



# Update On Neuroscience Underpinning Child Development –Why The First 1,000 Days Matters?

「首一千日」與腦神經發育

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# Disclosure

## 聲明

- No financial relationship with the organizing society

講者與主辦機構沒有財務關係

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# Content

## 內容

- Neuroscience of brain development  
腦部發展的科學基礎
- Why “First one thousand days”?  
什麼是「首一千日」?
- How can we help brain development in this critical period?  
在這關鍵的時期，我們可以怎樣幫助腦部發展?

# Brain development

## 腦部發展

- Brains are built over time, from the bottom up.

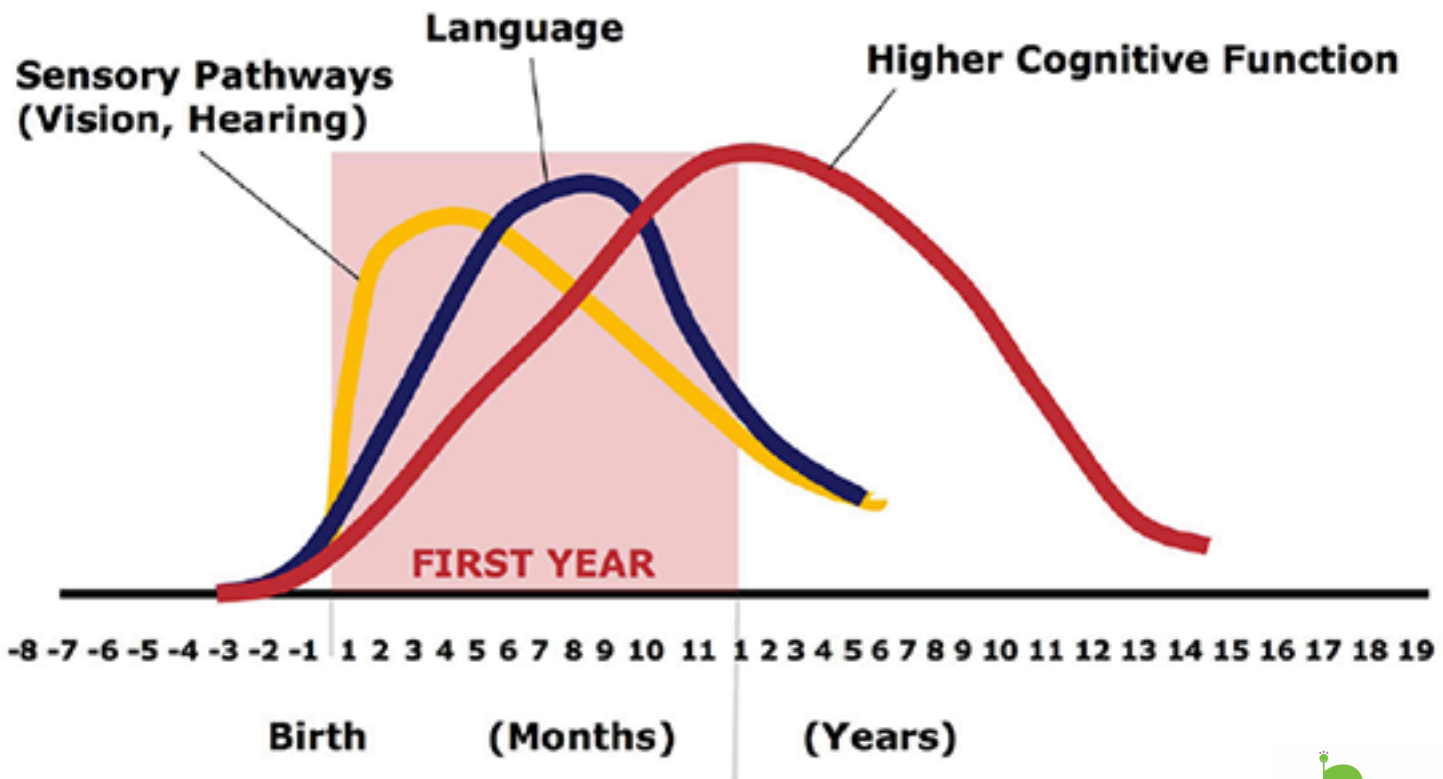
腦部隨著時間由基本技能發展至高階思維

- Brain architecture is comprised of billions of connections between individual neurons across different areas of the brain.

大腦由數十億個跨越大腦不同區域的單神經元連接而成

# Human Brain Development

Neural Connections for Different Functions Develop Sequentially



# Brain development

## 腦部發展

- The interactions of genes and experience shape the developing brain.
- 大腦的發展受到基因和環境的因素影響。



# How Early Experiences Alter Gene Expression and Shape Development

① **EXTERNAL EXPERIENCES**  
(e.g., stress, nutrition, toxins)  
spark signals between neurons

② **NEURAL SIGNALS** launch  
production of gene regulatory  
proteins inside cell

③ **GENE REGULATORY PROTEINS**  
attract or repel enzymes that  
add or remove epigenetic markers

④ **EPIGENETIC "MARKERS"** control  
where and how much protein is made  
by a gene, effectively turning a gene  
"on" or "off," thereby shaping how  
brains and bodies develop

**GENE** – a specific  
segment of a  
DNA strand

DNA strands encircle histones that determine  
whether or not the gene is "readable" by the cell

**CHROMOSOME** – can pass  
on genes to next generation

**NEURON** (brain cell)

# Brain development

## 腦部發展

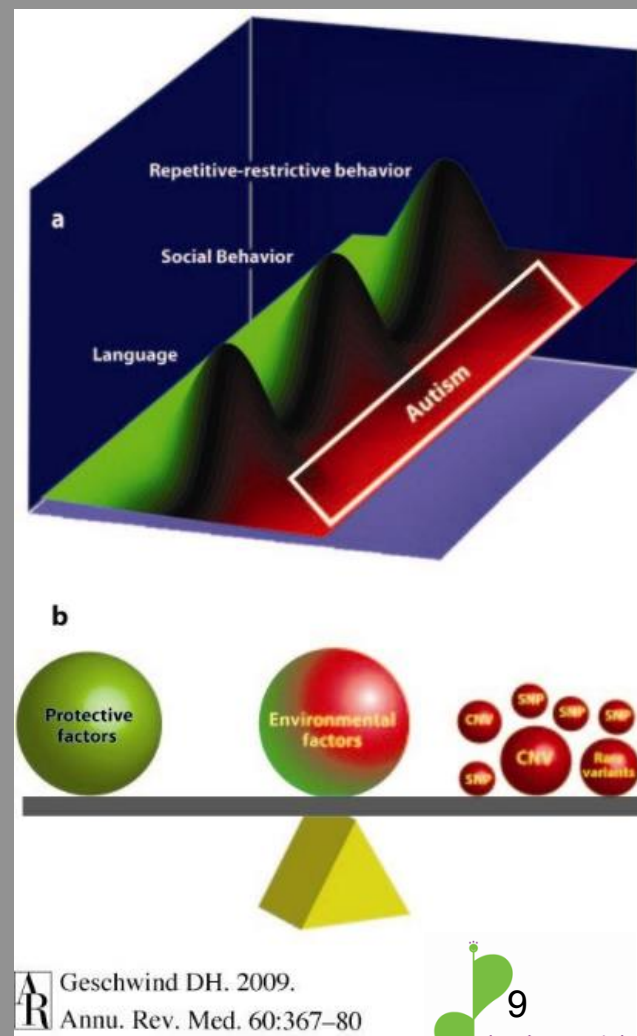
Genetic 基因 × Environment 環境



# Interaction between genetic factor and environmental factor of Autism

## 自閉症的基因與環境因素的相互作用

- Monozygotic Twins 同卵雙胞胎
  - Both have Autism Spectrum Disorder: as high as 90%  
同患自閉症譜系高達90%
  - Both have Autism: 70%  
同患自閉症的達70%



# Brain development-Environment

## 腦部發展-環境因素

- Prenatal 產前:
  - Infection, eg. Cytomegalovirus (CMV) infection  
感染, eg. 巨細胞病毒感染
  - Lack of Vitamin D/ Fe  
缺乏維他命、鐵質
  - Toxin e.g. Nicotine ,alcohol  
毒素 例如尼古丁、酒精

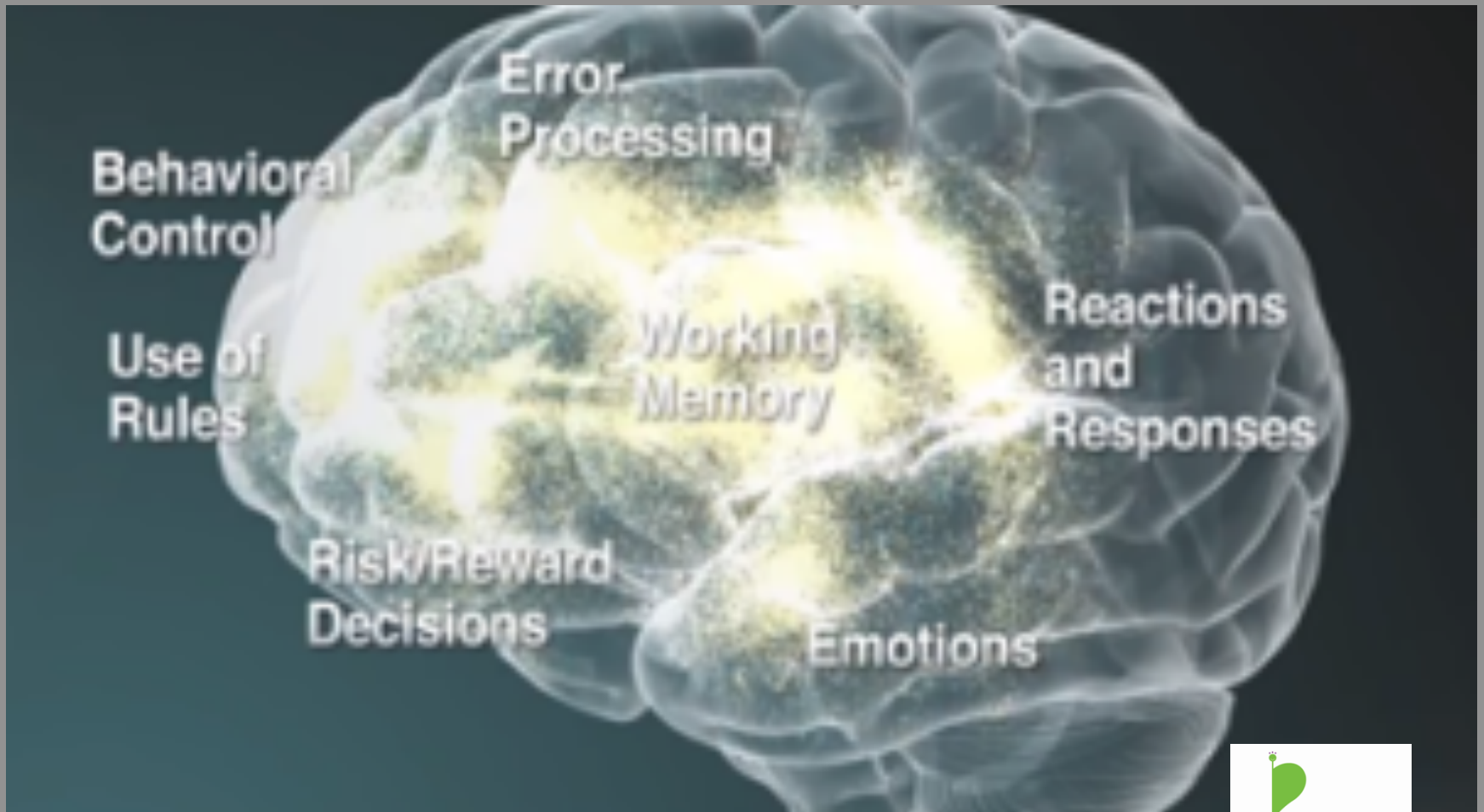
# Brain development-Environment

## 腦部發展-環境因素

- Postnatal產後:
  - Premature delivery, low birth weight  
早產、出生體重過輕
  - Metal: e.g. Lead and mercury  
金屬: 例如.鉛(Pb)和水銀(Hg)
  - Psychosocial adversity, chronic stress, child abuse  
逆境，長期的心理壓力，虐兒
  - Iron deficiency/iodine deficiency  
缺乏鐵/碘

# Executive Functions

## 執行能力



# Executive Functions

## 執行能力

- Attention 專注力
- Working memory 工作記憶
- Creativity, mental flexibility  
創意、思維的彈性
- Inhibition, self-control 抑制、自我控制
- Emotional regulation 情緒調節

# Executive Functions

## 執行能力

- Children aren't born with these skills—they are born with the potential to develop them

執行功能並不是與生俱來，但兒童可隨著成長的生活經驗培養出這些技能

# Executive Functions

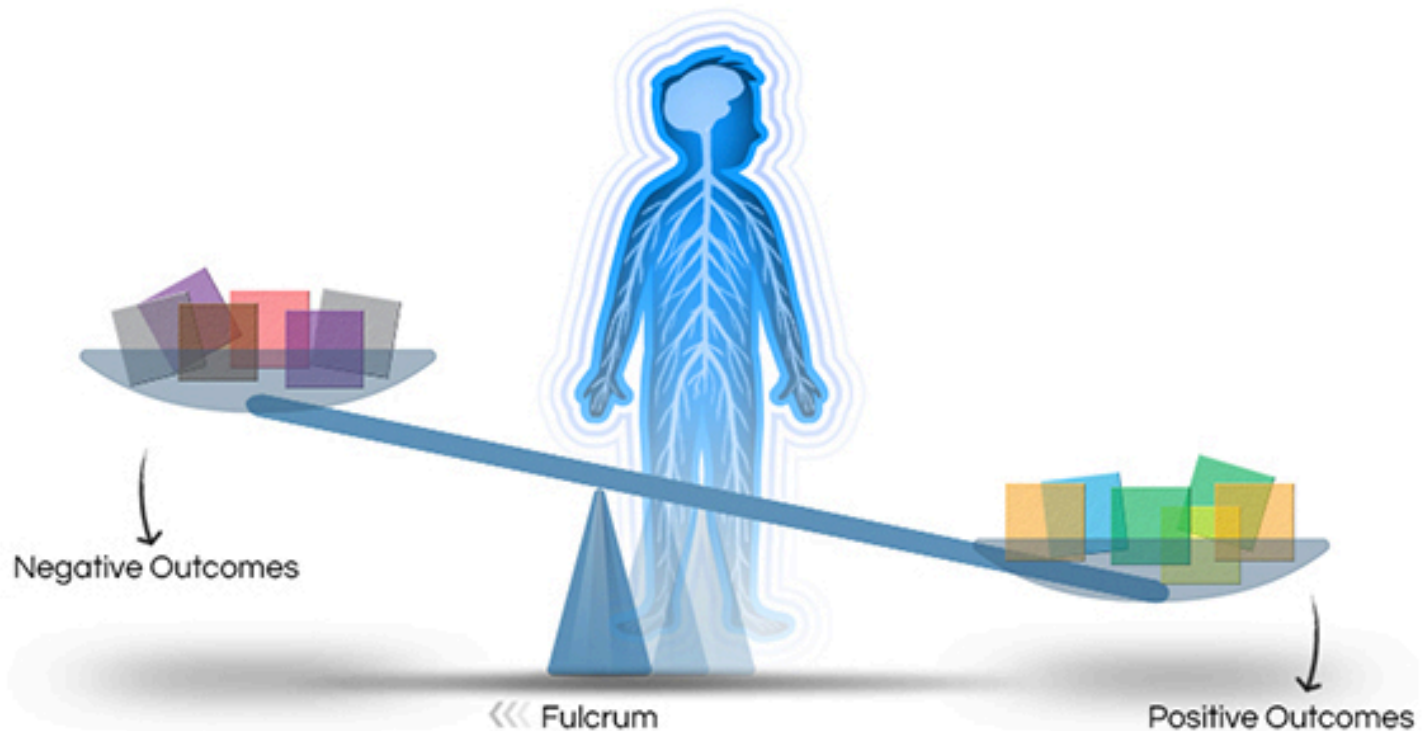
## 執行能力

- If children do not get what they need from their relationships with adults and the conditions in their environments—or (worse) if those influences are sources of toxic stress—their skill development can be seriously delayed or impaired.

如果孩子在成長時不能從照顧者身上得到他們需要的條件，或受毒性壓力影響，腦部發育可以嚴重延遲或受損。

# Stress Builds Resilience

## 壓力有助適應能力的建立





# Toxic Stress

## 毒性壓力

- Cognitive, emotional, and social capacities are inextricably intertwined throughout the life course.

認知、情感和社交能力在整个人生中是密不可分的。

- Toxic stress damages developing brain architecture, which can lead to lifelong problems in learning, behaviour, and physical and mental health.

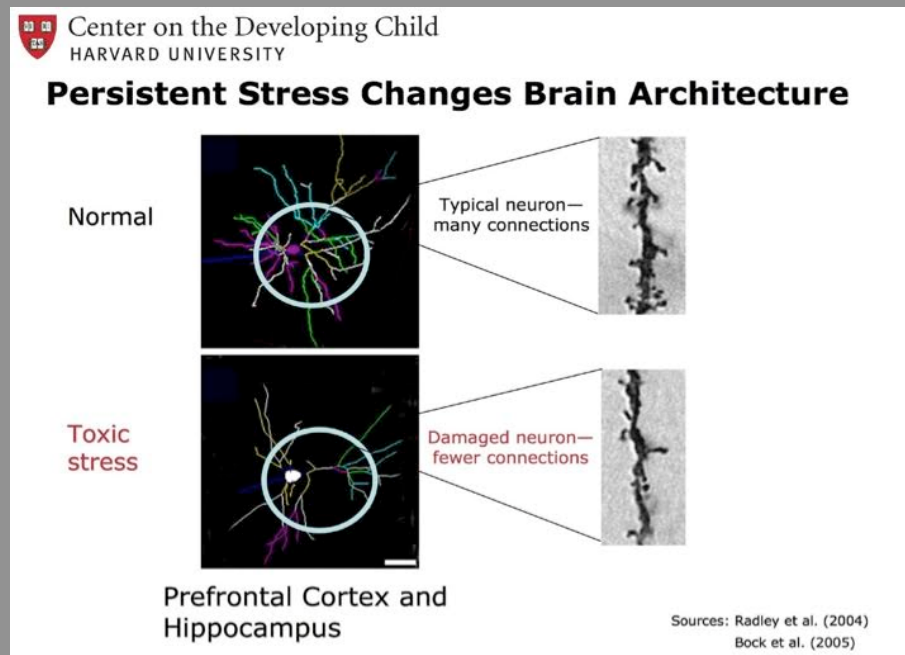
毒性壓力損害發展中的腦部結構，導致終身學習、行為和身心健康的問題

# Toxic Stress

## 毒性壓力

- Maternal depression and neglect affects cognitive and executive function development

產前/後抑鬱症和忽視影響認知和執行功能的發展



# Source of toxic stress

## 毒性壓力的來源

- Maternal depression 產前/後抑鬱症
- Chronic physical/ verbal/ sexual abuse  
長期身體/言語/性虐待
- Domestic violence 家庭暴力
- Chronic neglect 長期被忽視
- Bullying 欺凌

# What is the first 1,000 days

## 什麼是首一千日

- “ The first 1,000 days of life - the time spanning roughly between conception and one’s second birthday - is a unique period of opportunity when the foundations of optimum health, growth, and neurodevelopment across the lifespan are established.” -UNICEF

首一千日是指受孕和兩歲多之間的時間，是建立健康、成長和神經發育基礎的黃金時間。-聯合國兒童基金會

# Why the first 1,000 days?

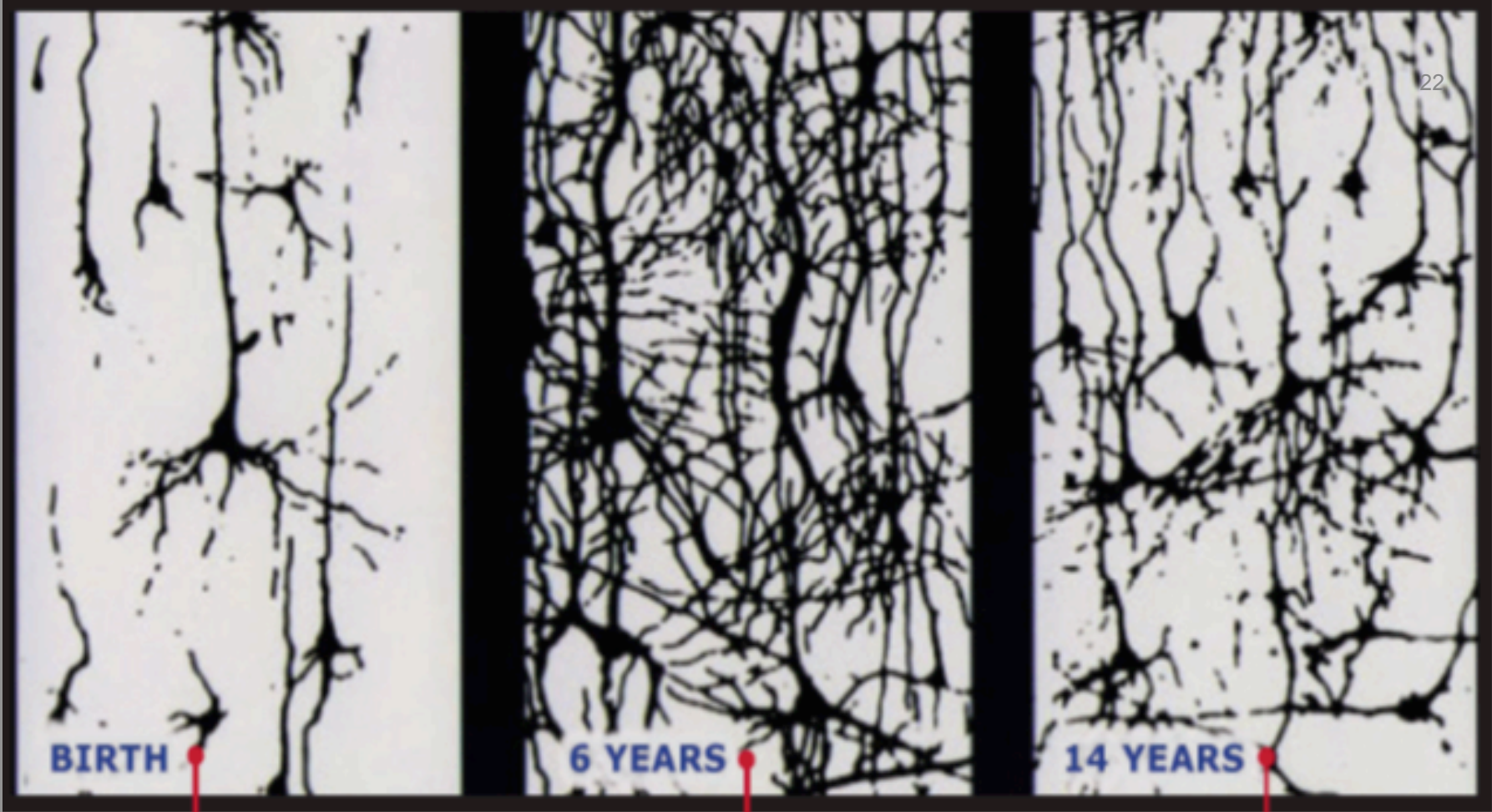
## 為什麼是首一千日？

- The first 1,000 days are characterized by rapid rates of neuronal proliferation (cell numbers), growth and differentiation (complexity), myelination, and synaptogenesis (connectivity).

首一千日腦部發展的特點是神經元細胞數量激增，生長和成熟。

- Every serve and return interaction creates 700+neural connection

每個嬰兒與父母的互動中產生多於七百個神經連接



2

Neural proliferation and pruning is a normal, healthy part of brain development: connections that are not used are pruned away.

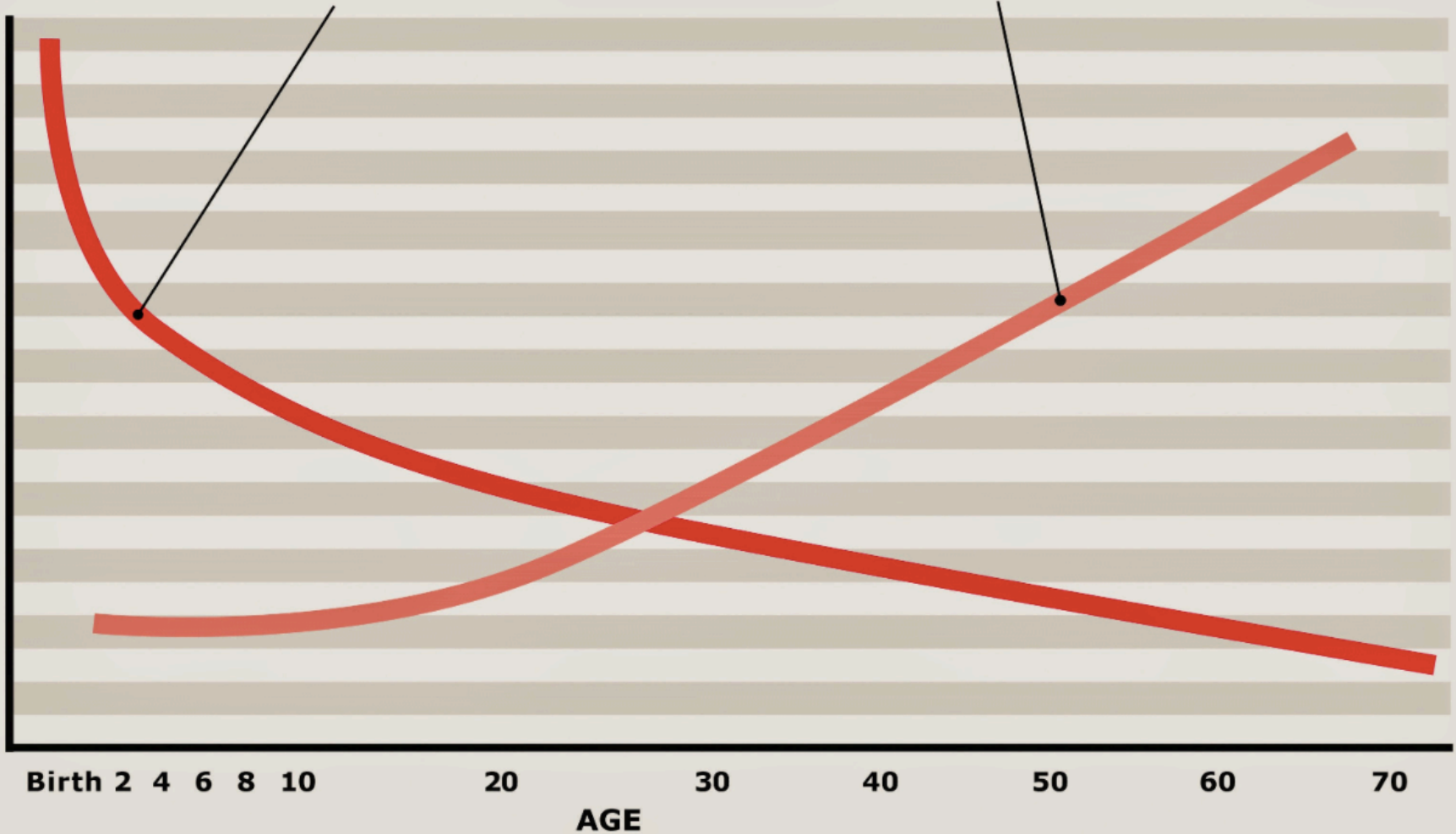
**1 million new neural connection every second in the first new years.**

新生兒頭一年每秒有多於一百萬個新的神經連接

During the first few years of life, 700 new synapses (neural connections) are formed every second. After a period of rapid proliferation, connections are reduced through a process called synaptic pruning. Environmental influences affect the nature and quality of the brain's developing architecture by determining which circuits are reinforced and which are pruned through lack of use. Some people refer to this as "use it or lose it." Graphic Source: Chugani, H.T. Synaptic Density. [Drawing]. In R. Shore, *Rethinking the Brain: New Insights into Early Development* (p. 20). New York: Families and Work Institute, 1997.

**The Brain's Ability to Change  
in Response to Experiences**

**Amount of Effort  
Such Change Requires**



# Physical health

## 身體的健康狀

- Nutrition 營養

- protein, polyunsaturated fatty acids, iron, zinc, copper iodine, choline, folate and vitamins A, B6, and B12

蛋白質，多不飽和脂肪酸，鐵，鋅，銅碘，膽鹼，葉酸和維他命A，B6和B12

- Iron deficiency is the most common nutritional deficiency in the world

缺乏鐵質是世上最常見的營養缺乏症



# Physical health

## 身體的健康狀況

- 47% (293 million) of all preschool-aged children and 42% (56 million) of all pregnant women are anemic, with approximately half attributable to iron deficiency

學前兒童中有47%（2.93億）和孕婦中有42%（5600萬）是貧血，其中約一半是由缺鐵所致

# Physical health

## 身體的健康狀況

– Affects intellectual, executive, or motor function at age 7-9 years

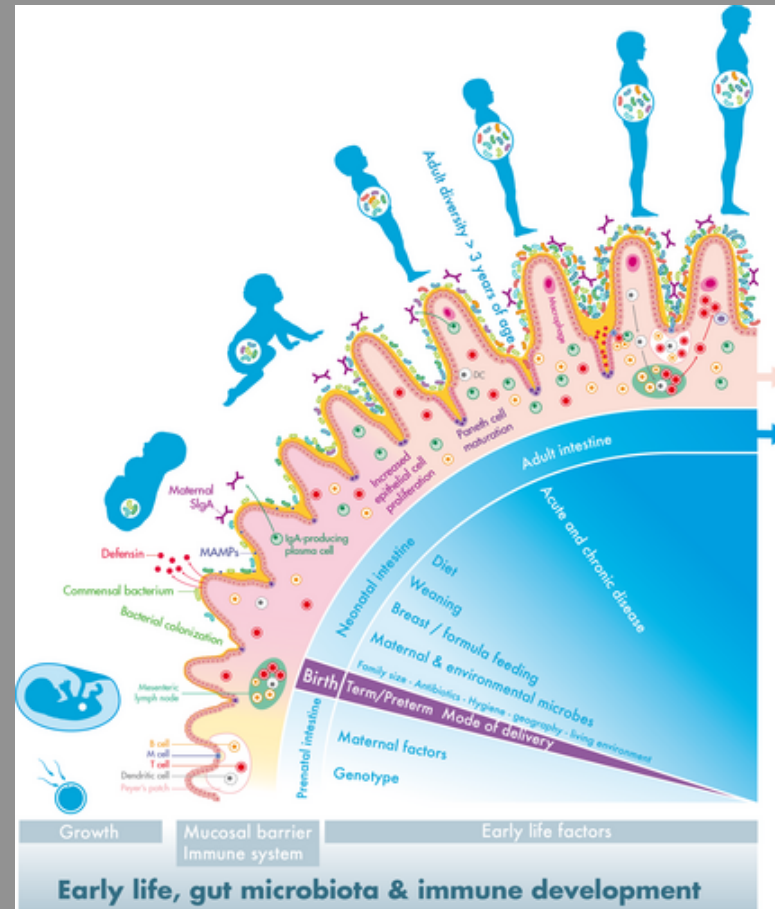
在7-9歲期間影響智力，執行或運動技能

– Critical period of iron supplementation :  
Pregnancy, neonatal/ infancy

補充鐵質的關鍵時期：懷孕，新生兒/嬰兒期

# The first thousand days – intestinal microbiology of early life: establishing a symbiosis

## 首一千日 - 早期腸道微生物學：建立共生



Pediatric Allergy and Immunology

Volume 25, Issue 5, pages 428-438, 5 JUN 2014 DOI: 10.1111/pai.12232

<http://onlinelibrary.wiley.com/doi/10.1111/pai.12232/full#pai12232-fig-0001>

Montessori Asia  
Conference

Dr Fanny Lam

21/May/2017



# Establishing the symbiosis

## 建立共生關係

- Sterile gut in utero: development of immune system of the gut mucosa depends on mother's nutrition  
由於子宮內是無菌狀態：母親的營養決定嬰兒腸部粘膜的免疫系統發展
- The initial bacterial colonizers of our gastrointestinal tract may determine the composition of our intestinal microbiota throughout life.  
腸胃道的初始細菌可以決定生命中的腸道微生物生態環境的組成。

# Establishing the symbiosis

## 建立共生關係

- Birth: exposure to microbiota depending on gestational age and mode of delivery

懷孕期與分娩方式影響嬰兒接觸微生物的機會

- Neontatal: breast feeding vs artificial feed, the presence of allergen in breast milk

母乳餵哺可提供致敏原刺激嬰兒的免疫系統

# Establishing the symbiosis

## 建立共生關係

- Early-life nutrition, the increase in caesarean deliveries and the increasing use of antibiotics may lead to altered growth of the microbia, immune diseases like allergy, metabolic diseases like obesity or cardiovascular diseases and maybe even brain and behavioural problems.

嬰兒飲用奶粉、剖腹產的流行及濫用抗生素導致微生物的生長改變，引致免疫系統疾病如過敏，代謝性疾病如肥胖或心血管疾病，甚至可能引發腦部發展問題和行為問題

# Establishing the symbiosis

## 建立共生關係

- Nutrition in early life and acquiring the essential microbes is a critical factor in the developmental of a healthy immune system.  
幼兒期攝取足夠的營養及微生物是建立成熟及健康的免疫系統一個關鍵的因素。

# Parenting – the best practice

## 育兒 - 最佳的方法

- The Attachment Theory 依附理論
- Core sensitivity and insecurity  
核心敏感性相對缺乏安全感
- Understanding the effect of Socio-economical status 社經地位的影響
- Reducing toxic stress 減少毒性壓力



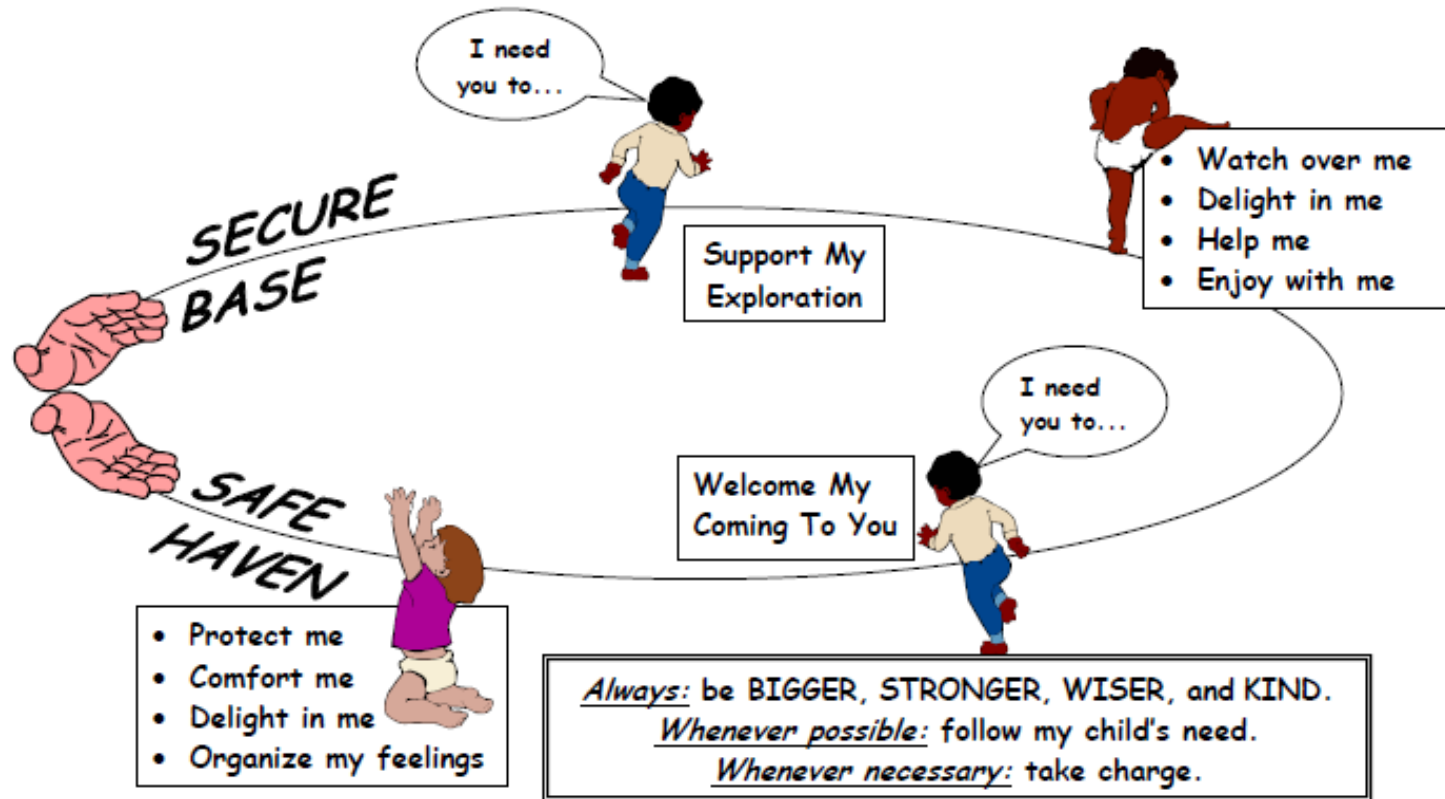
# Let's make the Fairy Tale a reality

## 讓童話成為現實

- Video

# CIRCLE OF SECURITY

PARENT ATTENDING TO THE CHILD'S NEEDS



© 1998 Cooper, Hoffman, Marvin, & Powell  
circleofsecurity.org

# The function of attachment

## 依附的作用

- Provide a sense of safe and security  
提供安全感
- Regulates emotion by comforting stress, creating joy and supporting calm  
透過抒解壓力、分享快樂和冷靜來調節情感
- Offer a secure base from which to explore  
提供一個安全的基地讓孩子去探索

# Positive effect of secure attachment

## 安全感的重要性

- Facilitating supportive adult-child relationships;  
促進成人與兒童的關係
- Building a sense of self-efficacy and perceived control  
建立自我效能感和行為控制能力
- Providing opportunities to strengthen adaptive skills and self-regulatory capacities  
加強孩子適應能力和自我監管能力
- Mobilizing sources of faith, hope, and cultural traditions.

推動信任，正面思維和文化

# The Development of The Person

## 全人成長

- From all the measurements taken during the first six years, the strongest predictor of psychopathology in adolescence (17 1/2) was disorganized attachment measured at 12 and 18 months of age.

從頭六年的所有測量結果來看，青春期精神病理學最強預測的因子（17 1/2）是在12至18個月時的無組織依附。

# The Development of The Person

## 全人成長

- Attachment insecurity (12 & 18 months) was significantly related to behaviour problems in preschool

12至18個月嬰幼兒缺乏安全的依附與學前時期的行為問題有顯著的相關性

- Behaviour problems in pre-school predicted behaviour problems in the first grade

在一年級出現的行為問題可從學前時的行為預測

# The Development of The Person

## 全人成長

- Early behaviour problems forecasted and laid the foundation for academic problems throughout the school years

早期的行為問題預測可為整個學年的學業問題奠定了基礎

- School achievement was forecast long before school entry

幼兒時期的行為表現可預測成長後的學業成績

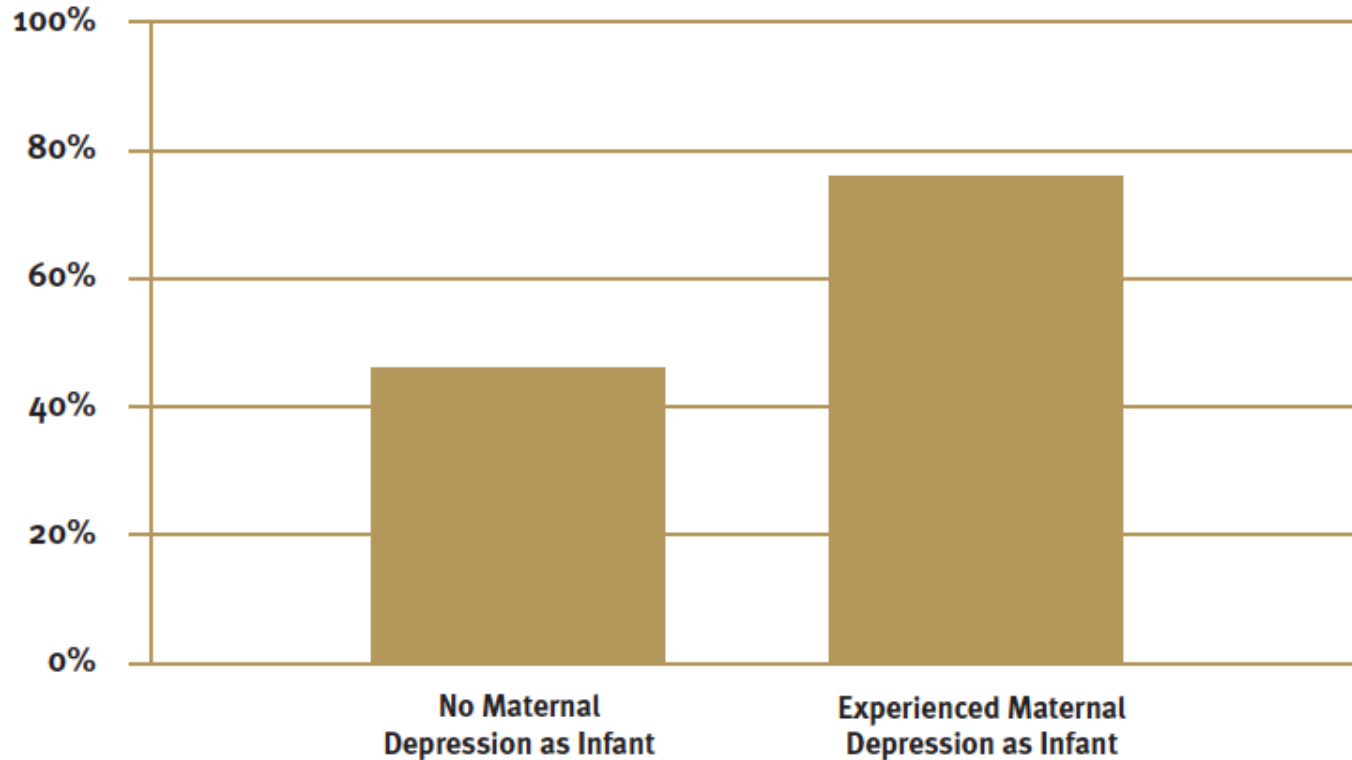
# The Development of The Person

## 全人成長

- The central outcomes of attachment security and early supportive care  
安全依附和早期支持性照顧的主要成果
  - Basic sense of social connection  
基本的社會關係意識
  - Positive expectations concerning self and others  
對自己和他人有正面的期望
  - Capacity for self regulation  
自我調節能力



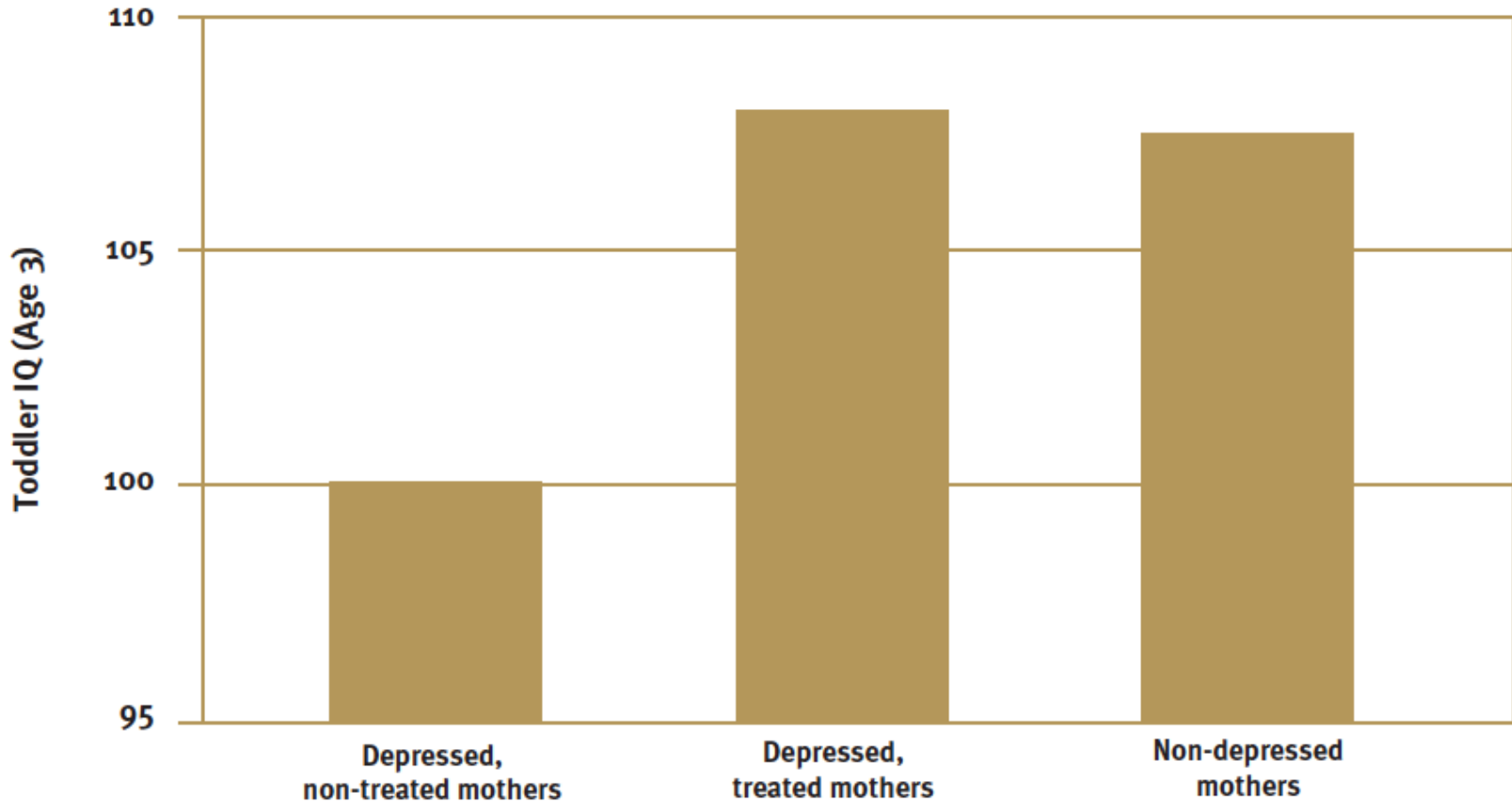
# Exposure to Maternal Depression in Infancy Cause Stress Hormone Level to Become More Extreme in Adolescence



## Percentage of Adolescents with Extremely High Cortisol Levels

(Above 90th percentile for gender) on 1 or more days out of 10 measured

# Toddler-Parent Therapy Improve Cognitive Development



Mothers with a major depressive disorder were randomly selected to participate in Toddler-Parent Psychotherapy as a preventive intervention for their children, age 20 months at entry to program. Children's scores on Bayley Mental Development index did not differ at age of entry, but significant differences appeared in IQ tests given at age 3.



# Teen Competency

## 青少年的能力

- Quality of care in early life was significantly correlated with high school achievement even when controlled for IQ

撇除「智商」這個因素，早期被照顧的質素與高中成績有顯著的關係

- Math scores 數學分數
- Reading scores 閱讀分數

# Teen Peer Relationships

## 青少年朋輩關係

- Teens with secure attachment histories were more competent in peer

有安全依附經歷的青少年比同齡的朋輩有更好表現

– Skillful in interaction 成熟及有技巧的互動

– Drew attention in positive ways

以正面的方式開展人際關係

– Effective in negotiating and persuading

有效的談判和說服力較強

– Guide group discussion 帶領小組討論

– Demonstrated leadership 展示領導才能

What should we do in the first  
one thousand days ?

我們在首一千日裡應該做些什麼？

# How to promote brain development and physical health?

## 如何促進腦發展和身體健康？

- Maternal physical health and mental health before and during pregnancy  
懷孕前和懷孕期間的孕婦生理和心理健康
- Pre and postnatal Nutrition , breastfeeding  
產前和產後營養，母乳喂養
- Safe and supportive chemical, physical, and built environments which allow a child's exploration  
安全和關懷的環境讓孩子進行探究

# How to promote brain development and physical health?

## 如何促進腦發展和身體健康？

- No screen time for children under 2 years of age  
兩歲以下兒童無屏幕時間
- Adequate sleep and downtime  
充足的睡眠和休息時間
- Avoiding toxic stress  
避免毒性壓力
- Early identification and intervention of developmental disorders  
發展障礙的及早識別及介入

# How to promote brain development and physical health?

## 如何促進腦發展和身體健康？

- Serve and return interaction 互動關係 <http://developingchild.harvard.edu/resources/serve-return-interaction-shapes-brain-circuitry/>
- Exercise/ activities that promote executive function  
促進執行能力的運動和活動
- Bonding and healthy attachment of caregivers and babies  
照顧者和嬰兒健康的依戀/依附關係



# Conclusion

## 總結

- Human brain development takes place in critical stages and the most intensive development happens in the first 1000 days of life

首一千日是人類腦部發展最關鍵和發展最密集時期

# Conclusion

## 總結

- Early nutrition and microbial exposure affects lifelong physical health

早期營養和微生物接觸影響終生的身體健康

# Conclusion

## 總結

- Early identification and intervention of developmental condition ensures good outcome in developmental conditions and mental health issues

老師及家長應為兒童發展障礙作及早識別和介入，確保幼兒有良好的發展狀況和精神健康

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[www.hkdpc.com](http://www.hkdpc.com)

Thank you!

多謝!

developmental  
paediatrics