DISRUPTION OF BIOLOGICAL RHYTHMS

Shift work:
- decreased alertness: Boivin et al. (1996) circadian trough, from midnight with lowest cortisol to 4am with lowest core body temp.
- sleep deprivation: av. 1-2 hours shorter in day, REM affected, circadian trough during night work
- health effects: Knutsson et al. (1986) 15 years of shifts, 3x likely heart disease, linked to other organ diseases too

Jet lag:
- dorsal portion of SCN takes one day per hour out to adjust (Winter et al., 2008)
- Recht et al. (1995) US baseball East to West (phase delay; easier) won 44%, West to East won 37% (phase advance; harder)

Other factors:
- shift work: may be like sleep as going to bed at unusual times, social disruption too – divorce high as 60% in night-shift workers (Solomon, 1993)
- jet lag: may sleep bad night before due to worrying, travel is tiring and stressful

Reducing harmful effects:
- rotating shifts: Gold et al. (1992) non-fluctuating shifts less disruptive as consistent sleep-wake pattern
- forward-rotating shifts: Bambra et al. (2008) easier as follow phase delay, quick changes better
- melatonin: Herxheimer and Petrie (2001) meta-analysis 10 studies, remarkably effective when taken at right time of day
- social customs: Fuller et al. (2008) fasting then eating helps entrain rhythms to new schedule

Individual differences: affects can vary between individuals, Reinberg et al. (1984) those who gave up shift work had rhythms that changed a lot

Lab experiments: carefully controlled to isolate causal variables, field studies needed too, thus Boivin and James (2002) found lights effective in study of nurses

IDA: (RWA)
- shift fatigue cost at $77 billion annually
- e.g. Exxon Valdez oil spillage 12.04am, Chernobyl disaster at 1:23am, Three-Mile Island at 4am, lorry accidents 4-7am

LIFESPAN CHANGES IN SLEEP

Infancy: (16hrs a day)
- 60 minute sleep cycle, often awakening
- quiet sleep and active sleep (immature SWS and REM)
- circadian rhythm established at 6 months, periods of deep sleep lengthen
- day sleep an adaptive mechanism? allows parents to work
- REM linked to neurotransmitter production and memory consolidation, explains longer REM sleep in babies, + premature babies spend 90% in REM sleep

Childhood: (12hrs, and declining)
- aged 5, EEG patterns look like adults
- REM still 30% of sleep pattern
- parasomnia
- have sleep slightly longer than girls

Adolescence: (9.5 hrs)
- need more sleep increases after dip at end of childhood to adolescence – feel more awake at night than morning
- ‘wet dreams’ most likely to occur at this age
- hormones primarily released at night, disturbed sleep patterns thus sleep deprivation
- Crowley et al. calls this circadian disruption ‘delayed sleep phase syndrome’

Adulthood: (8hrs)
- REM for 25%
- increasing frequency of disorders, e.g. insomnia, apnoea

Old age: (8hrs*)
- REM for 20%, SWS down to 5% or none (harder to stay asleep)
- phase advance – more awake in morning than at night
- difficulty going to sleep, waking up to 6 times a night
- reduced sleep a result of conditions like apnoea?
- Cauter et al. (2000) lack of energy & lower bone density due to less SWS (growth hormone production)
- treatments for lack of sleep: relaxation methods, melatonin

IDA:
- developmental approach: age-related change introduced, led to new understanding
- RWA: Wolfson and Carskadon (2005) school should start later, improvement of ‘sleep hygiene’
- cultural bias: Tynjälä et al (1993) 400,000 from 11 European countries, some differences but followed similar patterns (evolutionary), duration influence by cultural practices

FUNCTIONS OF SLEEP: RESTORATION EXP.

SWS: (bodily growth)
- growth hormone secreted during SWS, important in childhood, protein synthesis and cell growth in adulthood
- Sasson et al. (1969) sleep-cycle reversed, GH release reversed, GH controlled by SWS neural mechanisms
- van Couter and Plat (1996) GH amount correlates with SWS amount
- Kruegar et al. (1985) reduced immune system functioning associated with lack of SWS

REM: (mental growth)
- brain growth: immaturity of offspring at birth proportionate to REM; platypus 8hrs REM, dolphin no REM (Siegel, 2003)
- neurotransmitter: Siegel and Rogawski (1988) REM a break in neurotransmitter releases, neurons regain sensitivity
- memory: Crick and Mitchison (1983) unwanted memories discarded in REM – or REM for procedural memory consolidation (e.g. bike-riding) – SWS for semantic and episodic memory consolidation (Stickgold, 2005)

RE – total sleep deprivation:
- USA DJ Peter Tripp: 201hrs, 3 days unpleasant, 5 days hallucinations/paranoia, decline in body temperature throughout, brain waves same as sleeping at end, 24hrs sleep after and was fine
- student Randy Gardner: 260hrs, no psychotic symptoms, normal after lengthy sleep
- Vietnamese Hai Ngoc: reportedly awake since 1973, no ill effects
- but… Williams et al. (1959) after 72hrs periods of microsleep (EEG same as sleep) – above, all case studies

RE – partial sleep deprivation:
- Empson (2002) REM rebound after being awoken in REM sleep, ‘recovery nights’ 50% more REM
- Ferrara et al. (1999) SWS rebound when surprising SWS with acoustic stimulation

Animal studies: Rechtsaffen et al. (1983) forced rats physically active, all died after 33 days, stress killed rather than lack of sleep? Rattenborg et al. (2005) no effect on pigeons

Exercise: Shapiro et al. (1981) marathoners +1hr sleep 2 nights after race – Horne and Minard (1985) Ps went to sleep faster, not for longer

IDA: alternative is evolutionary approach, if REM is vital why none for dolphins?, Young (2008) more known about species more clear that environment rather than restoration