

*Health benefits of cognitive
stimulation*



Cognitive function and aging

- Types of cognitive deterioration with age
 - decline in verbal memory
 - reduced fine motor skills
 - decline in executive control functions associated with prefrontal and frontal cortex



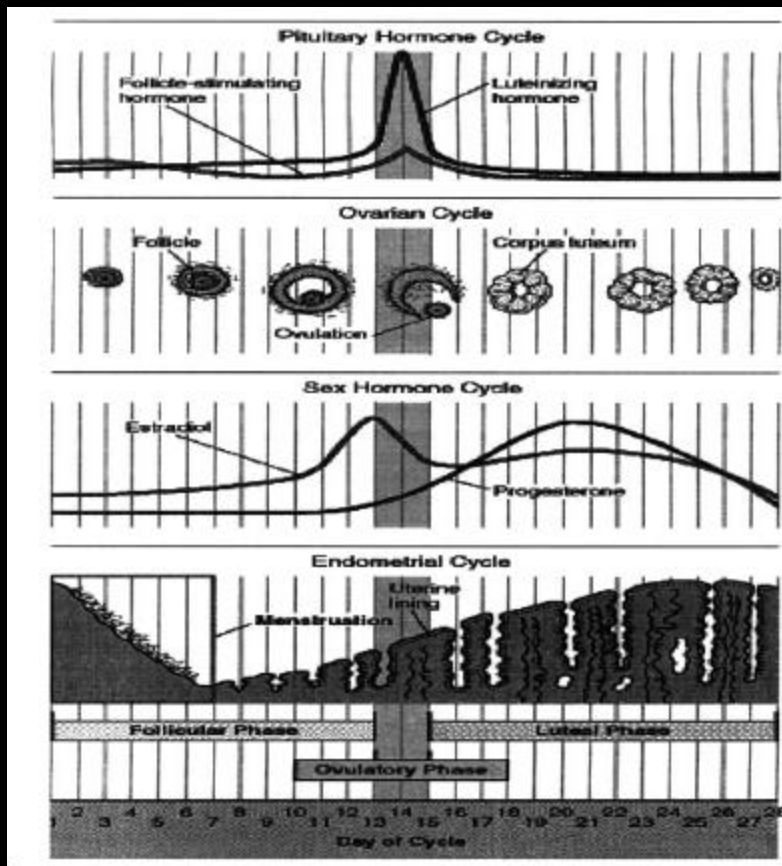
Cognitive function and aging



Estradiol and cognitive function

- Observations across menstrual cycle
- Post-menopausal changes
- Effects of hormone replacement

Estradiol and cognitive function



- High estradiol
 - late follicular phase
 - ovulatory period
 - proestrus
- Low estradiol
 - early follicular phase
 - metestrus
 - diestrus



High estradiol and cognitive function

- Cognitive and motor tests done across menstrual cycle (Hampson, 1990)
- Enhanced articulatory and fine motor skills during late follicular phase
- Poorer spatial ability
- Estradiol treatment of hypoestrogenic women with uterine myomas reversed decline in verbal memory (Sherwin & Tulandi, 1997)
- Increased extroversion, reduced neuroticism (Herrman & Beach, 1987)



Low estradiol and cognitive function

- Cognitive and motor tests done across menstrual cycle (Hampson, 1990)
- Reduced articulatory and fine motor skills during late follicular phase
- Better spatial ability
- Decline in verbal memory (Sherwin & Tulandi, 1997)
- Increased distress, anxiety & depression (Montgomery et al., 1987)



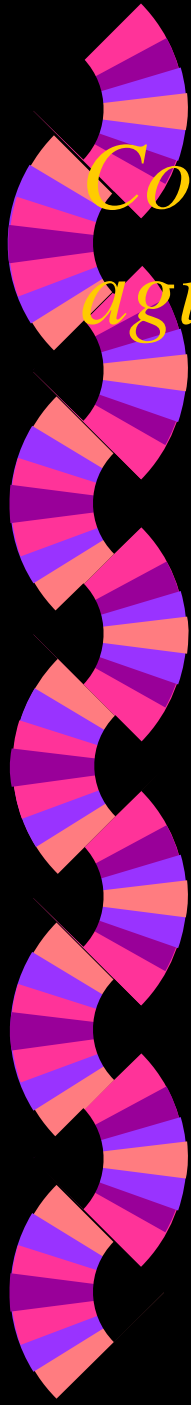
Sex steroids and brain structure

- Some sexual dimorphism of the brain
- Ovarian steroids regulate number of synapses in hippocampus (site of spatial and some other types of memory) : numbers respond rapidly to changes in hormone concentration (Desmond & Lewy, 1997)
- Androgens affect brain architecture during perinatal and adult life (Forget & Cohen, 1994)



Cognitive stimulation and mental function in aging

- Studies with nuns (Milwaukee, WI convents)
 - celibate
 - uniform lifestyle
- Does early cognitive function/ability affect mental function during aging? (Snowdon et al., 1996)
 - Linguistic ability assessed from autobiographies at 22 y
 - idea density (ID)
 - grammatical complexity (GC)
 - Level of early academic training (BA /no BA)



Cognitive stimulation and mental function in aging

Tests at age 75-102 y (n=678)

- ▶ Repeat 1.6 years later (n=575)
- ▶ Mini-Mental State Exam (MMSE) scores declined with age
- ▶ Decline was less in nuns with BA who were younger than 85, but not in those older than 85
- ▶ Low idea density (ID) and low grammatical complexity (GC) in early life were associated with low cognitive test scores 58 years later
- ▶ Low ID correlation was stronger than GC
- ▶ Alzheimers was confirmed in all with low ID and in none who displayed high ID in early life



Cognitive stimulation and mental function in aging

- Findings interpreted to indicate that
 - High neurocognitive reserve capacity in early life protects from manifestations of Alzheimer's disease in old age
 - Alternately, low idea density in early life may be a manifestation of early onset of, or predisposition for, Alzheimer's disease in old age.



Exercise and cognitive function in aging

- Aerobic training improves circulation and oxygen delivery to brain and other tissues (Kramer et al., 1999)
- Exercise training was either aerobic (walking) or anaerobic (stretching and toning) in 124 sedentary 60 to 75 y old
- Tests of executive control processes:
 - task switching (cost of, in terms of reaction time)
 - response compatibility (ability to ignore irrelevant stimuli)
 - stopping (ability to abort a preprogrammed movement)
- Non-executive processes
 - reaction time in non-switch trials and in stopping tests

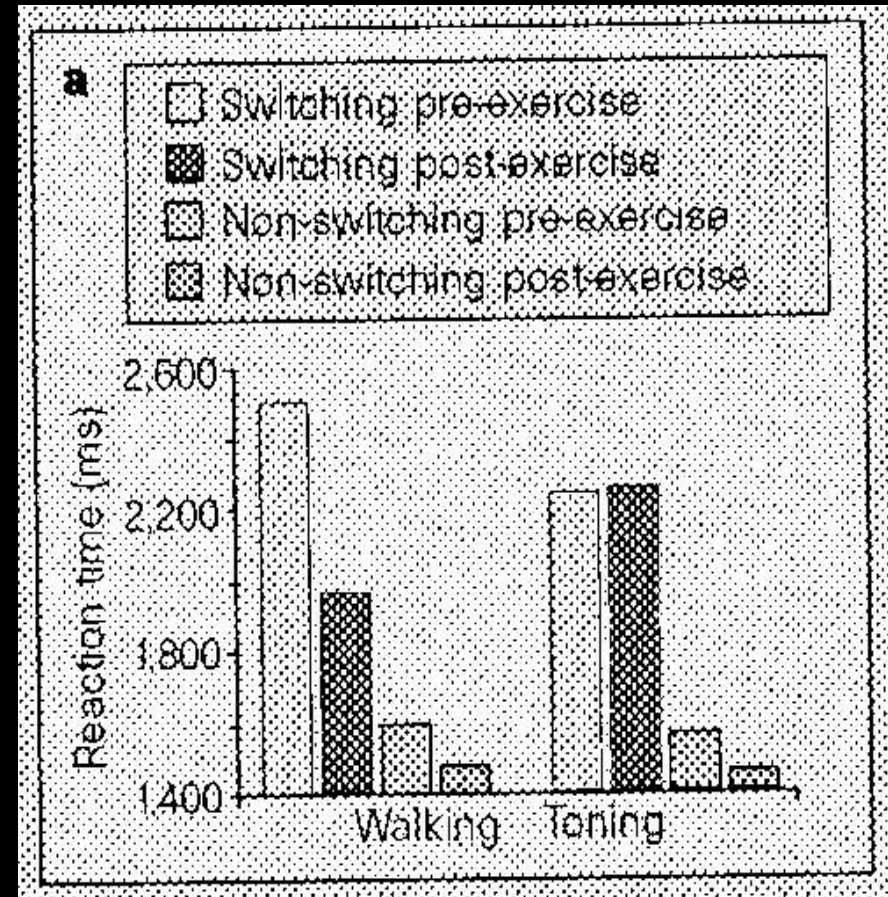
Exercise and cognitive function in aging

Walkers improved VO₂ max (+5% vs -3%)

Performance improved significantly in aerobic trained but not in aerobic trained in tasks requiring executive control

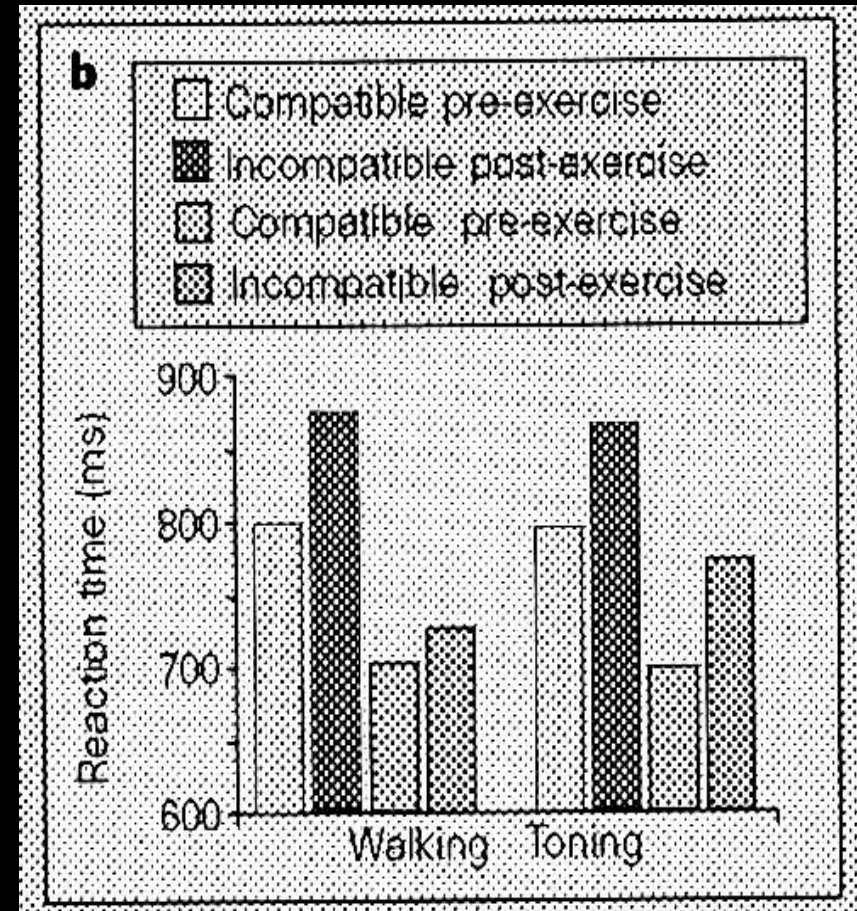
In task switching, walkers became faster (shorter reaction time)

In non-switch tasks both groups were the same



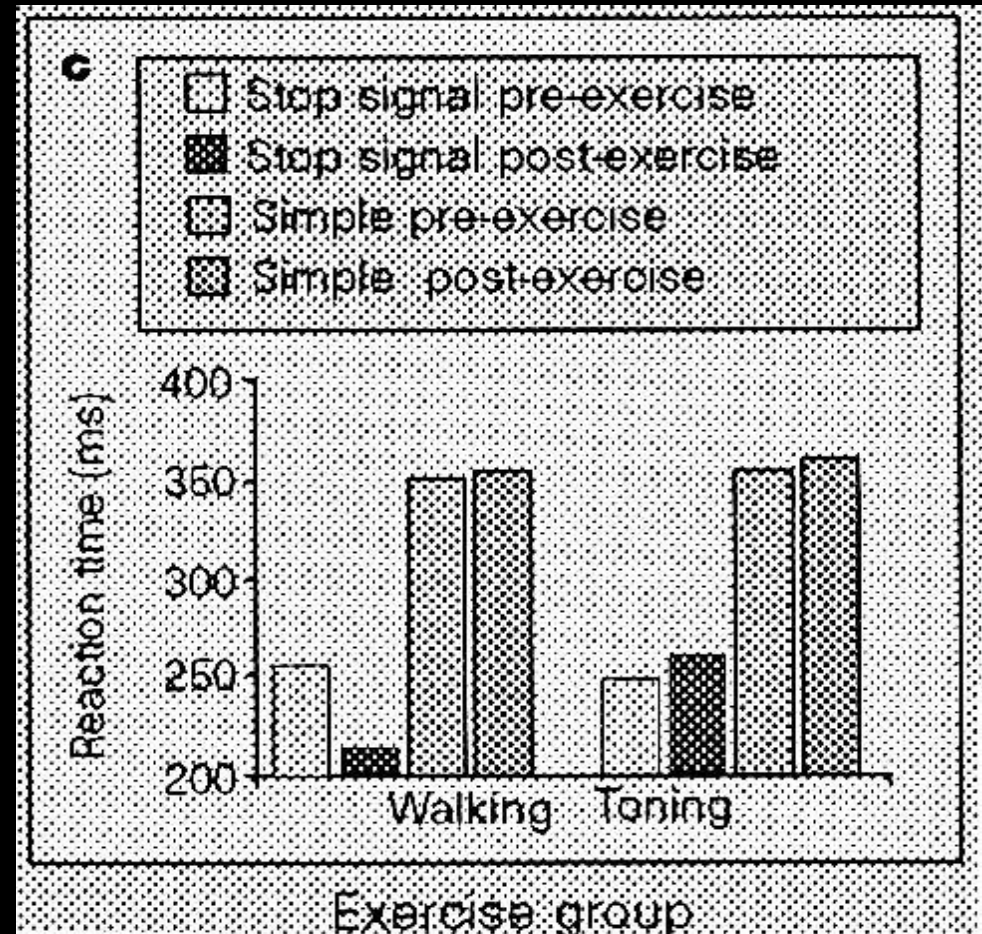
Exercise and cognitive function in aging

- In response-compatibility test, difference between incompatible and compatible reaction times decreased in the walkers but not in the toners
- Again this shows improvement in the executive control tasks after aerobic training



Exercise and cognitive function in aging

- In the stopping test, the reaction time for stopping was reduced in the aerobic group, but not in the anaerobic group
- Simple reaction time was unchanged by training in either group





Exercise and cognitive function in aging

- Aerobic exercise (but not anaerobic toning)
 - improves tasks that represent cognitive control processes
 - does not improve other tasks
 - affects these cognitive functions possibly through
 - increased circulation to the brain
 - increased oxygen delivery to the brain
 - increased neurotrophic changes in the brain (nerve growth factors, IGF-I, other)



Decline in cognitive function with aging

- may be due in part to
 - decline in sex hormone concentration and therefore amenable to protection with HRT
 - decline in circulation, oxygen supply to the brain and neurotrophic agents in the brain and therefore correctable by habitual aerobic exercise