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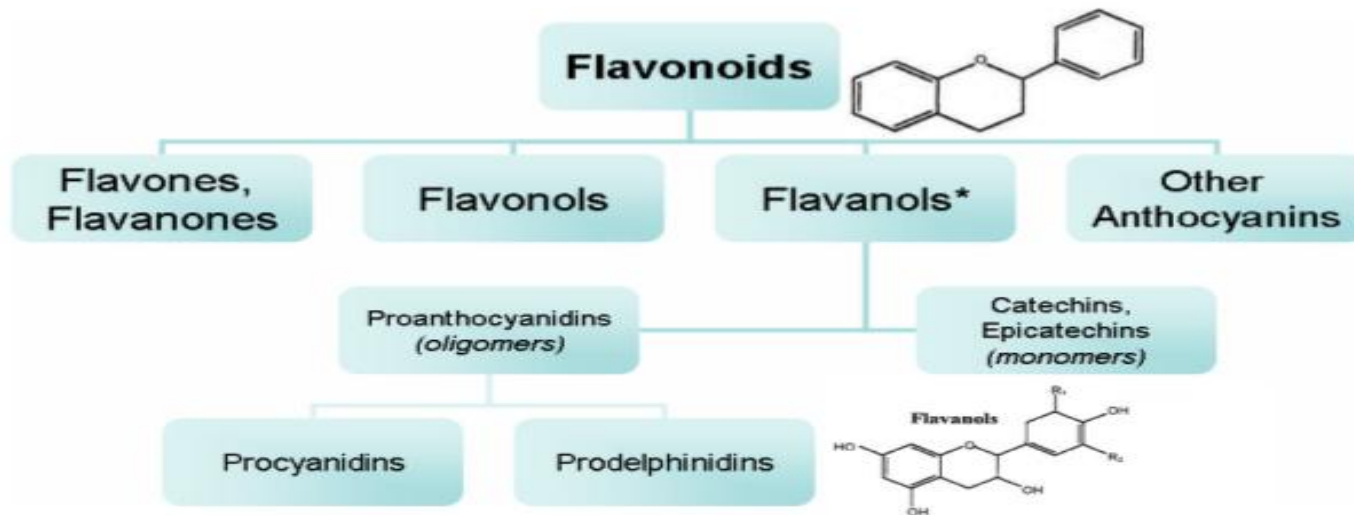
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# THE PSYCHOLOGY OF CHOCOLATE

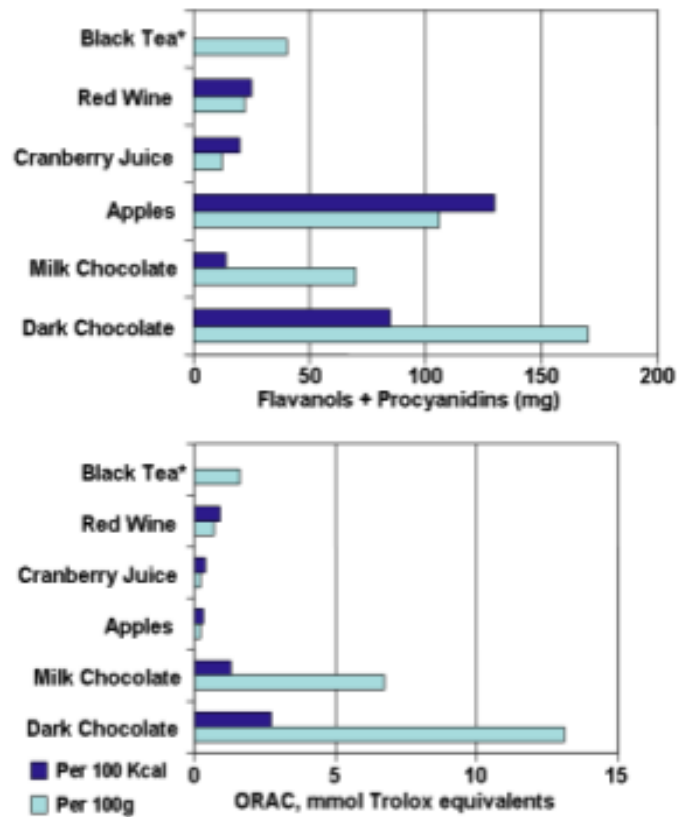
Dr G Neil Martin, FRSA, CSci



# THE USUAL SUSPECT (S)



**Figure 1**  
Structural skeleton of flavonoids and classification hierarchy of common flavonoids. \*Flavanol is the predominate class of flavonoid found in cocoa and chocolate.



**Figure 2**  
**Flavonoid content and antioxidant capacity (ORAC)**  
**of milk chocolate and dark chocolate versus other**  
**high flavonoid foods.** \* Brewed, per 2 g bag/200 ml water.  
 Antioxidant activity is reported as oxygen radical absorbance  
 capacity (ORAC). Adapted from: Steinberg et al. J Am Diet  
 Assoc 103: 215-23.



# HOW DOES THIS AFFECT BEHAVIOUR?





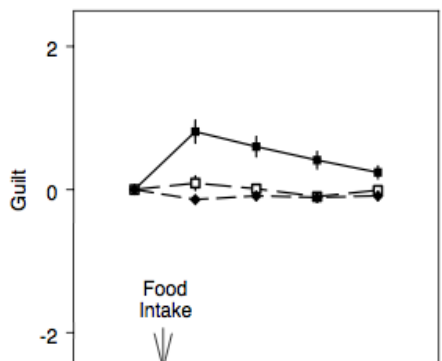
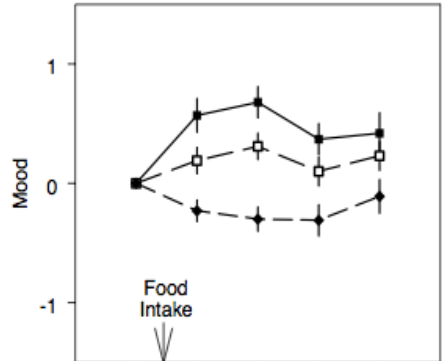
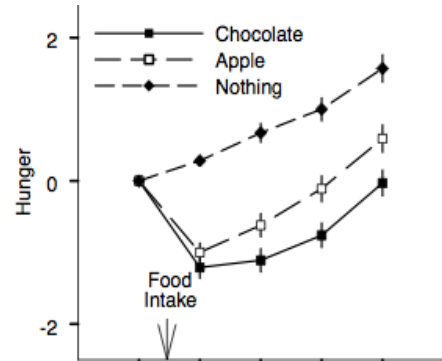
- People spend longer looking at slides in the presence of chocolate aroma
- More words recalled when learning and recall take place in presence of odour
- When paired with a nice painting, picture is rated artistically better
- Consumption greater in Parkinson's Disease (Wolz et al, 2009)



# DOES CHOCOLATE EATING AFFECT MOOD?

- Apple and chocolate eating improved mood but chocolate's effect was stronger (Macht & Dettmer, 2006)
- Chocolate eating reduced negative mood after watching sad film; no effect on positive mood (Macht & Mueller, 2007)
- Bad mood alleviated after eating palatable chocolate (up to 70% cocoa)- but effect very short-lived

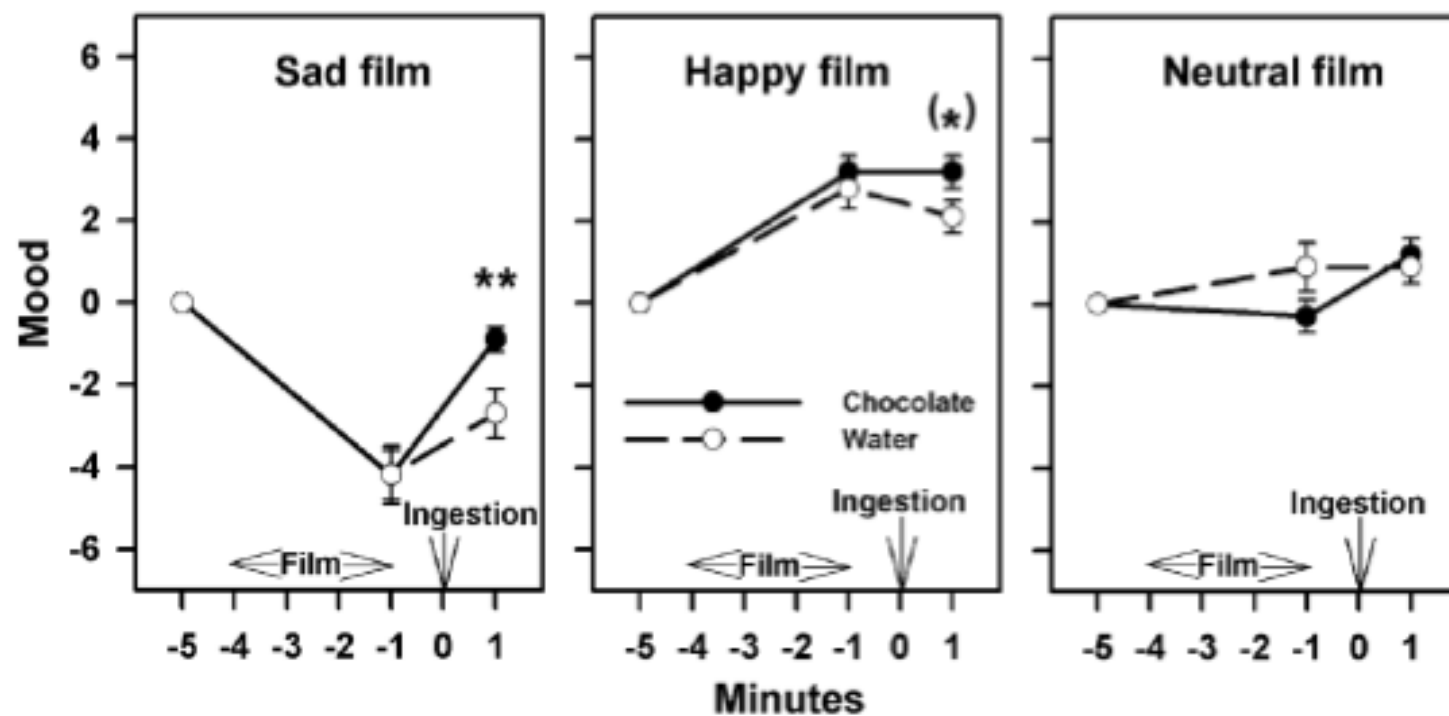




-5 5 30 60 90







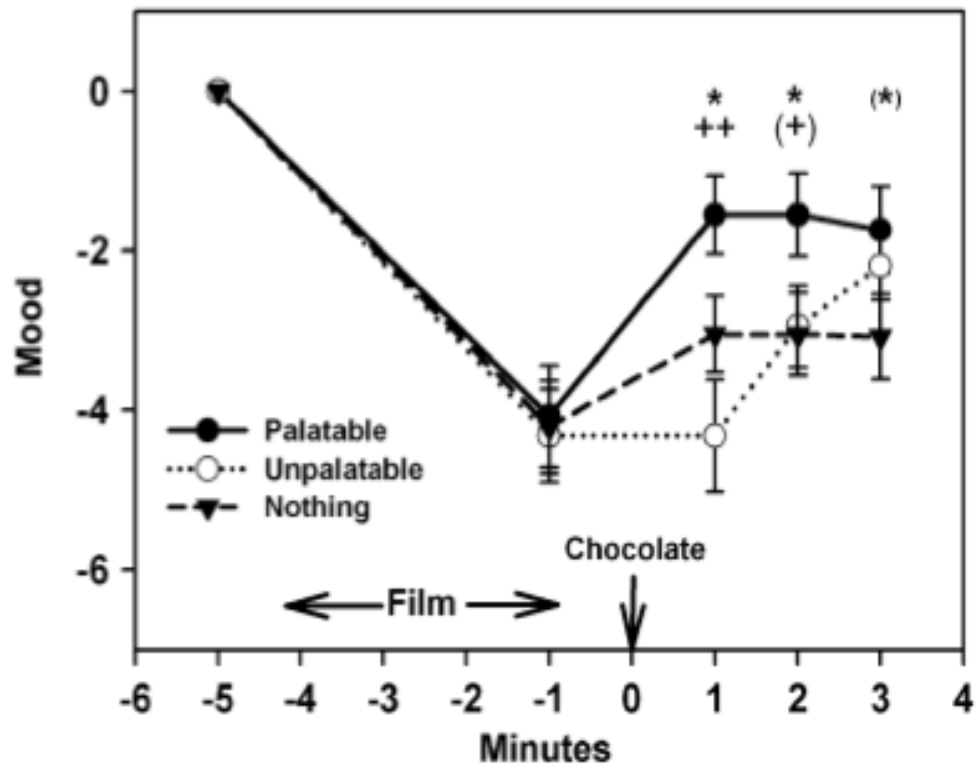


Fig. 2. Self-rated mood (mean  $\pm$  SEM) before and after viewing a sad film and after ingestion of palatable chocolate ( $n = 38$ ), unpalatable chocolate ( $n = 37$ ) or nothing ( $n = 38$ ). \*:  $p < 0.05$  and \*:  $p < 0.10$  for comparisons between palatable chocolate and eating nothing; ++:  $p < 0.01$  and +:  $p < 0.10$  for comparisons between palatable and unpalatable chocolate.



# HERNAN CORTES

- “just one glass was sufficient to refresh a soldier for a whole day”

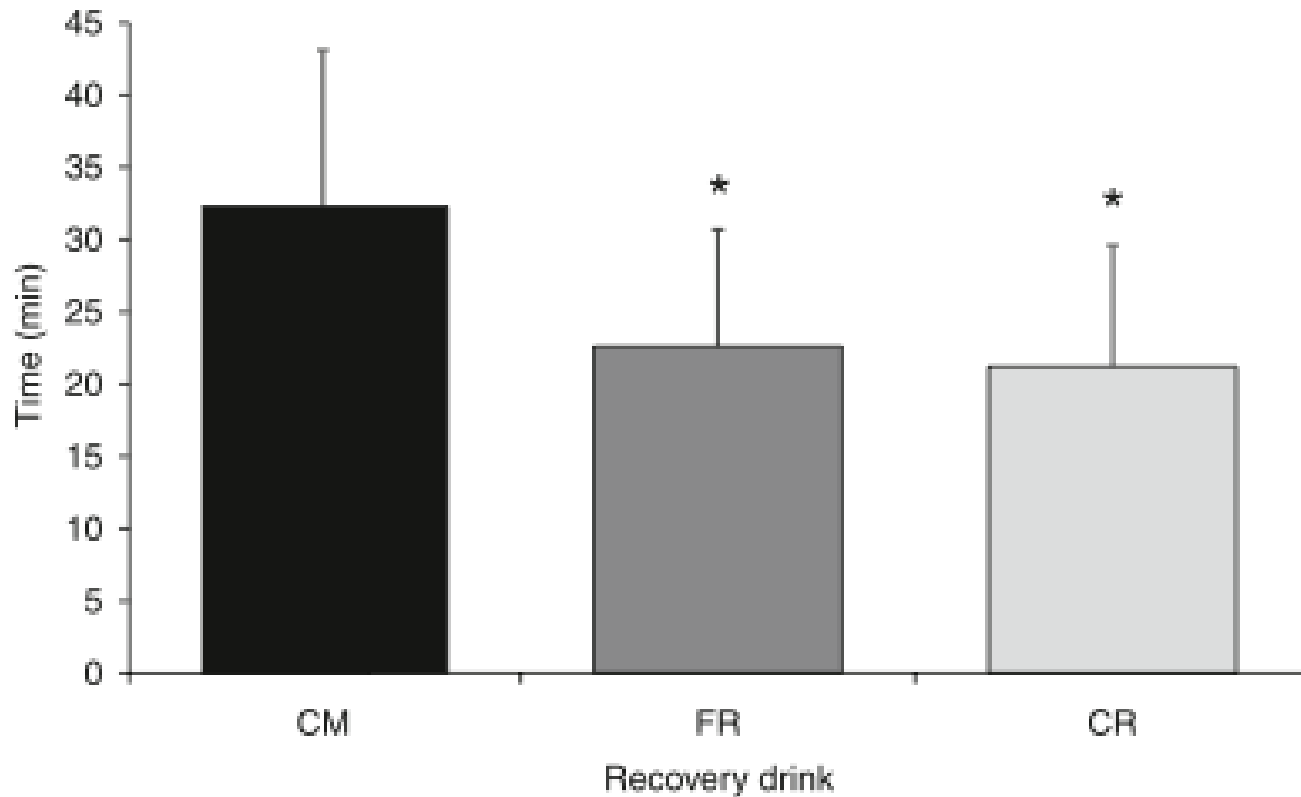


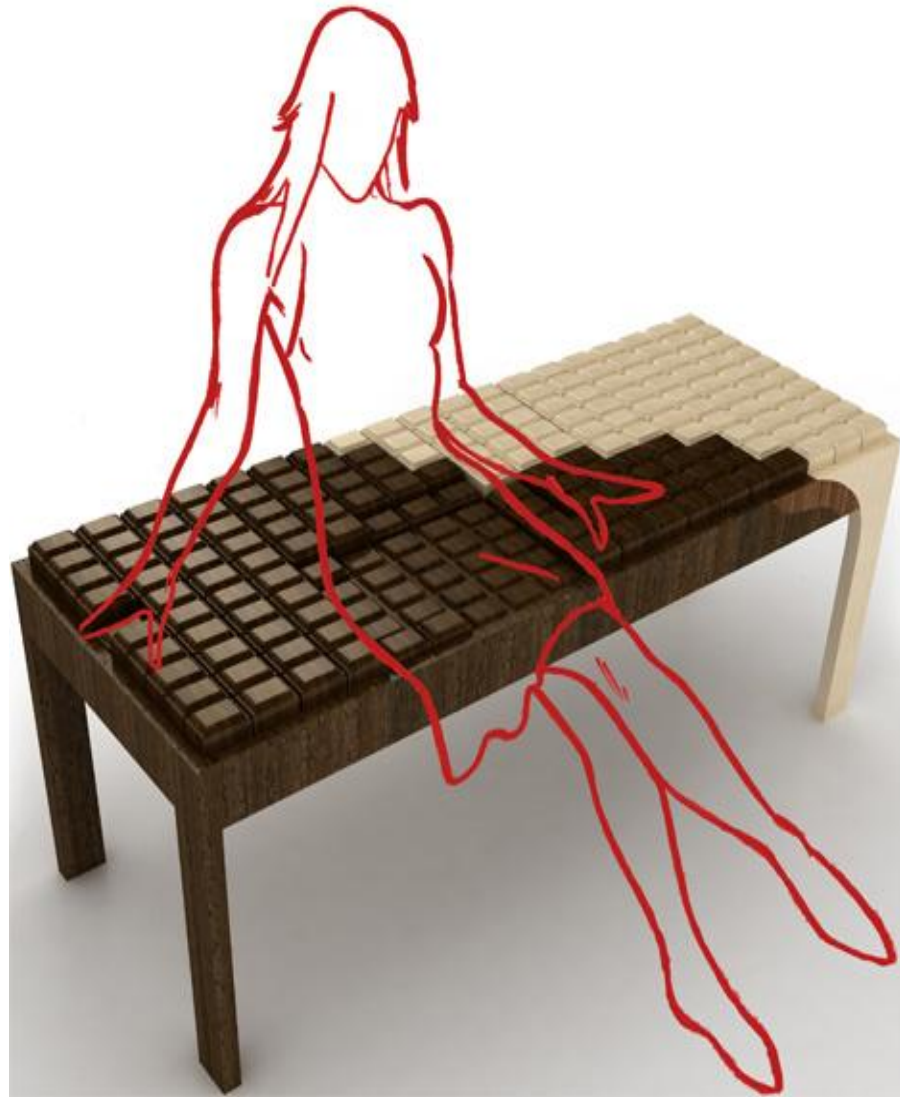
# AN AID TO RECOVERY?

- Cyclists cycle 49%-51% longer after milk choc ingestion (Karp et al, 2006; Thomas et al, 2009)...
- ...and become exhausted less quickly (Karp et al, 2006)
- Chocolate urges reduced by exercise (Taylor & Oliver, 2009)



**Fig. 2.** Time to exhaustion during endurance capacity trial, following ingestion of 3 different recovery drinks. CM, chocolate milk; FR, fluid replacement drink; CR, carbohydrate replacement drink. \*, Significantly different from chocolate milk.



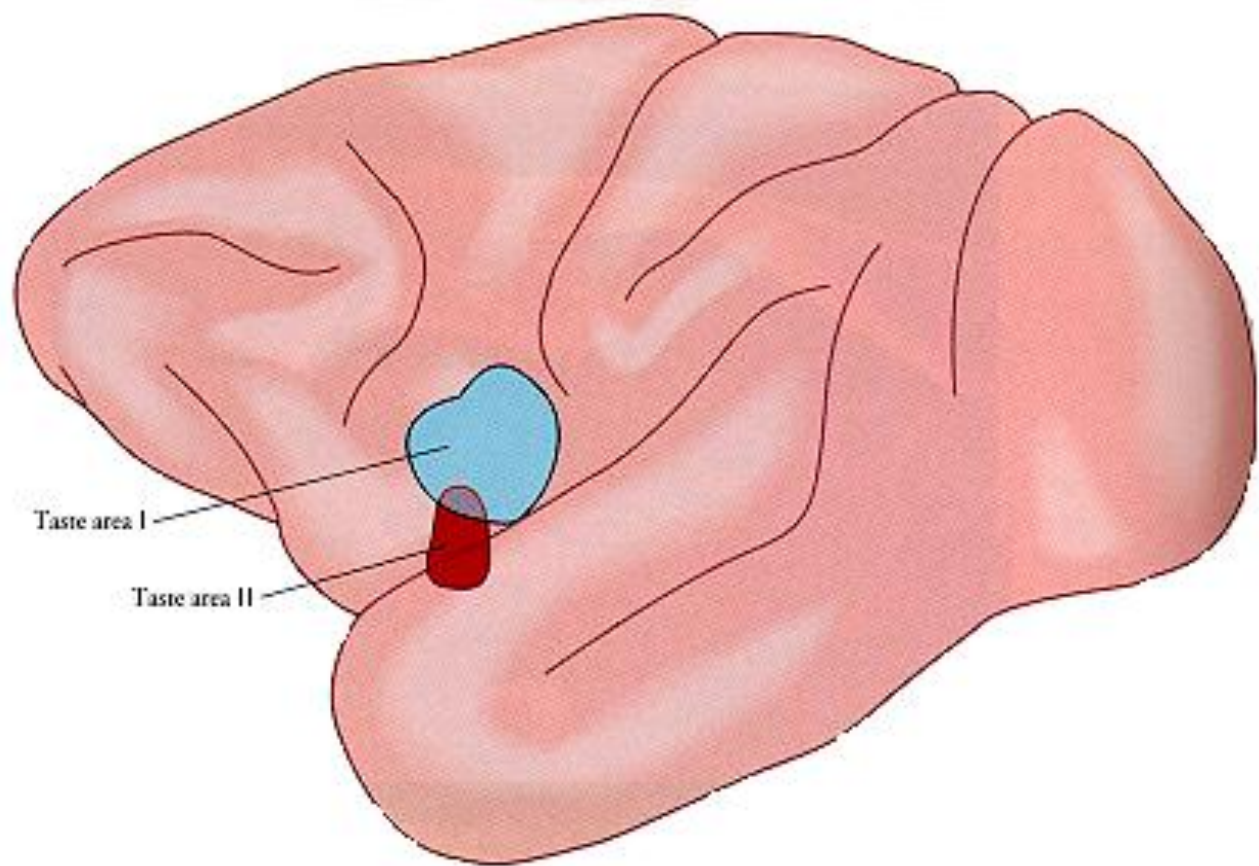




# THE NEUROPSYCHOLOGY OF CHOCOLATE

- Eating chocolate to satiety (Small et al, 2001)
- Pleasantness- orbitofrontal cortex/insula
- Satiety- different regions and decrease in OFC
- There are sex diffs (Smeets et al, 2006)





Taste area I

Taste area II



## Dopamine Pathways

## Serotonin Pathways

Frontal cortex

Striatum

Substantia nigra

### Functions

- Reward (motivation)
- Pleasure, euphoria
- Motor function (fine tuning)
- Compulsion
- Perseveration

Nucleus accumbens

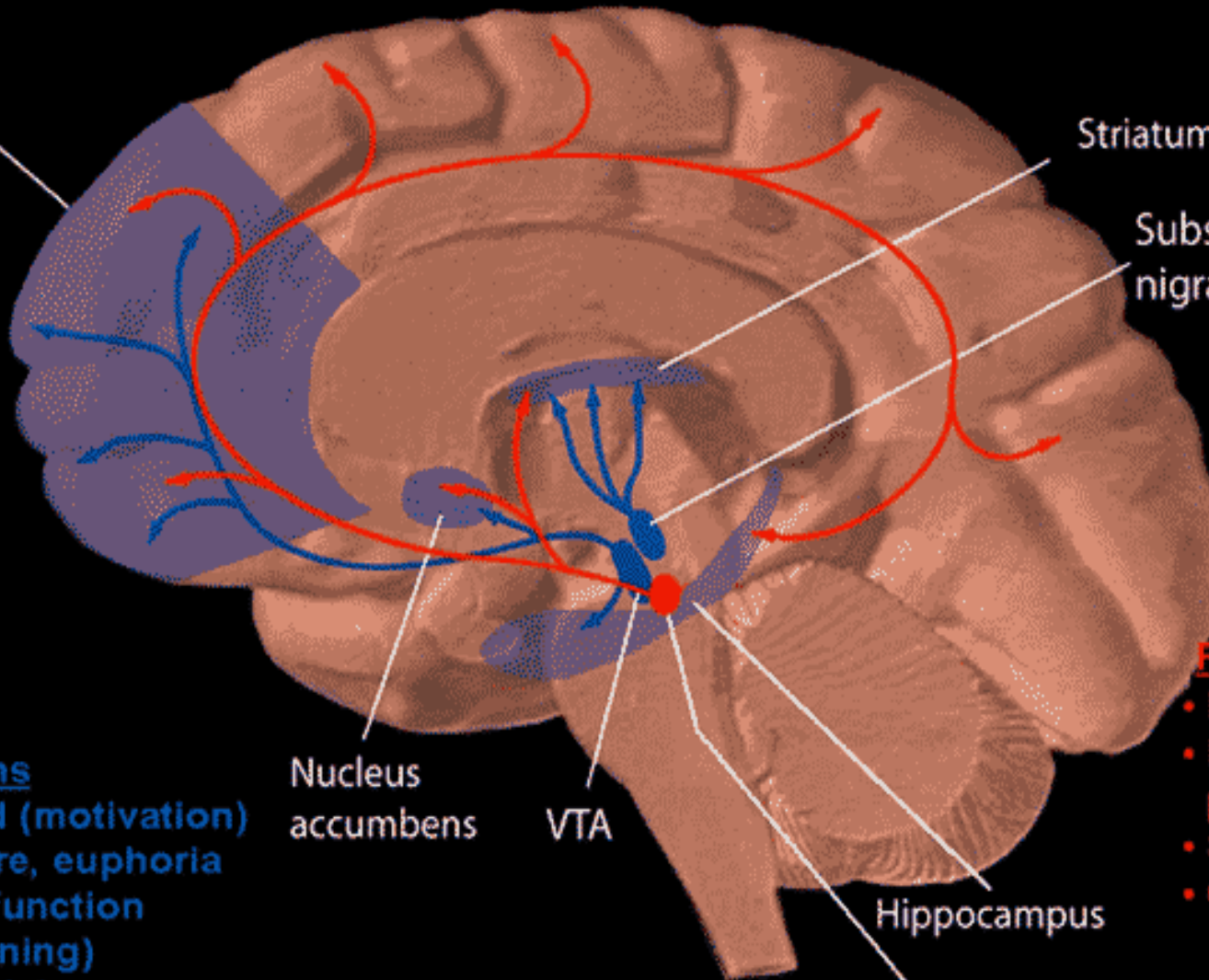
VTA

Hippocampus

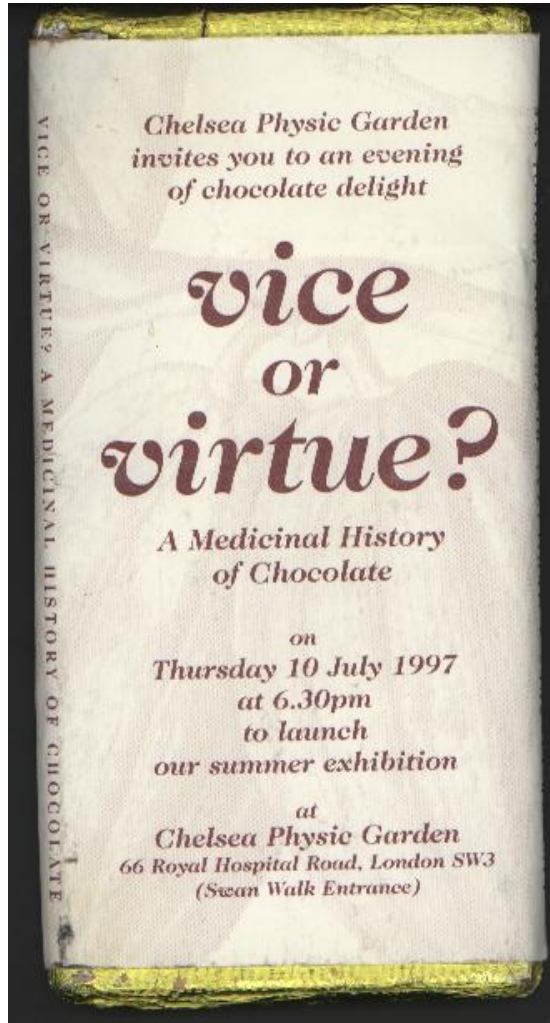
Raphe nucleus

### Functions

- Mood
- Memory processing
- Sleep
- Cognition



# CHOCOLATE AND BRAIN ACTIVATION



**Martin (1998)**

EEG response to  
synthetic/real food odour

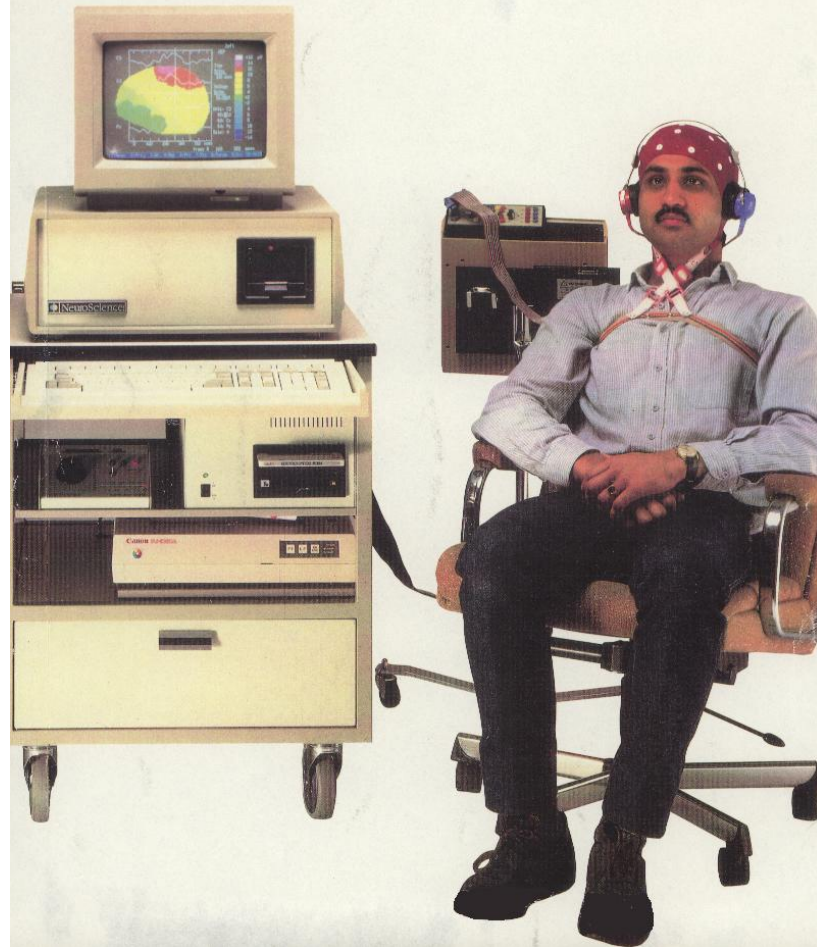






**BRAIN IMAGER**

neuroscience



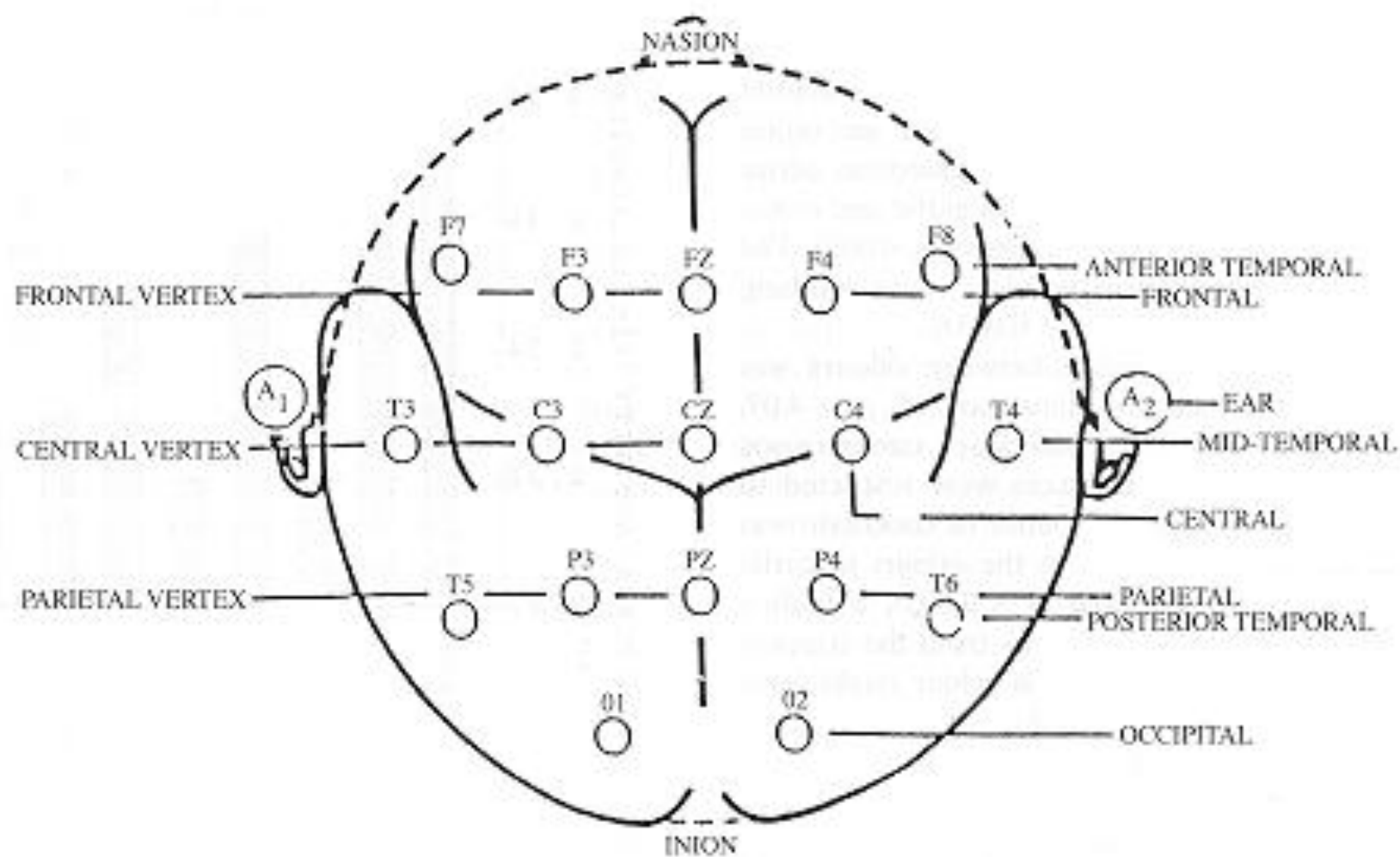
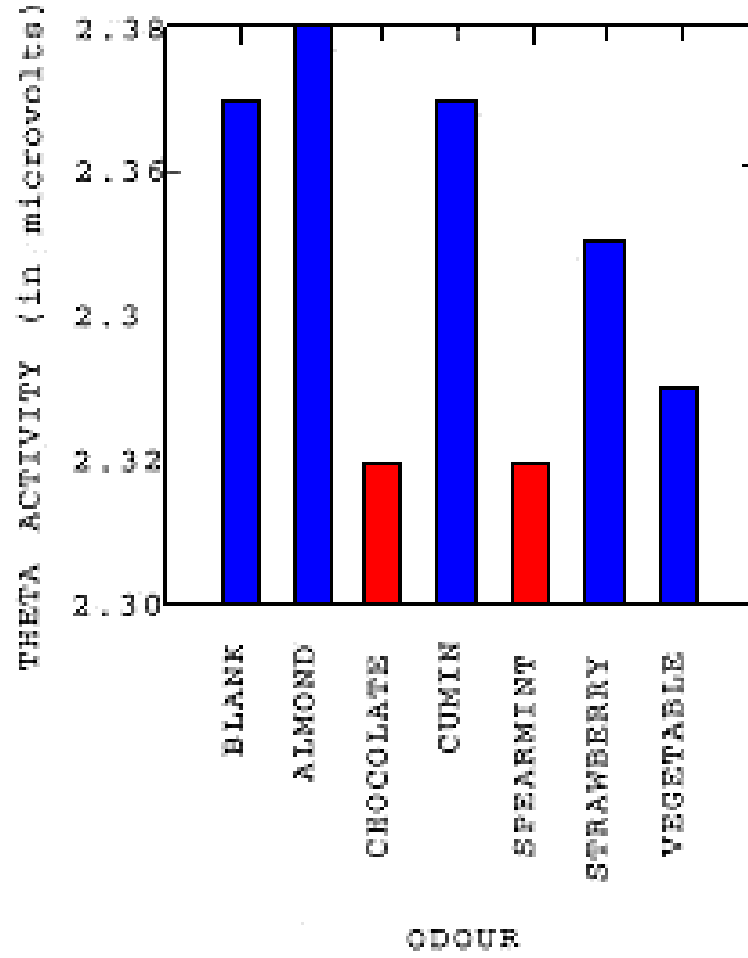


Fig. 1. An illustration of the 19 electrode sites employed.

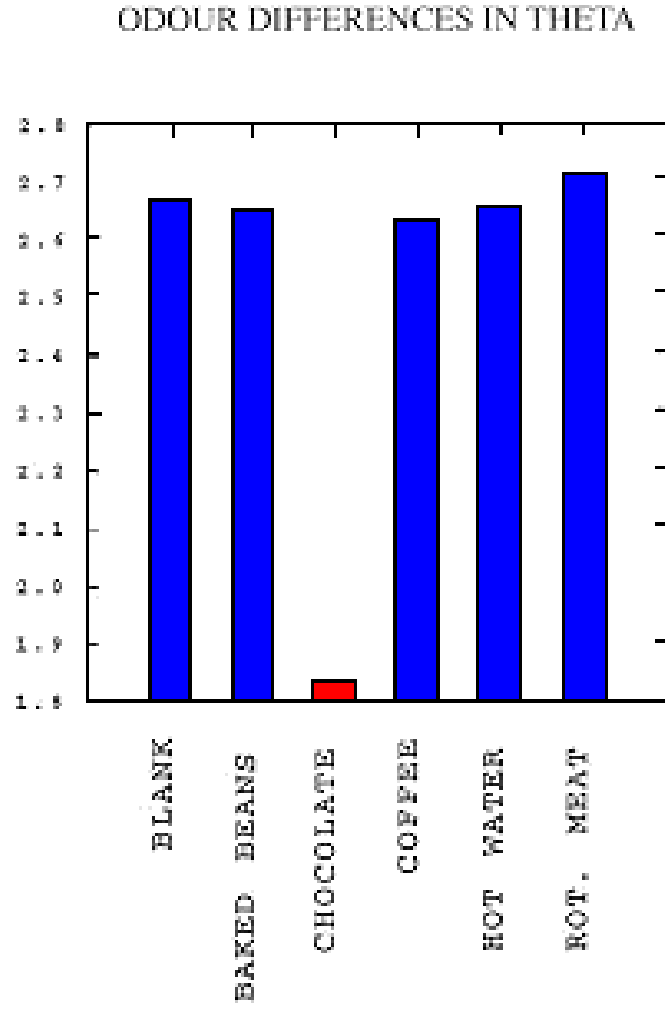




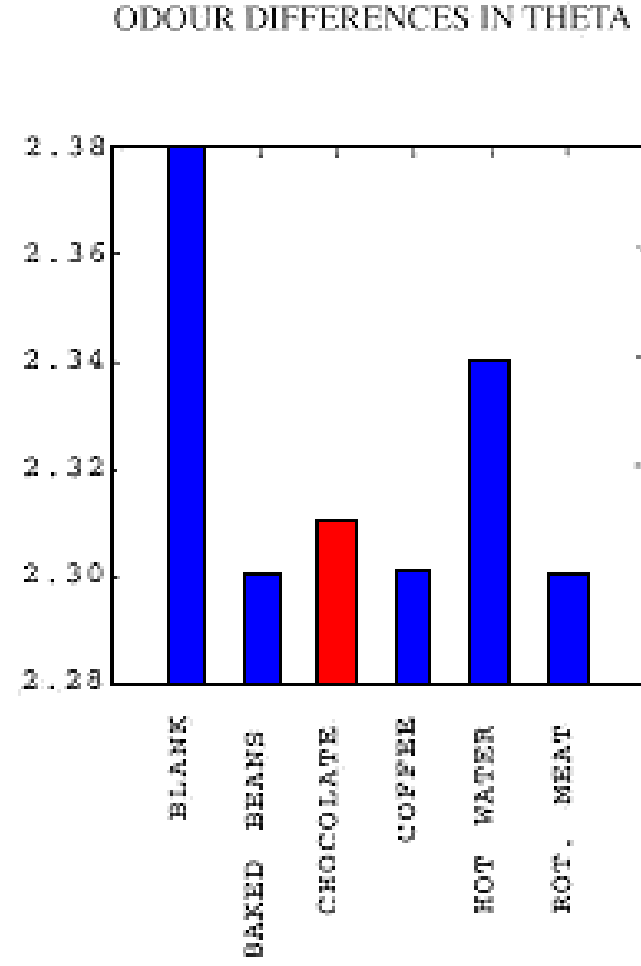
# ODOUR DIFFERENCES IN THETA



(a) THETA ACTIVITY (in microvolts)



(b) THETA ACTIVITY (in microvolts)



# EFFECT OF CHOCOLATE AROMA ON MOTOR BEHAVIOUR

- No effect on hand skill/co-ordination
- Participants less tense, depressed and confused



# HOW DOES CHOCOLATE AFFECT ME?

- 73%- puts me in a good mood
- 60%- makes me happy
- 50%- makes my temper disappear
- 53%- makes me feel better
- 37%- makes me feel relaxed
- 63%- the smell makes me crave/want it more
- 67%- seeing somebody else eat makes me want it
- 70%- preferred the smell to cakes/sweets



# PLEASURE CHART

1. GOING ON HOLIDAY
  2. HAVING SEX
  3. WATCHING A GOOD FILM
  4. GOING FOR A WALK IN THE PARK
  5. GOING TO THE BEACH
  6. GOING SHOPPING
  7. EATING CHOCOLATE
  8. EATING ICE CREAM
  9. READING A GOOD BOOK
  10. DRINKING ALCOHOL
- ....TO BE CONTINUED







# THE PSYCHOLOGY OF CHOCOLATE

**Dr G Neil Martin**

**Department of Psychology**

**Middlesex University**

[www.mdx.ac.uk/hssc/staff/profiles/academic/martinn.asp](http://www.mdx.ac.uk/hssc/staff/profiles/academic/martinn.asp)

n.martin@mdx.ac.uk

