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TRANSITION FROM PRIMARY TO SECONDARY VARIABILITY AT FUNCTION SPECIFIC AGES

Sucking	**Prior to term age**
Postural adjustments	**4 to 10 months**
Reaching	**6 to 10 months**
Fine manipulation	**12 to 18 months**
Heel-strike during locomotion	**12 to 18 months**

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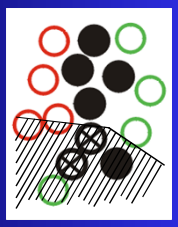
QUALITY OF SPONTANEOUS MOTOR BEHAVIOUR
PRINCIPLES OF NGST
(Neuronal Group Selection Theory, Edelman)

TYPICAL MOTOR DEVELOPMENT:

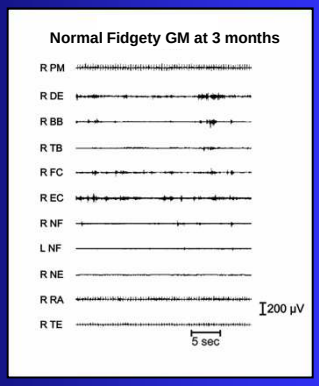
- **primary variability:**
  presence of rich repertoire, variations not adapted to specifics of condition
- **secondary variability:**
  best strategy can be selected from varied repertoire → adaptation

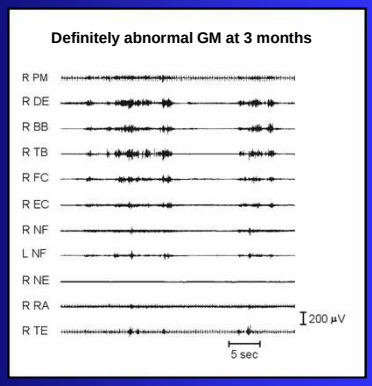
REDUCED VARIATION



MOTOR DEVELOPMENT IN CASE OF EARLY LESION OF THE BRAIN

- Reduced motor repertoire

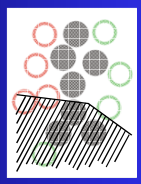


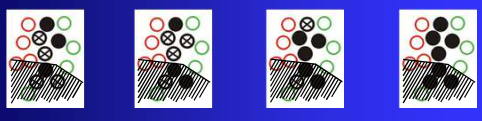


MOTOR DEVELOPMENT IN CASE OF EARLY LESION OF THE BRAIN

- Reduced motor repertoire
- Best motor solutions may differ from those of typically developing child

REDUCED VARIATION AND IMPAIRED SELECTION





MOTOR DEVELOPMENT IN CASE OF EARLY LESION OF THE BRAIN

- Reduced motor repertoire
- Best motor solutions may differ from those of typically developing child
- Dysfunctional processing of sensory information → impaired selection → need of increased amounts of 'trial-and error' experiences

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MORE INFORMATION?

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15-17 May 2014 International Meeting
INSPIRING INFANCY

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