Alcohol & Drug Related Brain Injury

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Outline

* The nature of alcohol related brain injury over the whole lifespan
* Which illicit drugs cause brain injury
* How can we predict who is likely to sustain substance-related brain injury
* Practical approaches to management of alcohol & drug related brain injury currently
* Moving forwards, what approaches to management of alcohol and drug related brain injury we need to be working towards

Alcohol and Other Drugs (AOD) and Brain Injury:
indirect
direct

AOD and Indirect brain injury

* Hypoxia
  (profound sedation >loss of consciousness: limited oxygen to brain)
* Other trauma (falls, road trauma etc)
* Assaults (while intoxicated)

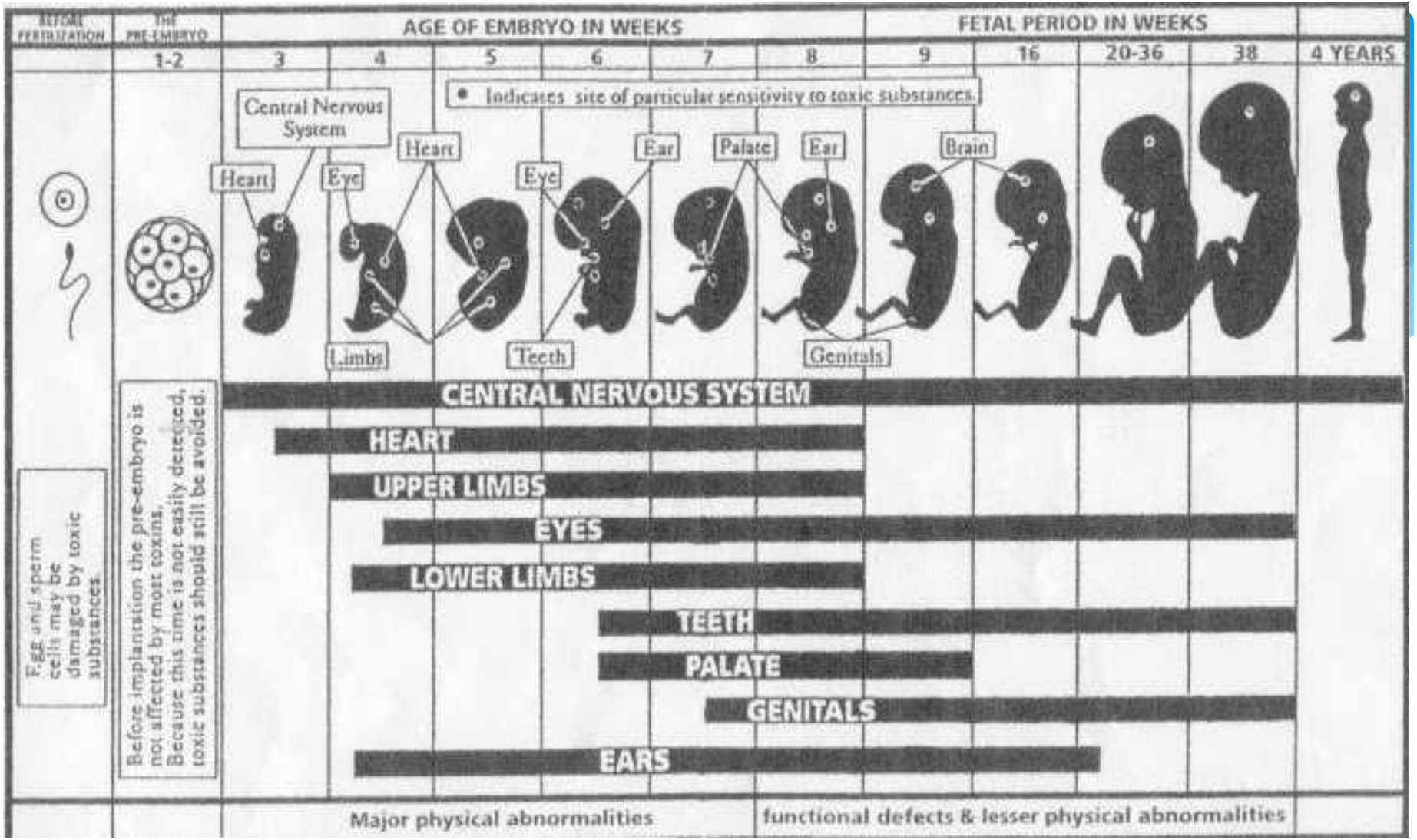
Alcohol and Other Drugs (AOD) and Brain Injury: **direct**

Alcohol related brain injury over the lifespan

FASD – fetal alcohol spectrum disorder

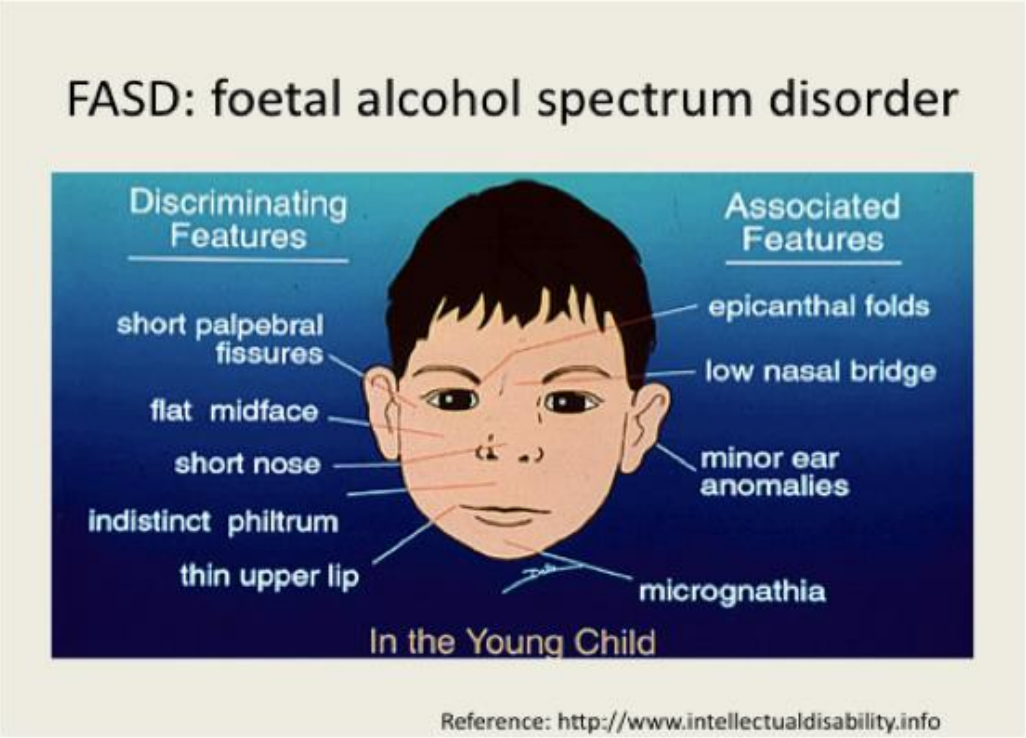
The leading known **preventable** cause of brain injury

Alcohol in pregnancy (c.f.other drugs) **unequivocally** associated with brain injury



Threshold level unknown:
single binge drinking episode shows brain cell 'drop out' in **rat** studies

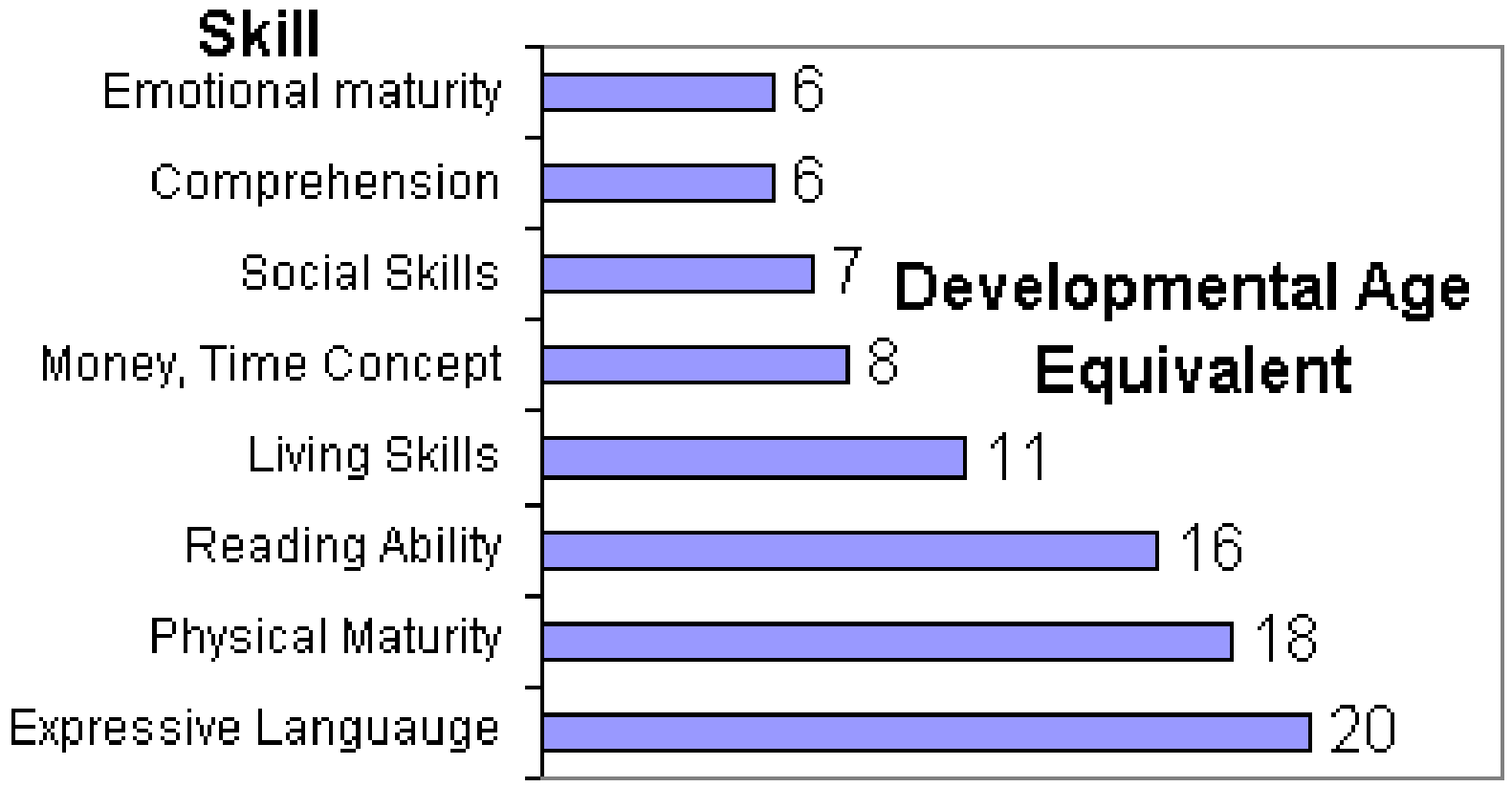
FASD



As the boy/girl gets older get problems with:

- Concentration (problems at school when can't learn easily)
- Controlling emotions & behaviour (problems with police & law)
- Making decisions
- Memory
- Learning new things (need extra support at school & in community)
- Later on, problems with alcohol and drugs

Chronological Age 18 with FAS/FAE



Alcohol in pregnancy

* Harm to the baby: threshold level not known
* Recommendation to NOT DRINK AT ALL in pregnancy

- *Health professionals don't like to ask women about drinking in pregnancy*
- *Community backlash about not drinking in pregnancy*
- *Stigma and guilt on part of mother so few women access treatment*

Neuroplasticity

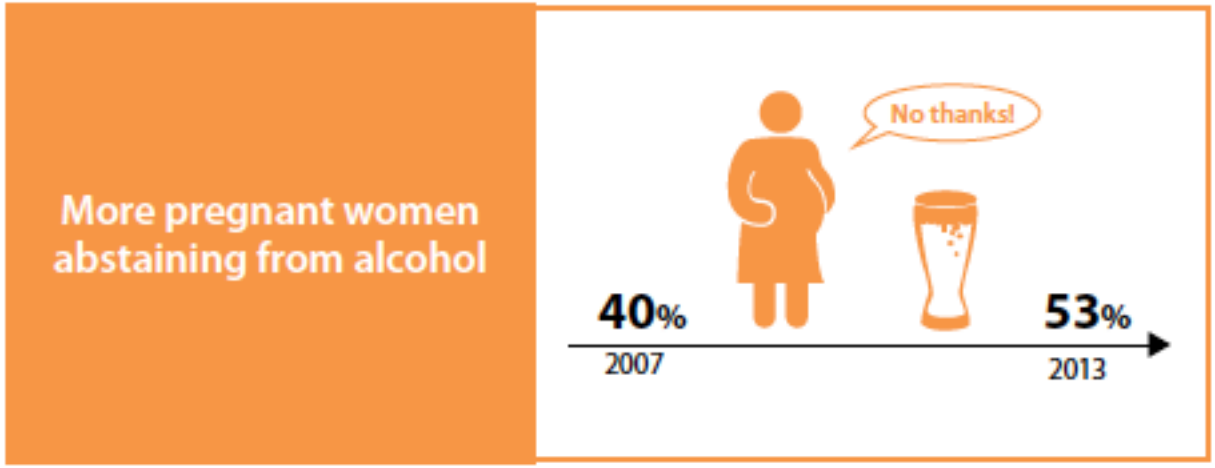
AOD in pregnancy:

* Importance of environment

* Comparing AOD exposed vs non-exposed:

  Nurturing vs stressful (MH, poverty) environment

Improvements are occurring…



NDSHS_2013_AIHW

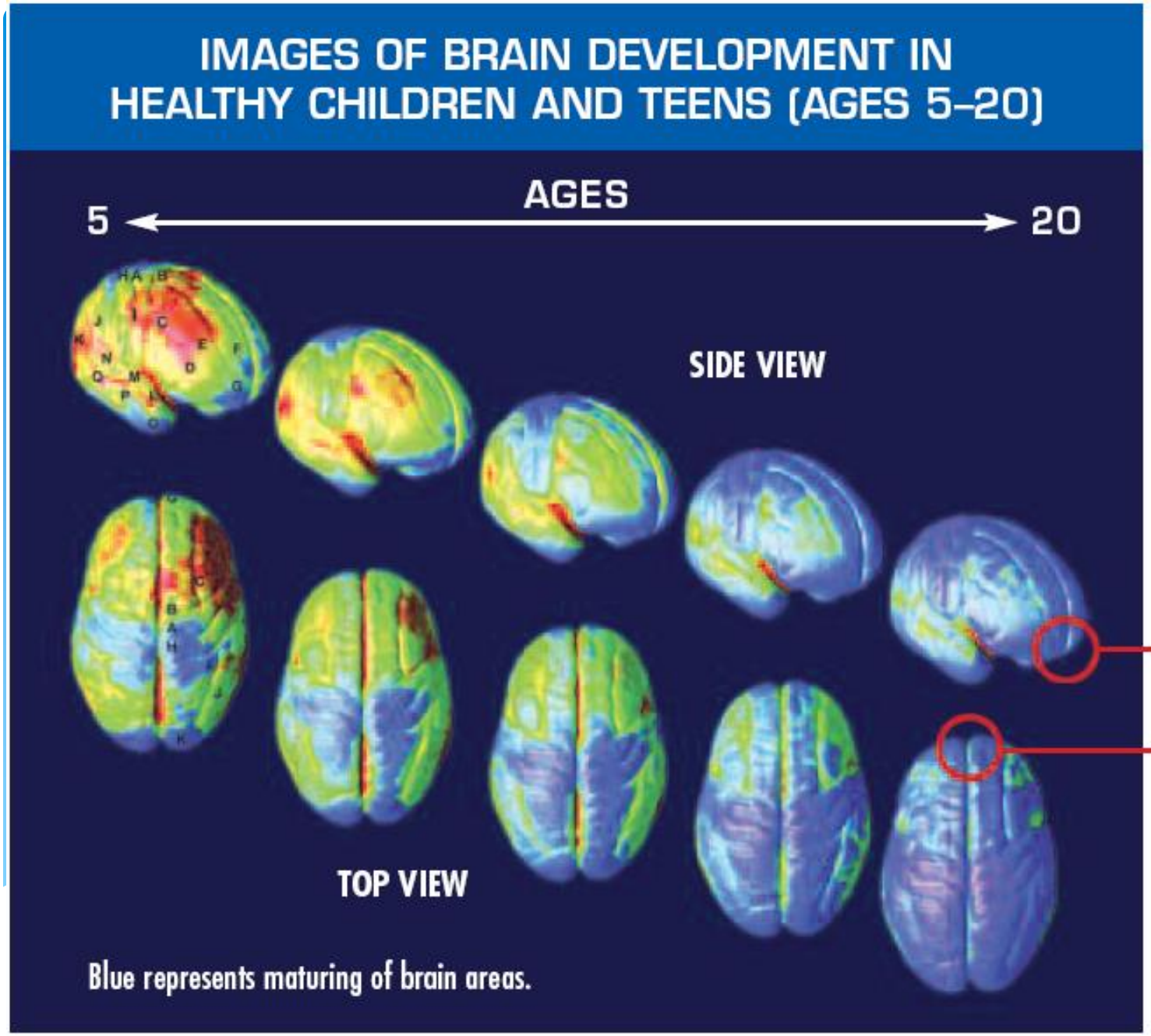
Alcohol: adolescence & young adulthood

Adolescence & young adulthood is a critical period of brain development

Brain composition (neuronal connections) changes substantially in adolescence – called "brain re-modelling"

Re-modelling is dramatically influenced by the young person's

experiences and interactions with the outside world



Source: PNAS; 101:8174–8179. 2004.

Prefrontal Cortex

Decision making
Right vs wrong
Inhibition
Working memory
Planning
Cognitive flexibility

Alcohol: adolescence & young adulthood

Intoxication

Post-intoxication (mid-week Wednesdays)

Longer term:

Alcohol causes premature aging of the brain
(memory, executive function)

Before: need 10 years heavy alcohol consumption before impairment

Now: age of onset and amount of alcohol are very important factors

Hermens 2013

Improvements are occurring…

12-17 year olds choosing NOT to drink: 64% (2010) to 71% (2013)

Onset alcohol consumption in 14-24 yo : 14.4 (1998) to 15.8 (2013)

Nb. parents

NDSHS_2013_AIHW

Areas for more work

18-24 yo's are still the group most likely to binge drink

Especially males

Levels of consumption ("binges") are very high
eg bottle of spirits, 15-20+ standard drinks

NDSHS_2013_AIHW

Alcohol and older person

Spectrum: alcohol causes premature ageing of the brain

* Cognitive impairment (subtle memory deficits, other)
* Alcohol impact on dementia
* Acquired brain injury

Which illicit drugs are associated with brain injury?

Illicit drugs and brain injury

Cannabis

Methamphetamine (“ice”)

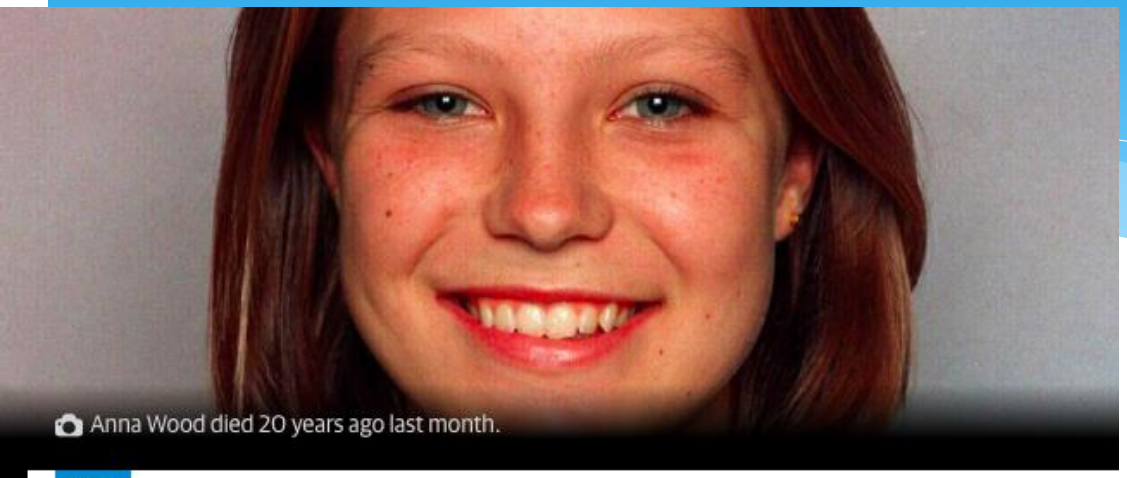
New psychoactive agents (NPS)/NBoMES

Opioids:

- heroin
- prescription opioids

Indirect injury more common
eg sedation, apnea

New psychoactive agents (NPS)/NBoMES



Anna Wood died 20 years ago last month.

NSW

Anna Wood's drug death message falling on deaf ears, says her father Tony

Part of the crowd at Sydney's Stereosonic music festival at Olympic Park on Saturday.

Henry Kwan jumps to his death in a synthetic psychosis

Illicit drugs and brain injury

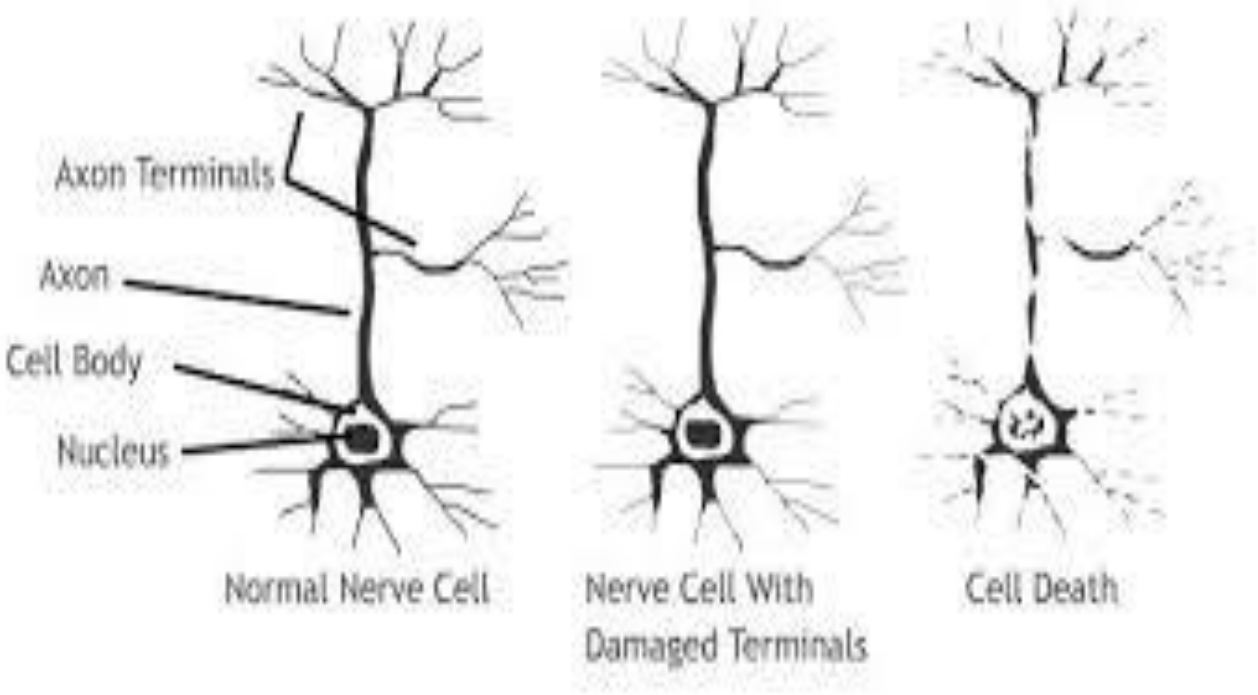
New psychoactive agents (NPS)/NBoMES

cerebral toxicity – unconsciousness, coma

Methamphetamine (“ice”)

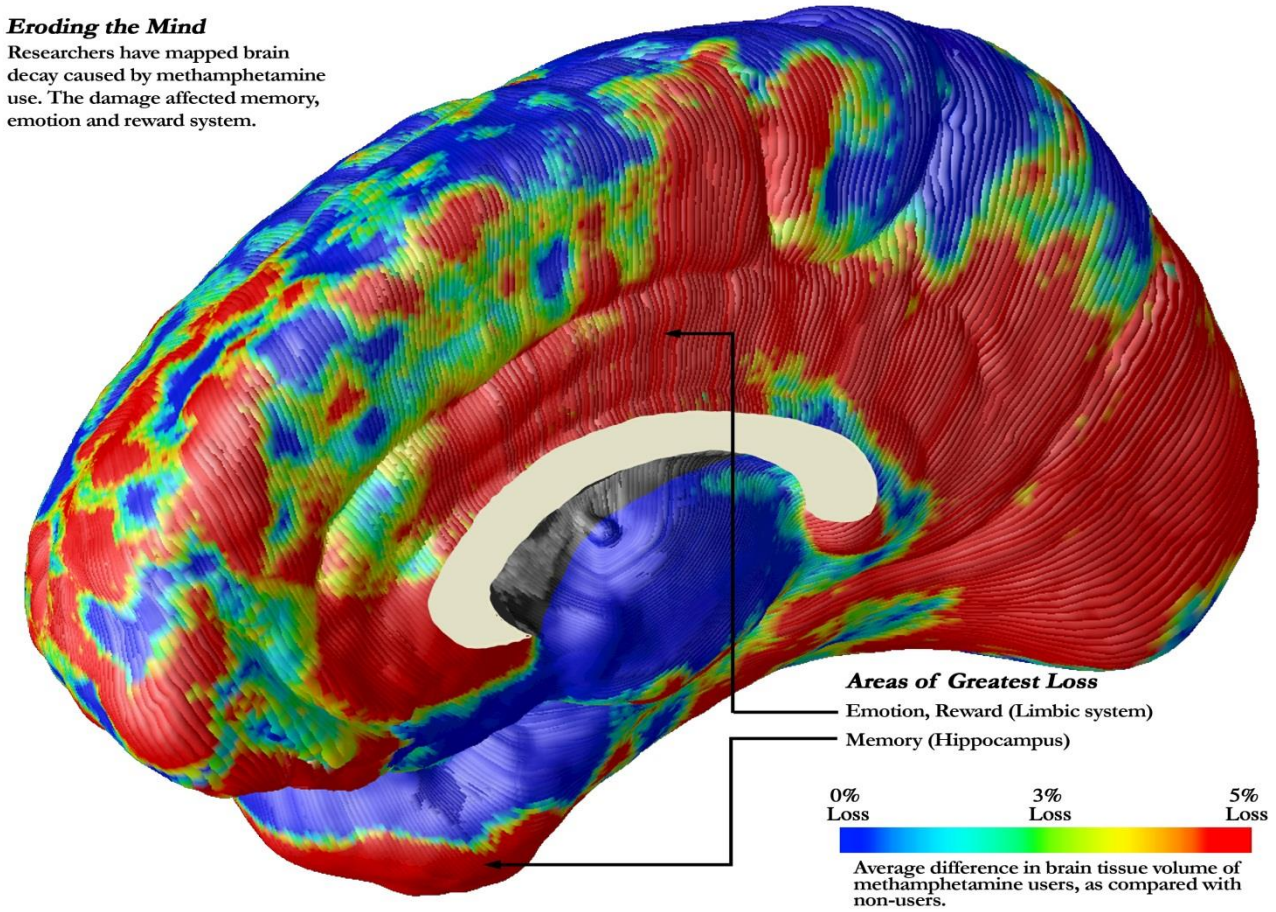
Prolonged stimulant use

Changes the brain in fundamental and long-lasting ways

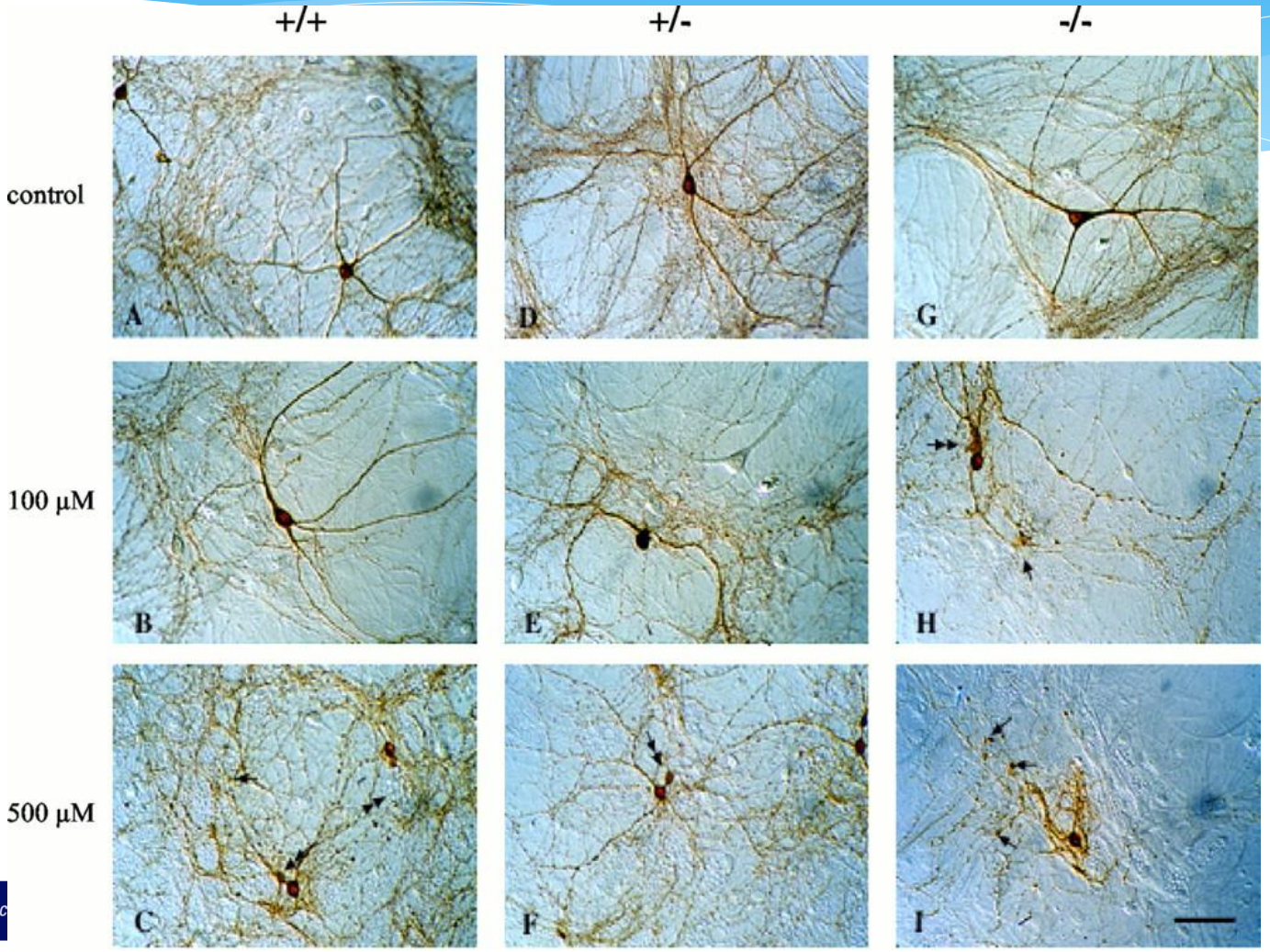


Dopamine neurons

Methamphetamine effects on the brain - chronic



Genetic susceptibility to nerve damage



The Journal of Neurosc
©2002 by Society for Neuroscience

Kristin E. Larsen et al. J. Neurosci. 2002;22:8951-8960

Young methamphetamine users

* Impulse control

  Salo, R., et al. (2002). "Preliminary evidence of reduced cognitive inhibition in methamphetamine-dependent individuals." Psychiatry research 111(1): 65-74.

* Memory and executive function

  King, G., et al. (2010). "Neuropsychological deficits in adolescent methamphetamine abusers." Psychopharmacology 212(2): 243-249.

* Long term users have cerebral atrophy

  Nakama, H., et al. (2011). "Methamphetamine users show greater than normal age-related cortical gray matter loss." Addiction **106**(8): 1474-1483.

* Use before 21 years -> smaller brain volume

  Schwartz, D.L., et al., Global and local morphometric differences in recently abstinent methamphetamine-dependent individuals. Neuroimage, 2010. 50(4): p. 1392-401.

How does this play out ?

Deficits on executive tasks:

- Poor judgment
- Lack of insight
- Poor strategy formation /planning
- Impulsivity
- Reduced capacity to determine consequences of actions

Can individual recover?

* Recovery from heavy use requires prolonged abstinence
  * Nb craving
* Irreversible damage in some

Cannabis and the brain

Cannabis

longterm injury – attention, working memory, verbal memory

adolescent onset vs later, dose, frequency, duration

in utero exposure?

recovery with abstinence?

nb. Role of cannabinoids in acute brain injury??

How can we predict who will sustain substance related brain injury?

Predicting AOD related brain injury

* Family history
* Genetic

* Age of onset
* Degree of use (amount, frequency)

Current practice

* Neuropsychological monitoring?

As a proposed practice ?
Research
Theory

Practical approaches to AOD related brain injury

* Early intervention – presently not nearly enough yet important
  * Impacts on retention in treatment
  * Impacts on treatment success

* More regular monitoring of cognitive function
  * Not currently mainstream practice, usually late eg for guardianship reasons
    * Best method?
      * Formal neuropsychological testing time consuming and costly
    * Bedside testing – MOCA, others – relatively blunt tools
    * Software?

Moving forwards

* Greater practical focus
  > will stimulate the research into knowledge gaps

* Consistent measurement
  > determine which tool, use across sector

* Regular monitoring
  > identify deteriorations earlier and intervene
  > neuroplasticity