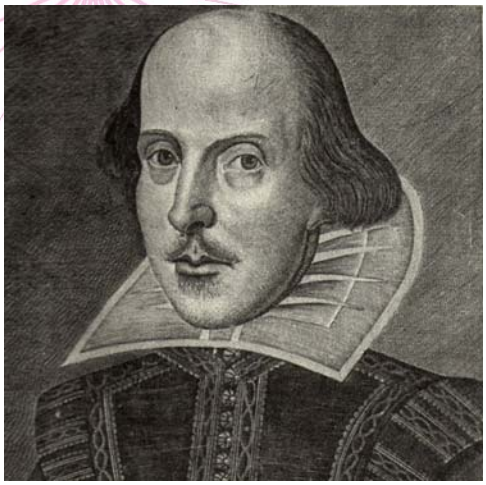
Teenage Brain Maturation - progression through risk taking

A/Prof Stephen Wood
Principal Research Fellow

Melbourne Neuropsychiatry Centre

THE UNIVERSITY OF MELBOURNE

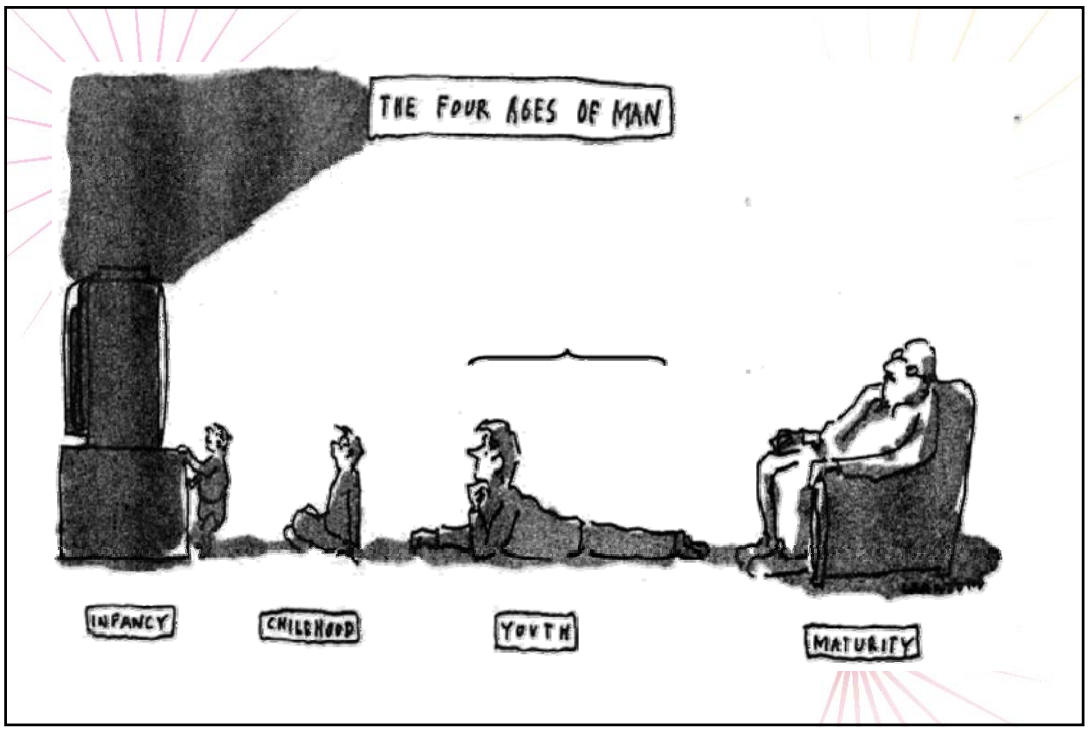
- *Youth are heated by Nature as drunken men by wine.*
  - *Aristotle*



- *I would that there were no age between ten and twenty three…for there is nothing in between but getting wenches with child, wronging the ancientry, stealing, fighting…*
  - *Shakespeare (The Winter's Tale; Act III)*

Adolescence

- When does it start?
- When does it end?



Adolescence

That awkward period between sexual maturation and the attainment of adult roles and responsibilities

Adolescence

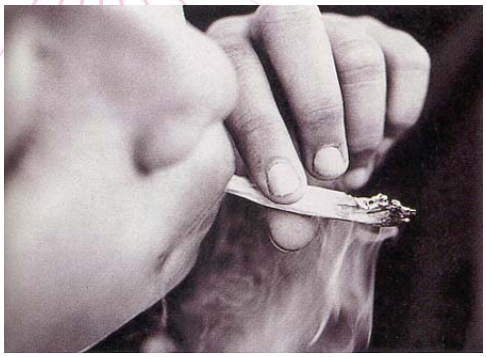
- Major changes
  - Risk taking/Sensation seeking
    - Vast majority of teenagers will do something against the law
  - Social interaction
    - Close to one-third of waking hours talking to peers, but only 8% to adults
    - Also increase in perceived conflicts with parents
  - Intellectual expansion

The Health Paradox of Adolescence

- Measures of most abilities indicate adolescence is the healthiest and most resilient period of the lifespan
- From Childhood to Adolescence:
  - Improvements in strength, speed, reaction time, mental reasoning abilities, immune function …
  - Increased resistance to cold, heat, hunger, dehydration, and most types of injury …
- Yet: overall morbidity and mortality rates *increase* 200-300% from childhood to late adolescence

- Primary causes of death/disability are related to problems with problems with *control of behaviour and emotion.*
- Increasing rates of accidents, suicide, homicide, depression, alcohol & substance use, violence, reckless behaviours, eating disorders, problems related to risky sexual behaviours…
- Increase in risk-taking, sensation-seeking, and emotionally erratic (emotionally-influenced) behaviour.

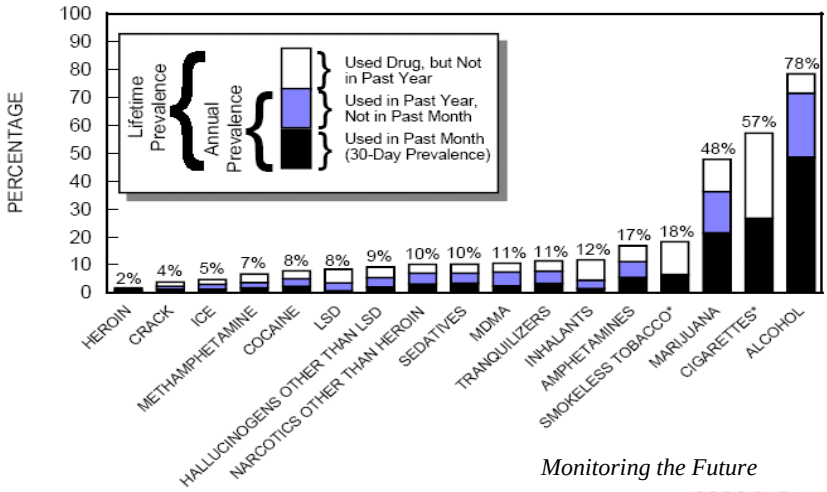
Development of substance use



UK adolescents	11 years	15 years
Smoking (regular)	1%	30%
Alcohol (regular)	2%	40%
Binge drinking	1%	20%
Having tried drugs	2%	20%

Prevalence of substance use amongst 12th graders – 2002

N=43,716



Monitoring the Future

Experimental drug use

- Is experimental use 'developmentally appropriate'?
- Abstainers
  - anxious, over-controlled, emotionally constricted, lack social skills
- Frequent users
  - alienated, distressed, poor impulse control
- Experimental users
  - more socially competent in both childhood & adolescence than frequent users or abstainers

Shelder & Block, 1990

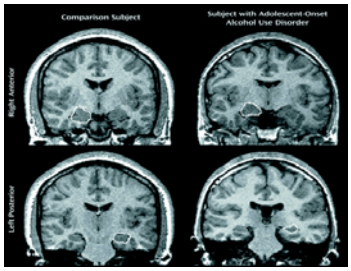
Drugs during adolescence

Nicotine is neurotoxic in the adolescent brain cf. Adults

Abreu-Villaça et al., 2003

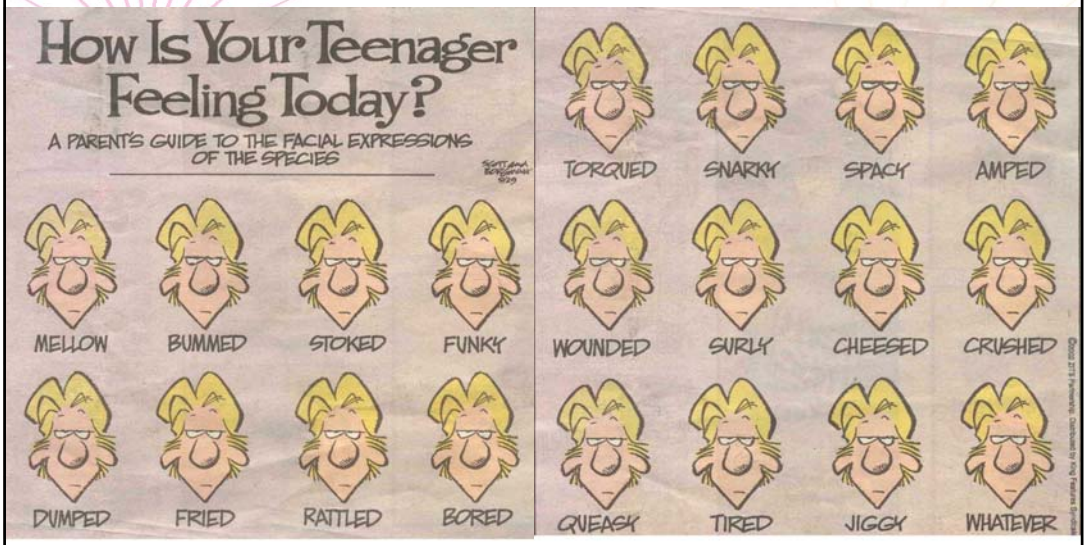
Early-onset cannabis users (<17 yrs) exhibit poorer cognitive performance than late-onset users (>17yrs) or control subjects, especially in Verbal IQ

Pope et al., 2003

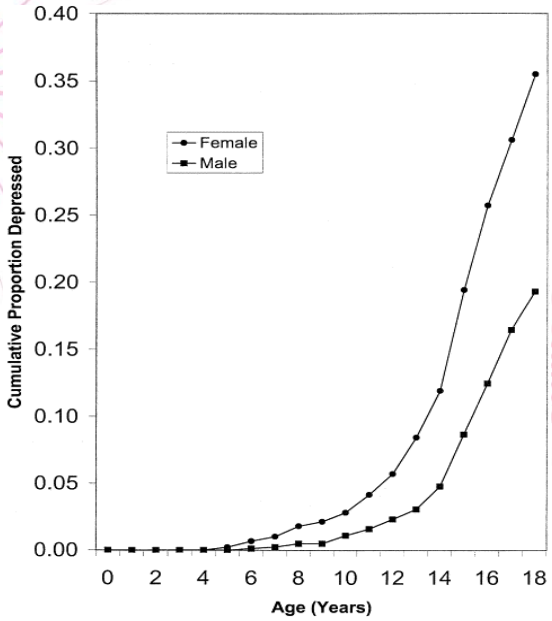


- 12 young people with alcohol use disorders
- Mean age 17.2yrs
- 24 matched controls
- Total hippocampal vol.
  - +vely correlated with age at onset
  - -vely correlated with duration of alcohol disorder

De Bellis et al., 2000

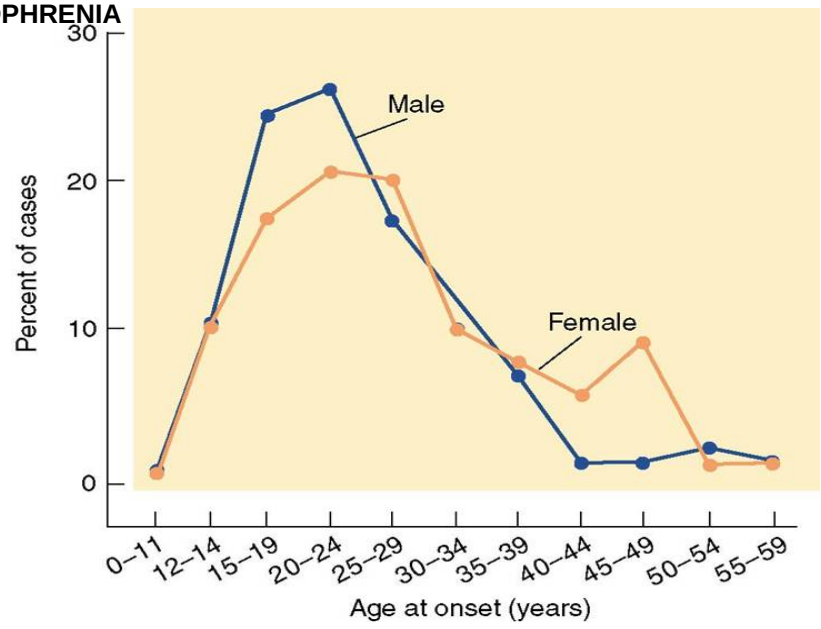


DEPRESSION

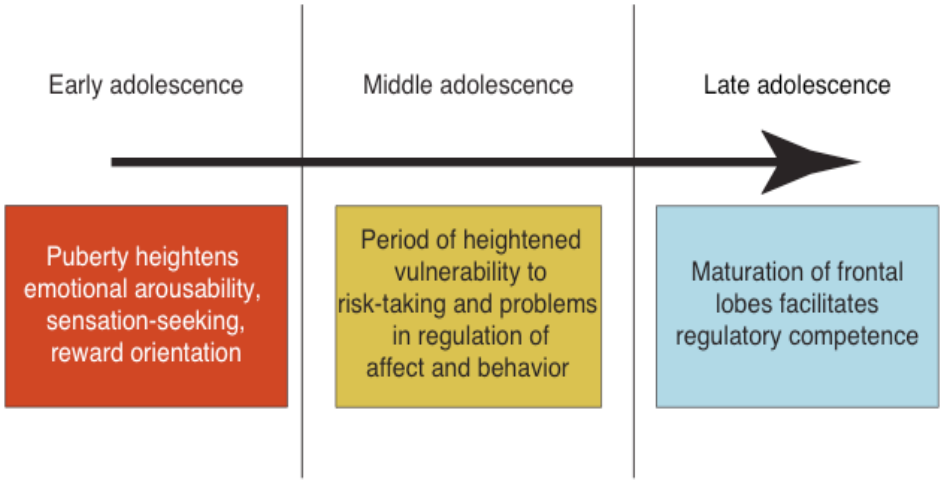


Data adapted from Lewinsohn

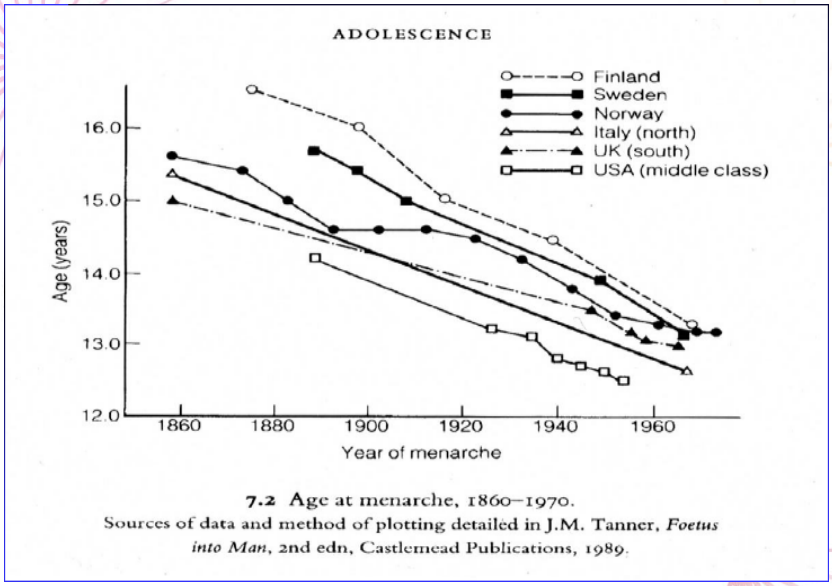
SCHIZOPHRENIA



A model of development

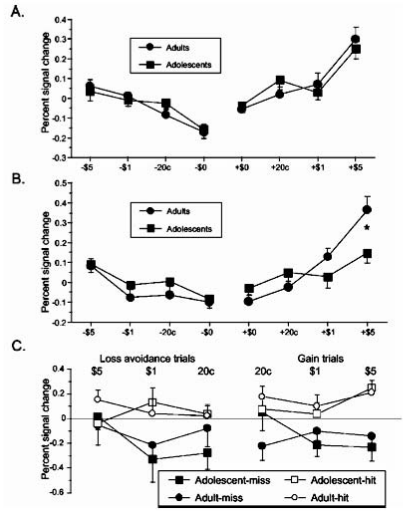


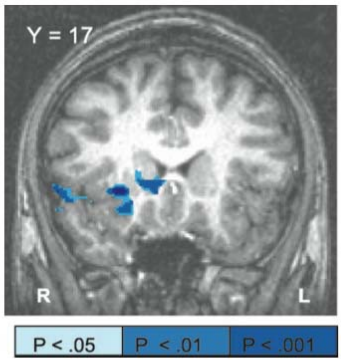
Steinberg, TICS 2005



7.2 Age at menarche, 1860–1970.
Sources of data and method of plotting detailed in J.M. Tanner, *Foetus into Man*, 2nd edn, Castlemead Publications, 1989.

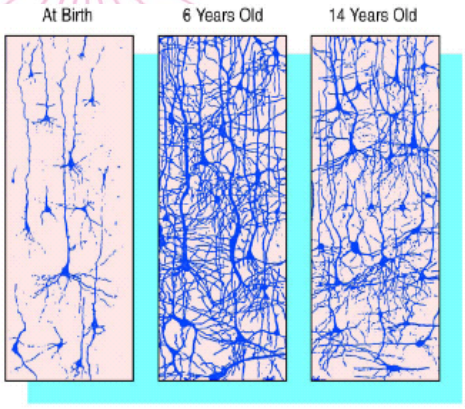
Adolescent response to reward





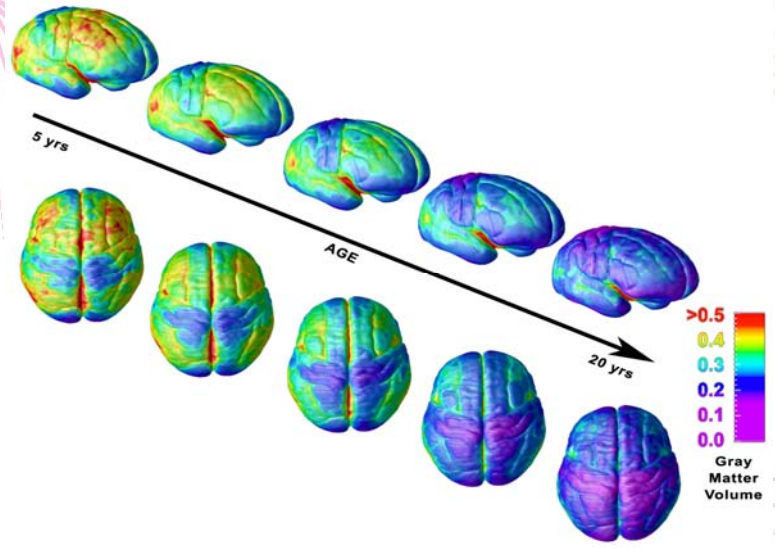
Bjork et al, 2004

Adolescent neurodevelopment



- The final phase of brain development, “synaptic pruning”, occurs early in sensory cortex and late in frontal cortex
- Grey matter is lost from the frontal cortex throughout adolescence

Cortical Thinning During Adolescence



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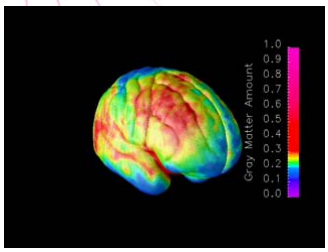

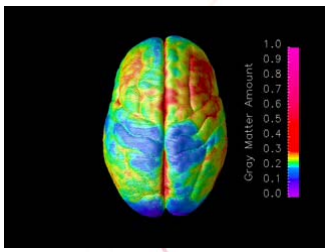

Gogtay, PNAS 2004

Risk-taking behaviours

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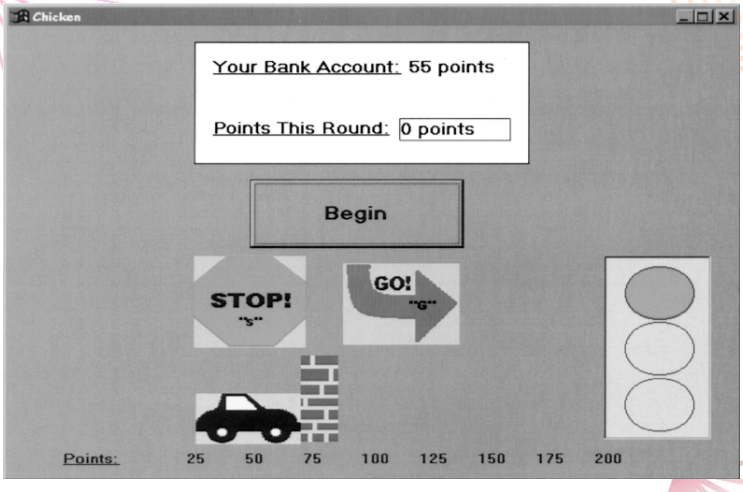

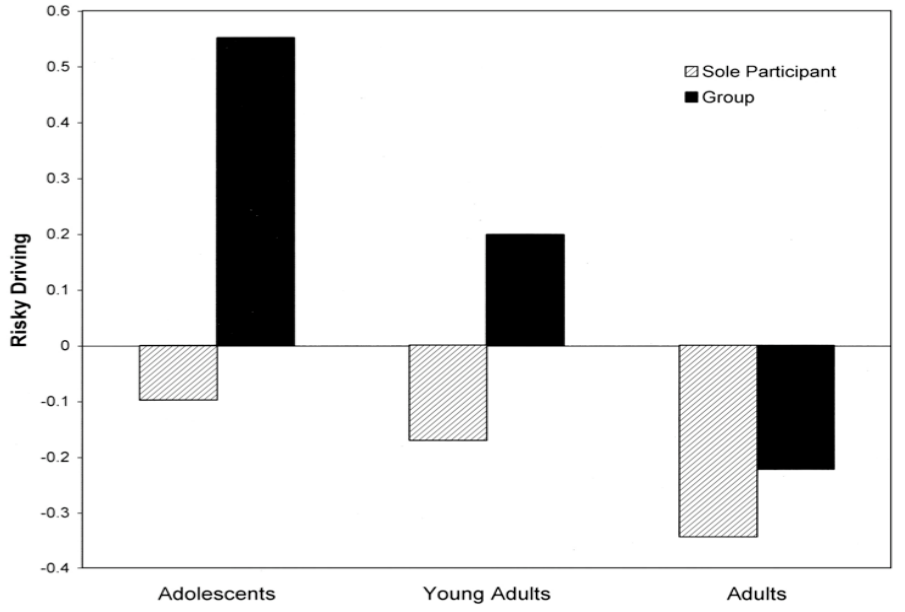

Difficulties and Stress in Adolescence

- Although it is commonly believed that adolescence is an inherently difficult time, this is little scientific support for this idea.
- Adolescent is a period of change, but not necessarily stress.
- However, some individuals experience more difficulty and stress than others.