

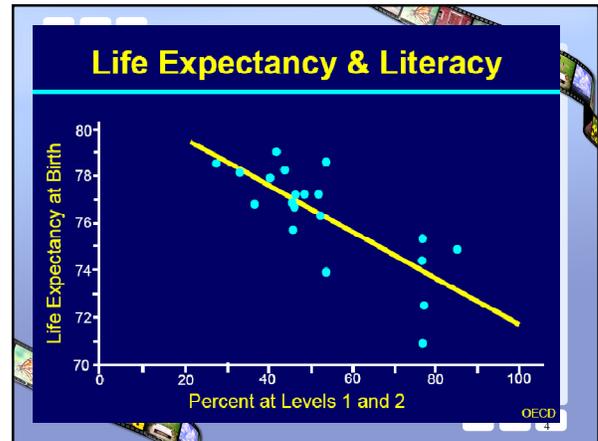
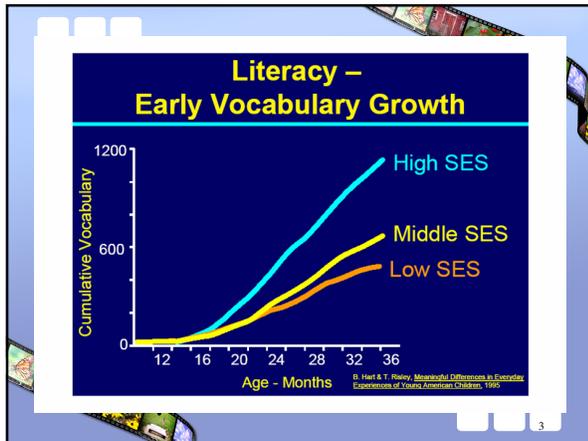
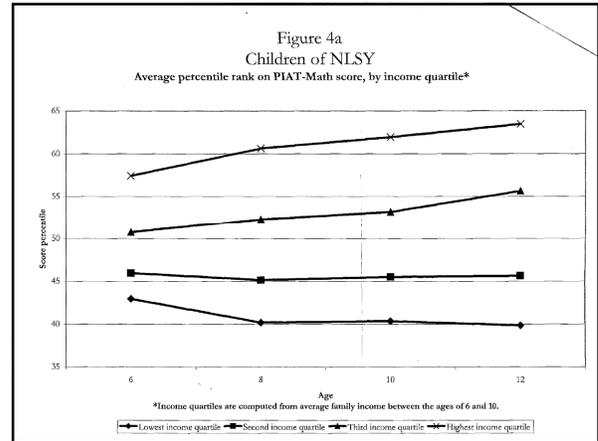
CHILDREN COMMUNITIES CONNECTIONS CONFERENCE  
UniSA Mawson Lakes Campus November 2008  
www.salisbury4c.org.au

**Applying neurobiological evidence to  
caring for infants and toddlers**

**Associate Professor Margaret Sims**  
[http://www.psychology.ecu.edu.au/staff/cv/sims\\_m.php](http://www.psychology.ecu.edu.au/staff/cv/sims_m.php)  
m.sims@ecu.edu.au

The experiences children have shapes their brains  
And their brains determines what kind of people they will be

Copyright 2008



**How does what happens  
outside our brains impact on  
growth inside our brains?**

**There are two pathways**

1. neurological
2. biochemical

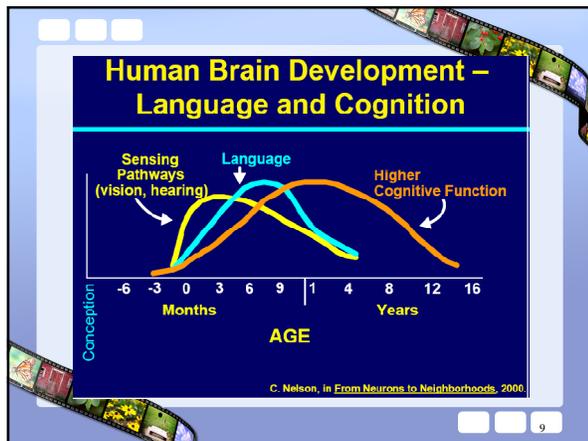
Stress plays a key role in both of these pathways

Both involve epigenetics – how the environment turns genes on or off

### Neurological pathway

- When we are born some brain cells (neurons) are not connected up
- Stimulation from outside forces brain to lay down pathways to process the incoming information

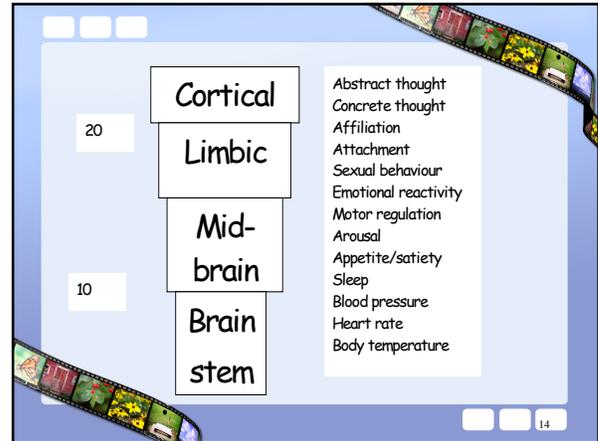
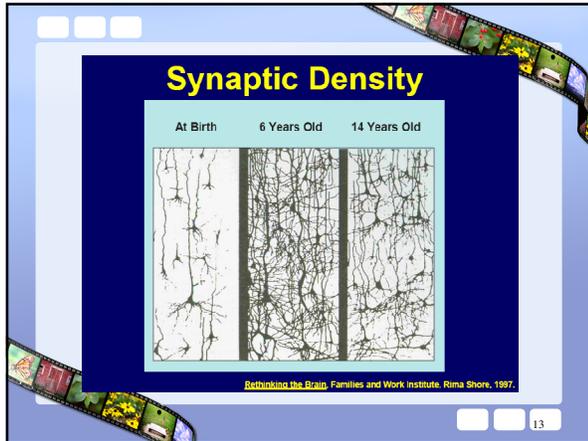
- Kitten research
- In humans birth cataracts – first months of life
- In humans sensitive periods for hearing 0-3 months, language 6-9 months, higher cognitive functions 9-48 months



- By age 3 children have 3x more neuronal connections than adults
- At birth babies' brain 25% of the size of an adult brain. By 3 years babies' brains are 80% of adult size
- Children need more energy to keep these connections happening – by age 2 toddlers' brains are twice as active as adults, by age 3 their brains are 2.5 times more active

- Brains become too complex to function effectively – too many pathways
- 'pruning' of connections from about 3-12 years
- 33 connections per second in the cortex but not in the lower brain

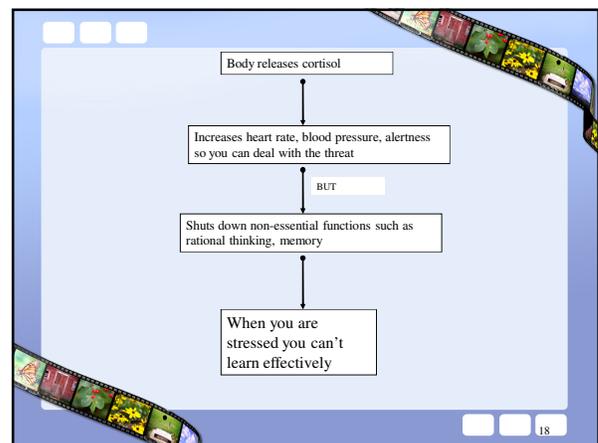
- Connections not used very much get pruned
- Connections that have been used a lot remain
- children who have not heard sound lose pathways that are used to process sound so even if they get a bionic ear later in life they can not hear
- 7 months both Japanese and American infants differentiate 'r' and 'l'. By 12 months Japanese infants lost this ability



- ### What does this tell us children need?
- Ensure we stimulate pathways associated with learning, problem solving, language, social skills, emotional development – pathways in the upper brain
  - Minimise stimulation in pathways in the lower brain
- 15

- ### but
- It's not quite that simple
  - There's more we need to understand to make sure that we are doing the right thing
- 16

- ### Biochemical pathway
- Humans evolved the stress reaction to protect us in times of danger
  - A biological response triggered by fear, anxiety, feeling uneasy, feeling unsafe, feeling unsure of yourself, hunger, thirst, feeling unwell
- 17



- Normally when you determine the danger is no longer present your body stops releasing cortisol
- Heart rate, blood pressure, alertness go back to normal levels
- Thinking and memory work again

19

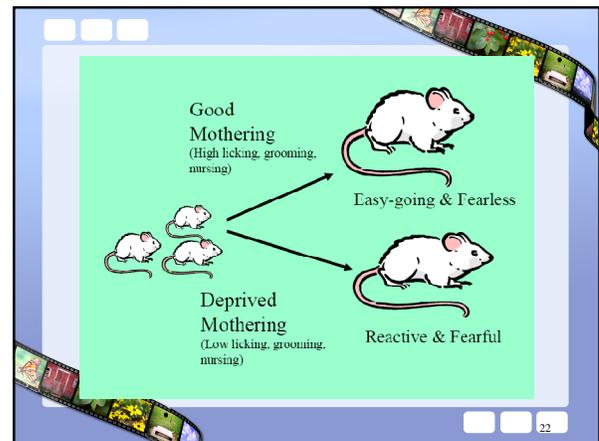
**but**

- If you are stressed a lot of the time
- You have lots of cortisol in your body a lot of the time
- Cortisol damages neuronal connections and brain cells
- The part of your brain responsible for shutting off cortisol is damaged

20

- Chronic high levels of cortisol – **behaviour, depression, type II diabetes, malnutrition, cardiovascular disease, memory, immune system, drug and alcohol addiction**
- Chronic low levels of cortisol – **chronic fatigue syndrome, fibromyalgia, immune system (autoimmune disorders), rheumatoid arthritis, allergies, asthma**

21



**Rhesus monkeys – those who are genetically highly reactive**

- Remain with poor mothers – disrupted sleeping, high cortisol levels, anxiety, depression, excessive alcohol consumption, aggression, poor mothering so inter-generational transmission of neglect/abuse
- Fostered with highly nurturing mothers had good outcomes – good social skills, robust immune responses, lower cortisol levels, females become nurturing mothers

23

**How can we prevent these things?**

- Minimise stress in children's lives (we need a small amount but not too much)
- Children are NOT stressed when they feel safe, secure, confident, when they are not hungry, thirsty, uncomfortable or unwell

24

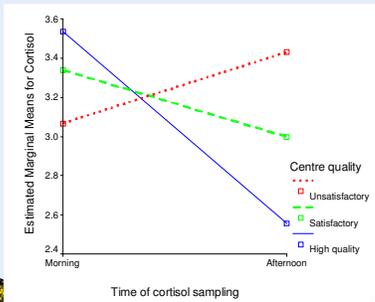
### In humans, children who feel loved when they were little

- Demonstrate better school achievement as they get older
- Are more likely to have friends
- Are more likely to be healthy
- Are less likely to have mental health problems
- Have less extreme reactions to stressful situations and they return to a non-stressed state more quickly

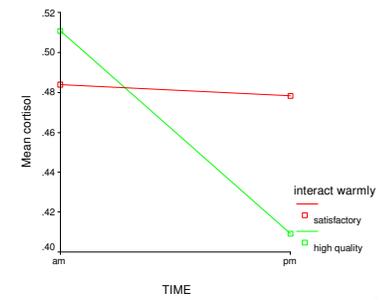
### Relationships are the key to emotional well-being and positive developmental outcomes

High quality environments for children are places where children are loved, where they feel physically and psychologically safe

### Evidence from my research

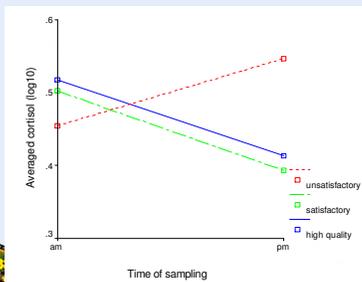


### Principle 1.1 interact warmly - differentiation between satisfactory and high quality (kindy aged)



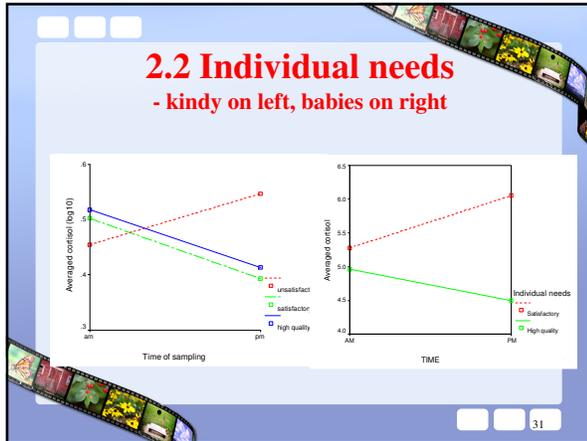
### Different pattern for programme curriculum measures of quality

#### 2.2 Individual needs (kindy)



### Infants and toddlers

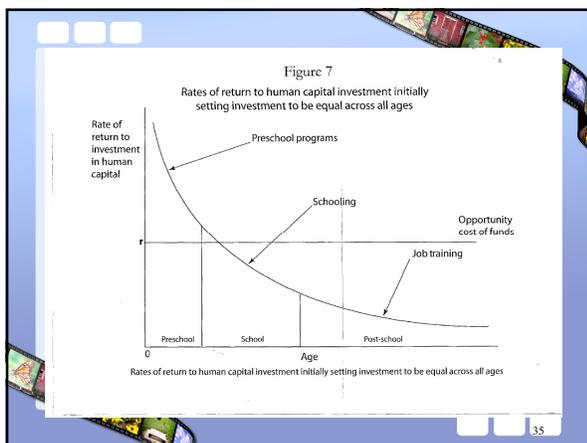
- More likely to show increases in cortisol in satisfactory programmes
- ie more vulnerable to less than high quality



- ### Remember if children feel unloved, unsafe, unwanted, insecure, nervous
- They will be biologically stressed which means
  - They will not learn
  - Exciting, challenging, developmentally appropriate activities will stress them more and lead to negative long-term outcomes
- What does this mean for transition into care?
- 32

- ### Consequences of non-intervention
- aggression
  - hypervigilance
  - hypersensitivity
  - hyperactivity
  - Post Traumatic Stress Disorder
  - mental health problems
  - social isolation
  - substance abuse
  - suicide
- 33

- ### Is it ever too late?
- Brain research indicates **CRITICAL PERIODS**
  - connections made between neurons more easily during these times
  - **BUT**
  - brain remains capable of reorganisation all our lives
  - intervention needs to be ecological in focus
- 34



### There is enough money

5% of the money spent on military technology and training in 1999 could have provided basic education, health care, nutrition, potable water and sanitation to ALL the people of the world (Arias, 2000/2001)

36



**Quality care for children requires**

- A society organised in such a way that parents have the physical and mental resources to provide a quality environment
- Communities that are organised in such a way as to be child and family friendly
- Services are organised in such a way as to be relevant, accessible and sufficiently flexible to meet the needs of every member of the community

37



**These things require us to truly believe children are important**

- Change happens when there are enough voices demanding change

AND

- When we share the dream we are working towards

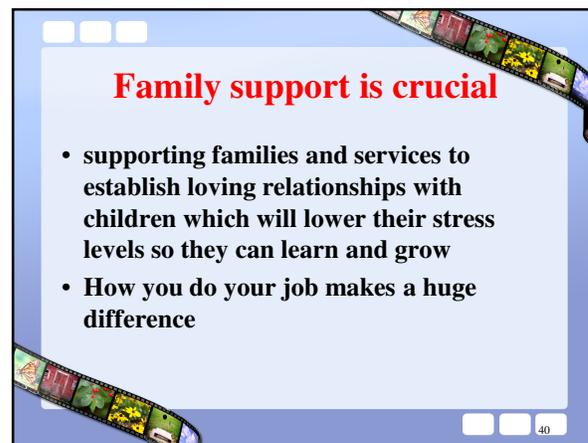
38



**What is your role?**

- Advocacy
  - How important does YOUR Government think young children are in your society?
  - What will it take for them to put the resources you need into service development?
- Involvement at community level
- Involvement at family level

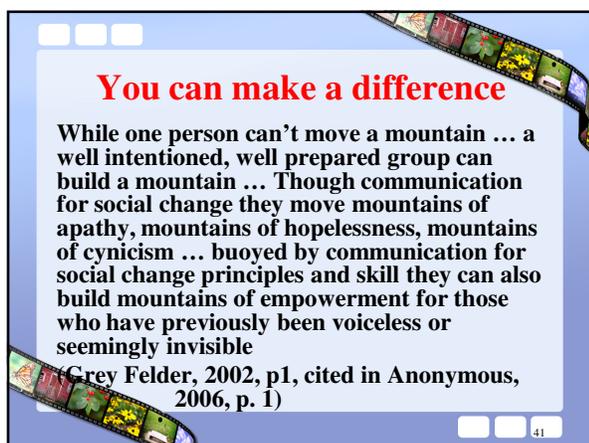
39



**Family support is crucial**

- supporting families and services to establish loving relationships with children which will lower their stress levels so they can learn and grow
- How you do your job makes a huge difference

40

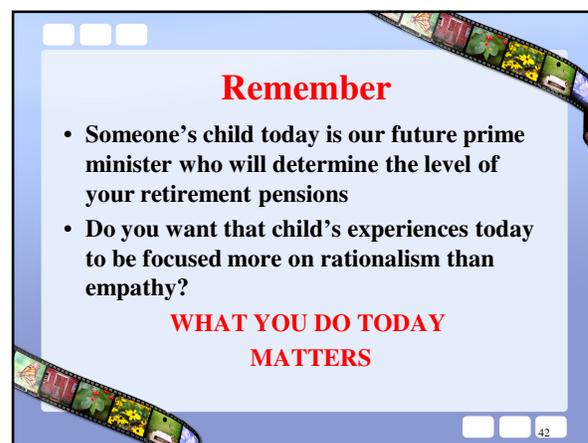


**You can make a difference**

While one person can't move a mountain ... a well intentioned, well prepared group can build a mountain ... Though communication for social change they move mountains of apathy, mountains of hopelessness, mountains of cynicism ... buoyed by communication for social change principles and skill they can also build mountains of empowerment for those who have previously been voiceless or seemingly invisible

(Grey Felder, 2002, p1, cited in Anonymus, 2006, p. 1)

41

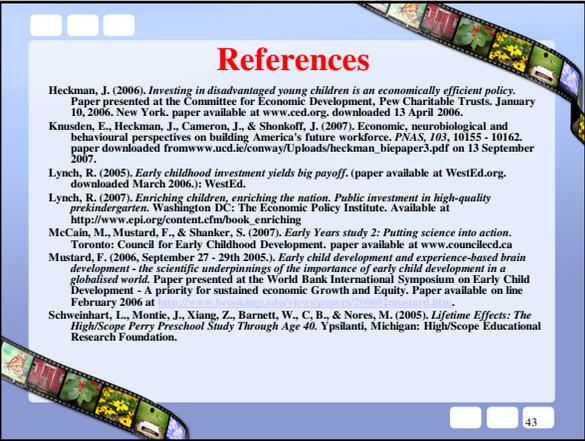


**Remember**

- Someone's child today is our future prime minister who will determine the level of your retirement pensions
- Do you want that child's experiences today to be focused more on rationalism than empathy?

**WHAT YOU DO TODAY MATTERS**

42



## References

Heckman, J. (2006). *Investing in disadvantaged young children is an economically efficient policy*. Paper presented at the Committee for Economic Development, Pew Charitable Trusts, January 10, 2006, New York, paper available at [www.ced.org](http://www.ced.org), downloaded 13 April 2006.

Knudsen, E., Heckman, J., Cameron, J., & Shonkoff, J. (2007). Economic, neurobiological and behavioural perspectives on building America's future workforce, *PNAS*, 103, 10155 - 10162, paper downloaded from [www.aed.ie/conway/uploads/heckman\\_biepaper3.pdf](http://www.aed.ie/conway/uploads/heckman_biepaper3.pdf) on 13 September 2007.

Lynch, R. (2005). *Early childhood investment yields big payoff*. (paper available at WestEd.org, downloaded March 2006.): WestEd.

Lynch, R. (2007). *Enriching children, enriching the nation. Public investment in high-quality prekindergarten*. Washington DC: The Economic Policy Institute. Available at [http://www.epi.org/content.cfm/book\\_enriching](http://www.epi.org/content.cfm/book_enriching)

McCain, M., Mustard, F., & Shanker, S. (2007). *Early Years study 2: Putting science into action*. Toronto: Council for Early Childhood Development, paper available at [www.councilcecd.ca](http://www.councilcecd.ca)

Mustard, F. (2006, September 27 - 29th 2005). *Early child development and experience-based brain development - the scientific underpinnings of the importance of early child development in a globalised world*. Paper presented at the World Bank International Symposium on Early Child Development - A priority for sustained economic Growth and Equity. Paper available on line February 2006 at <http://www.brocku.ca/~edu/ess/papers/200602/rooster.html>.

Schweinhart, L., Montie, J., Xiang, Z., Barnett, W., C. B., & Nores, M. (2005). *Lifetime Effects: The HighScope Perry Preschool Study Through Age 40*. Ypsilanti, Michigan: HighScope Educational Research Foundation.

43