http://www.sge-ssn.ch/de/ich-und-du/essen-und-trinken/ausgewogen/lebensmittelpyramide/

Warum wir oft anders essen, als wir uns ernähren sollten

Wolfgang Langhans

Physiology and Behavior Laboratory
ETH Zurich, Switzerland

MTB

Warum wir oft anders essen als wir uns ernähren sollten

- **Steuerung der Nahrungsaufnahme**
- Warum wir essen, was wir essen

  - «Mindless Eating»

  - Genuss/Belohnung

  - Konditionierung/Lernprozesse
- Wird das Körpergewicht reguliert?
- Empfehlungen

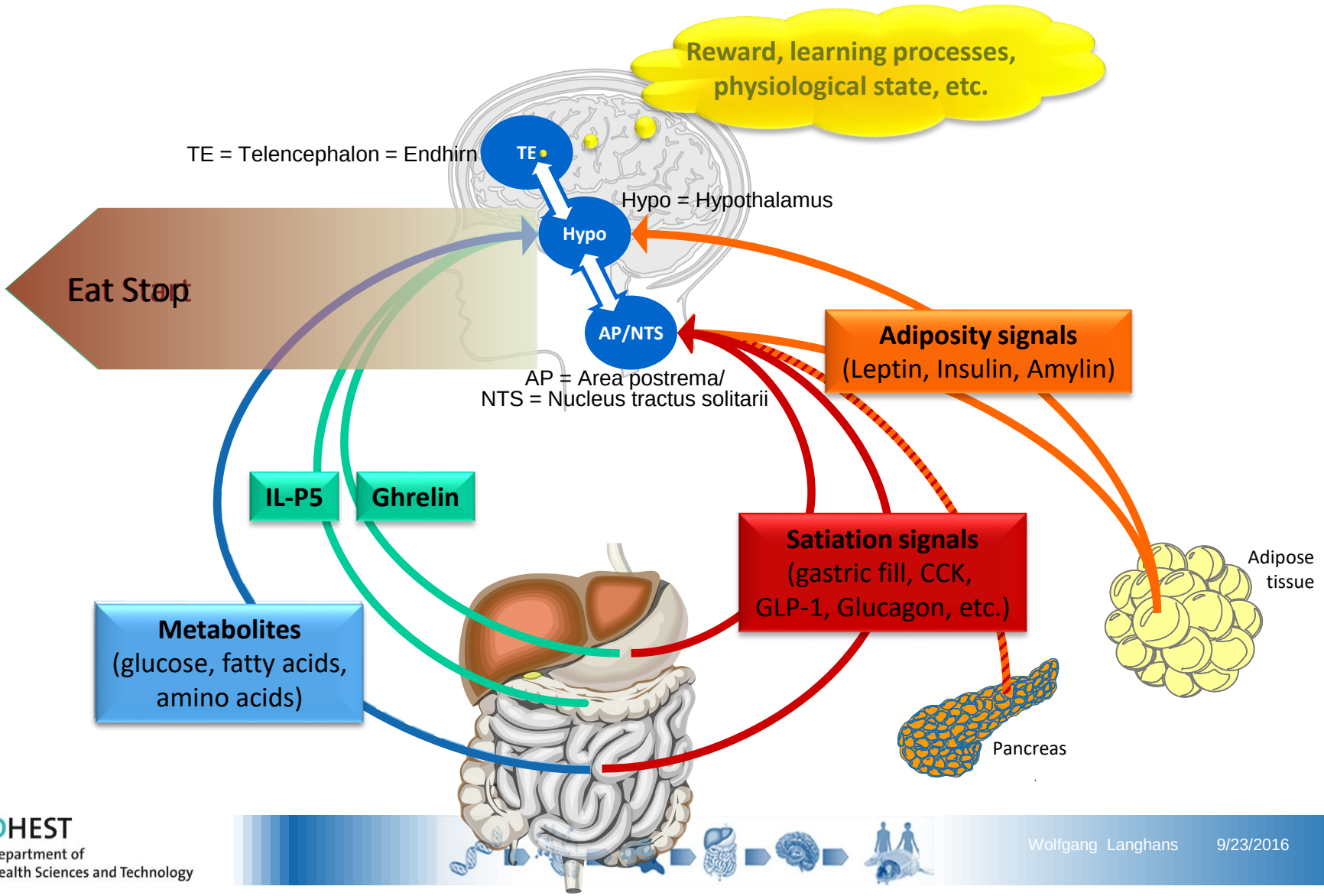
Hunger: physiological need for food

Appetite: desire for food, related to the attractiveness of food

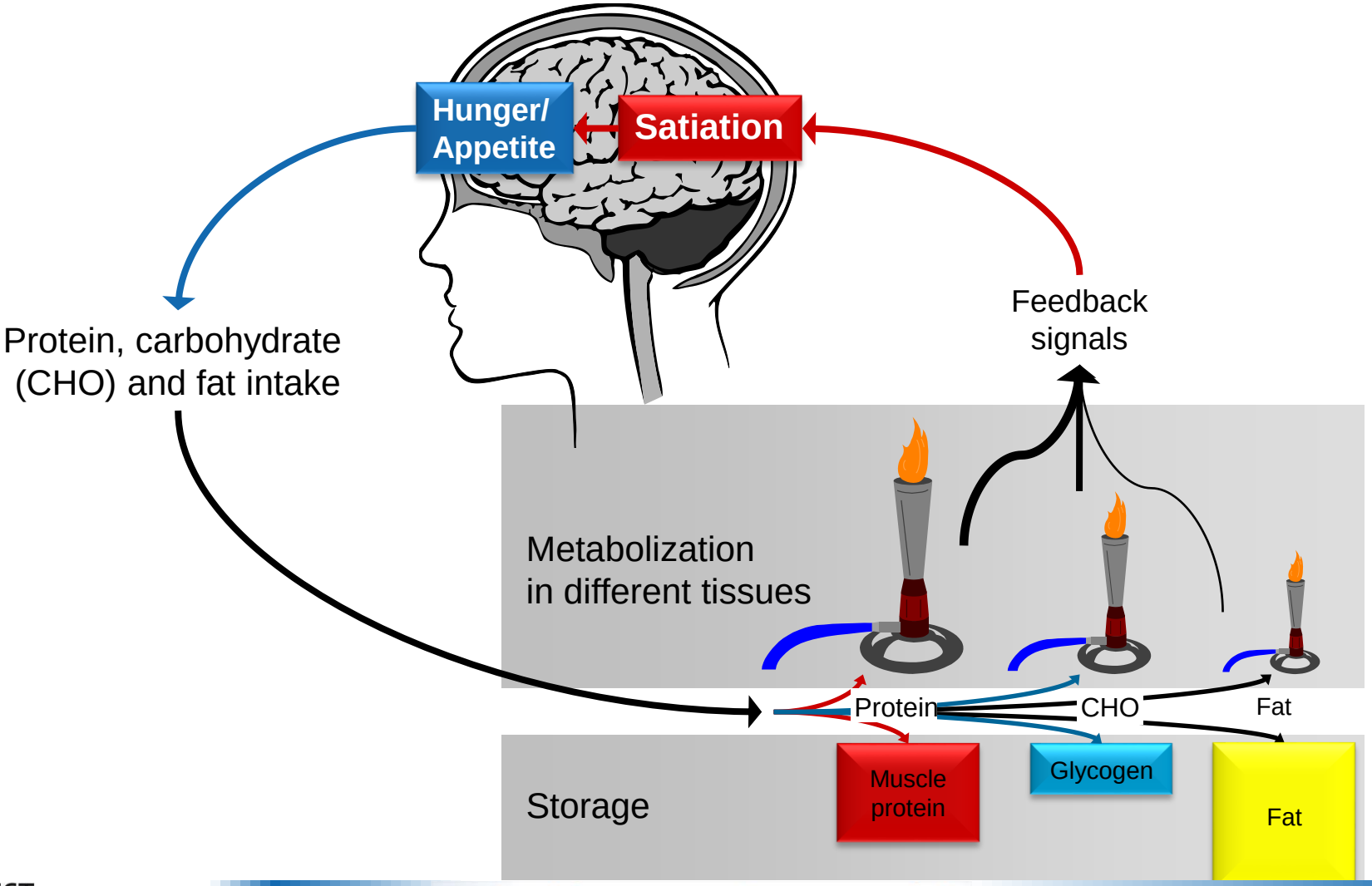
Satiation: the process of meal termination

Satiety: The state of "fullness" between meals

Control of eating



Hierarchy of nutrient oxidation



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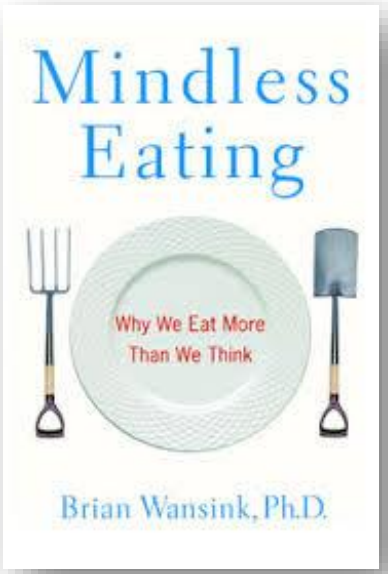
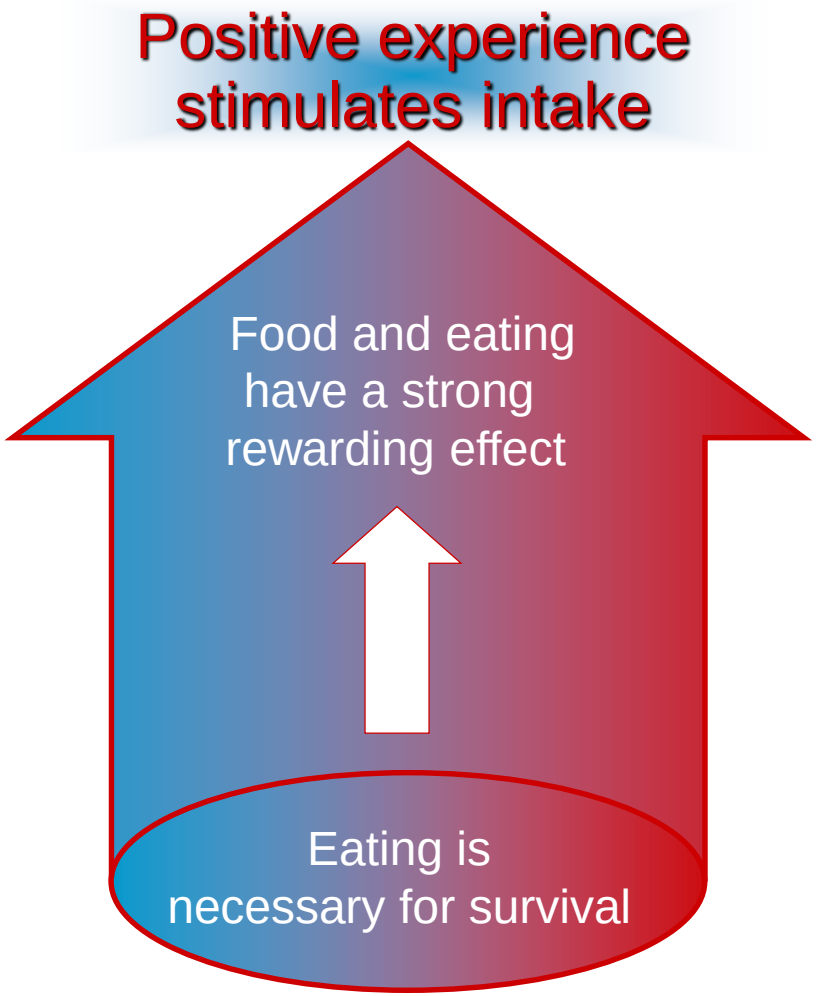
Mindless eating…



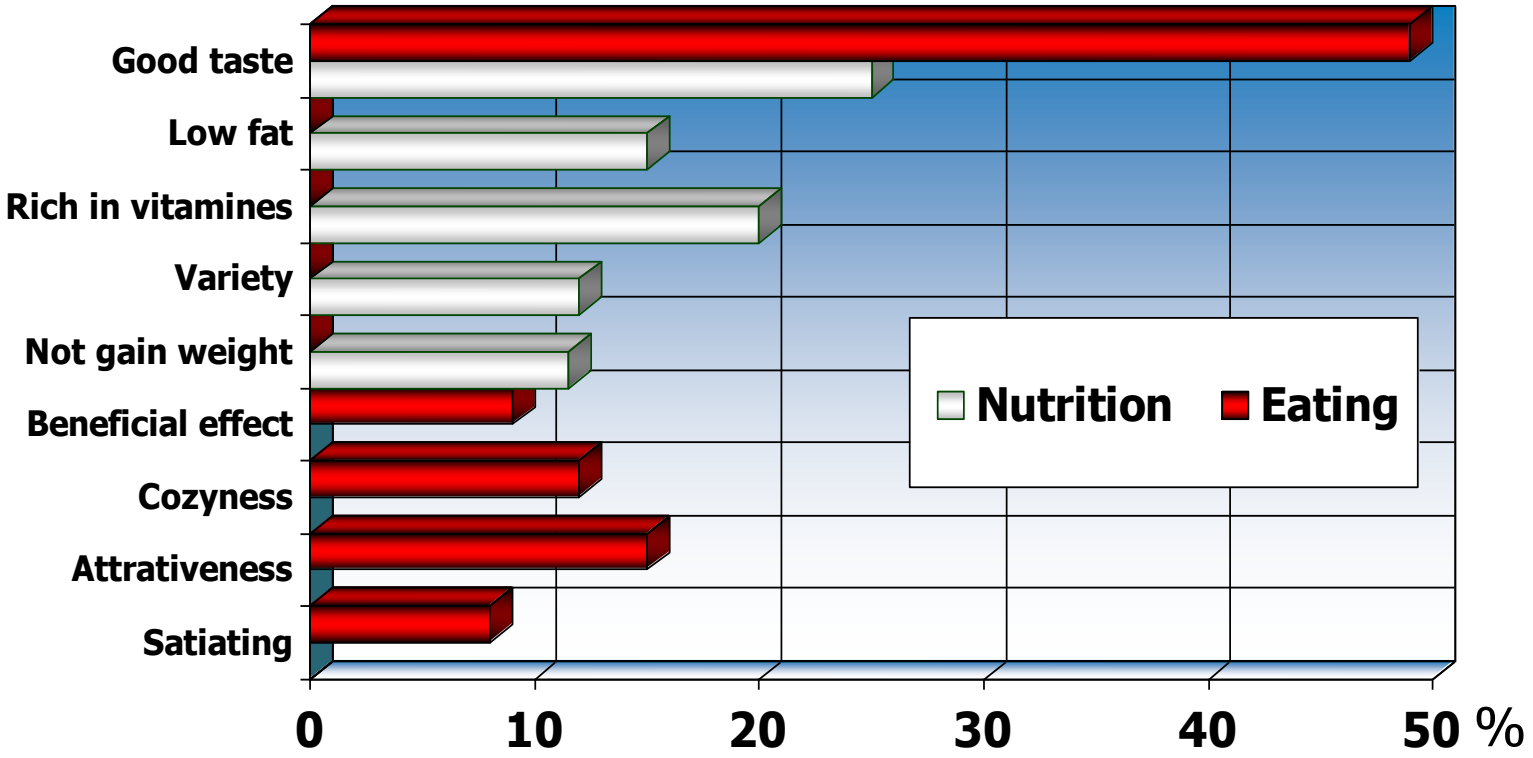
… eating for other reasons than being hungry…

Warum wir essen... ?
1. Genuss / Belohnung
(Carl Warner)

Why is reward so important?



Discrepancy between "NUTRITION" and "EATING"



(Courtesy of V. Pudel)

Unfavorable contingency ratios

Reward

The pleasure of good tasting food is experienced immediately;
The negative consequences for health are

- less tangible and
- usually in the distant future

Health consequences

http://www.sge-ssn.ch/de/ich-und-du/essen-und-trinken/ausgewogen/lebensmittelpyramide/

Im Überfluss des Schlaraffenlandes...

...**essen** Menschen anders als sie sich **ernähren** sollten.

(V. Pudel, 2007)

Sugar (sweetness) has a particularly strong rewarding effect

Affective reactions to taste stimuli in newborns

Sweet

Bitter

(Steiner et al. Neurosci. Biobehav. Rev. 25:53-74, 2001)

Why…?

In part it's sheer physiology…?

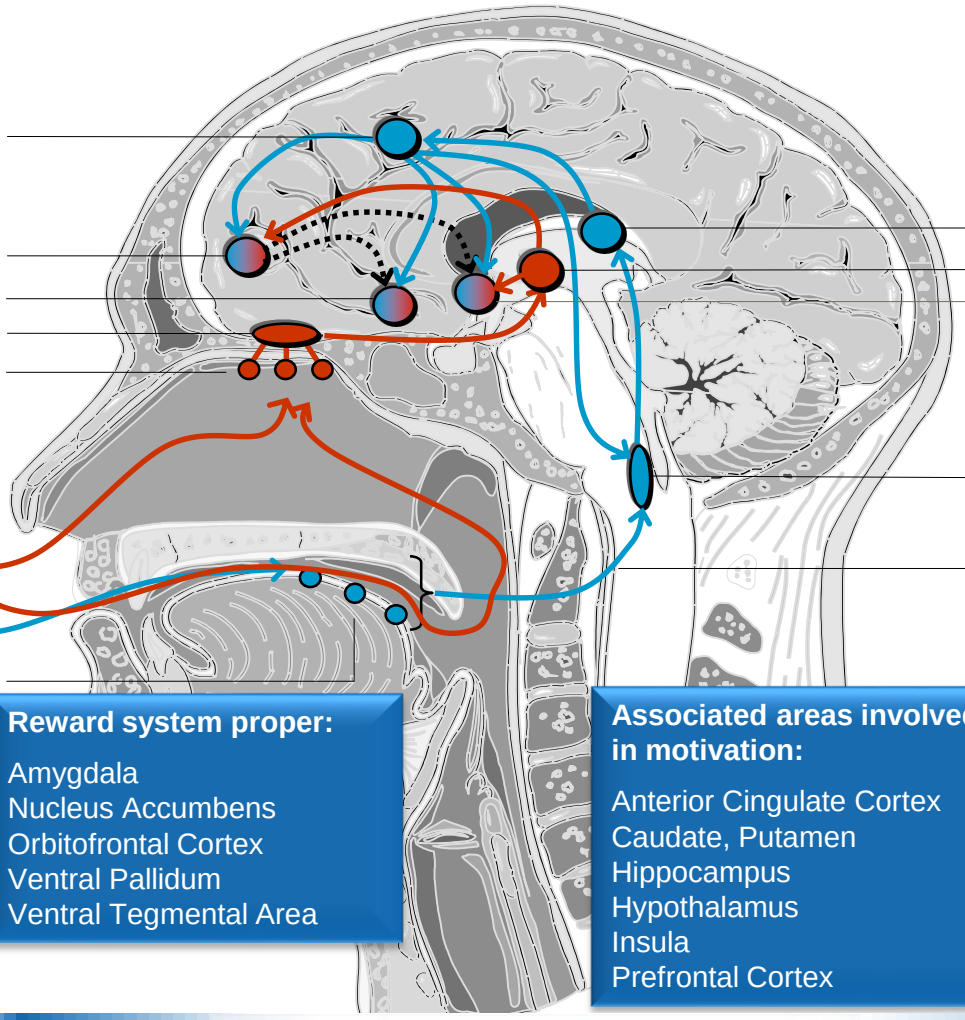
- **D-glucose is the preferred fuel for neurons** ⇨ motivation to maintain high levels of circulating glucose
- **Low storage capacity for glucose** ⇨ need for continuous sugar procurement and, if available, consumption
- **Specialized sugar receptors** in oral cavity ⇨ connected to brain **reward** circuitries promoting ingestion

We enjoy primarily the **„flavor“** of food; therefore, **palatability** usually determines the **rewarding effect** of food.

„Flavor“ =

- Gustaory,
- olfactory,
- tactile
- thermal
- food stimuli…

Taste and smell pathways converge in the OFC, the hypothalamus, and the amygdala



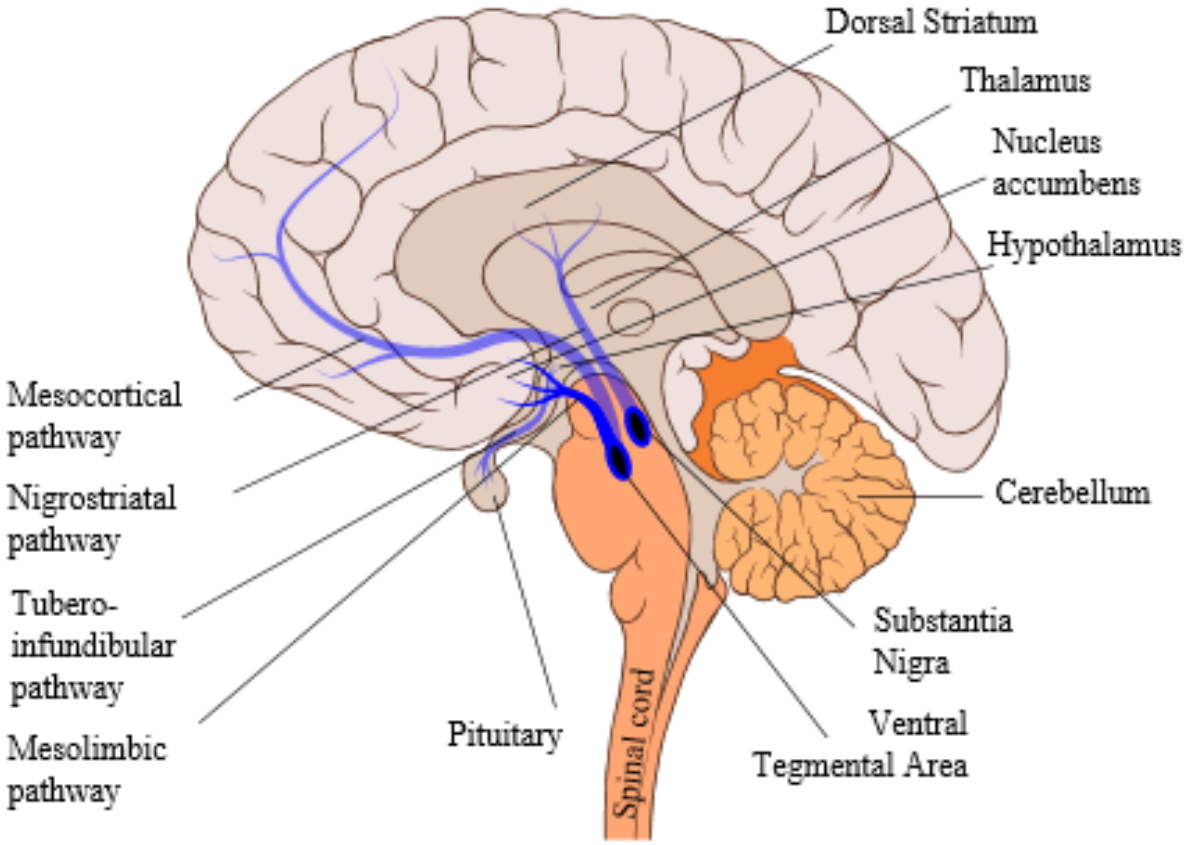
Reward system proper:

Amygdala
Nucleus Accumbens
Orbitofrontal Cortex
Ventral Pallidum
Ventral Tegmental Area

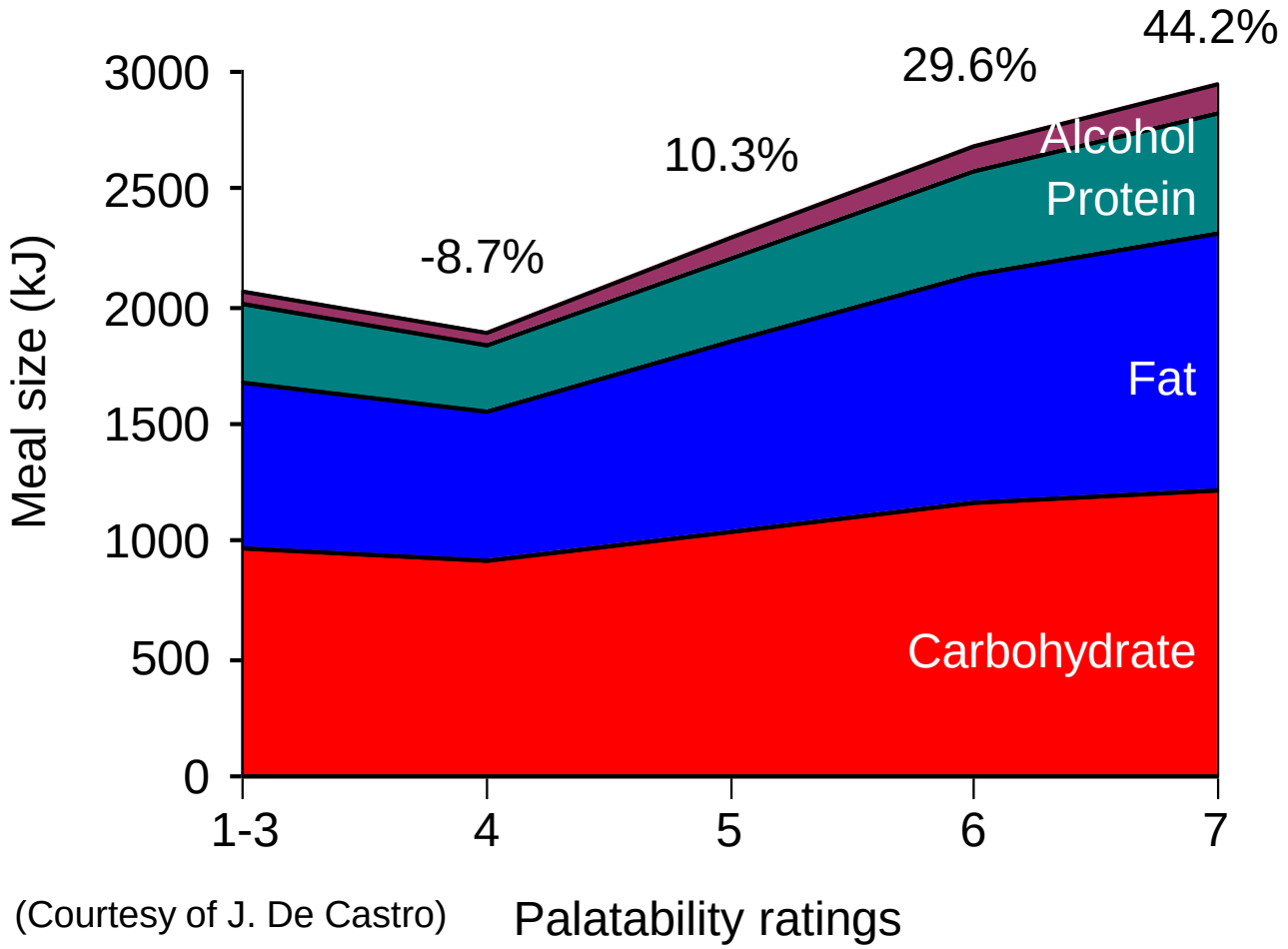
Associated areas involved in motivation:

Anterior Cingulate Cortex
Caudate, Putamen
Hippocampus
Hypothalamus
Insula
Prefrontal Cortex

Dopaminergic reward pathways

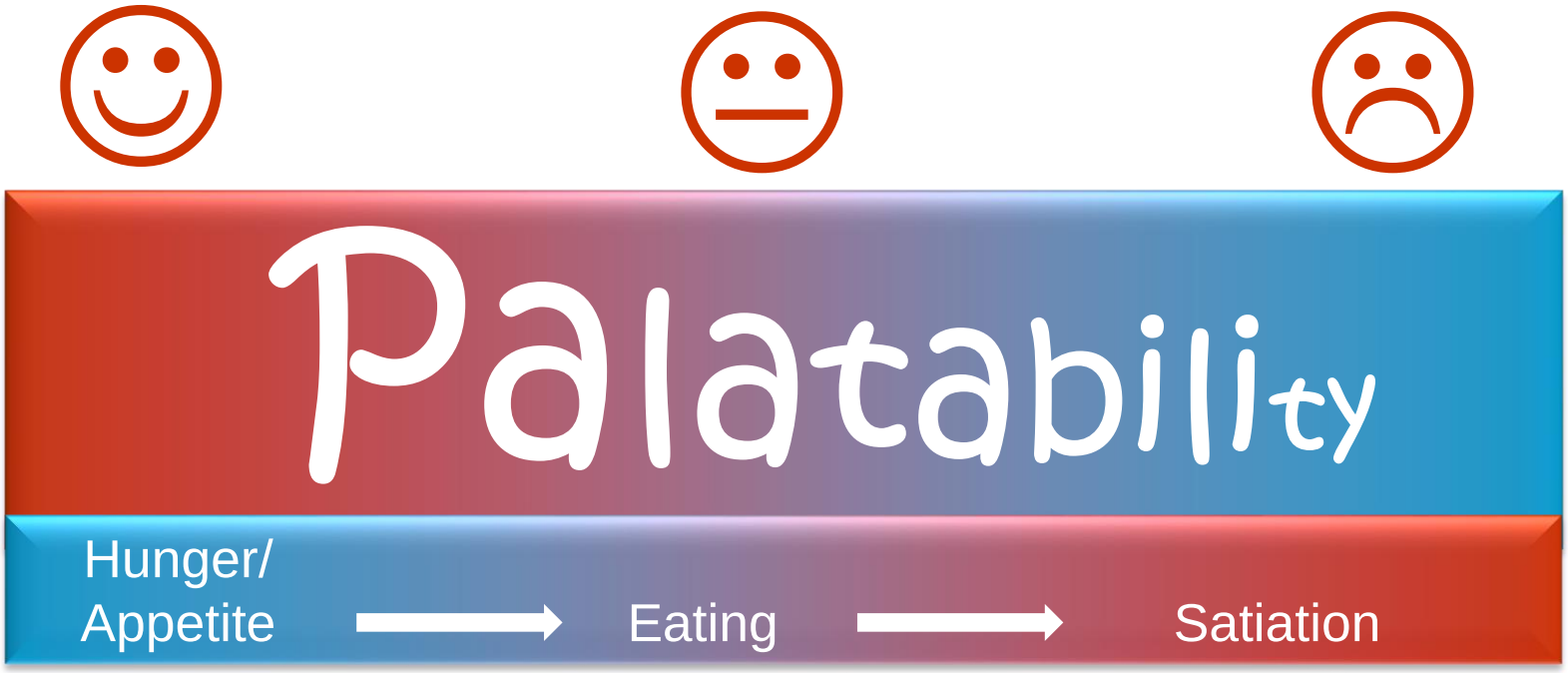


Palatability increases meal size

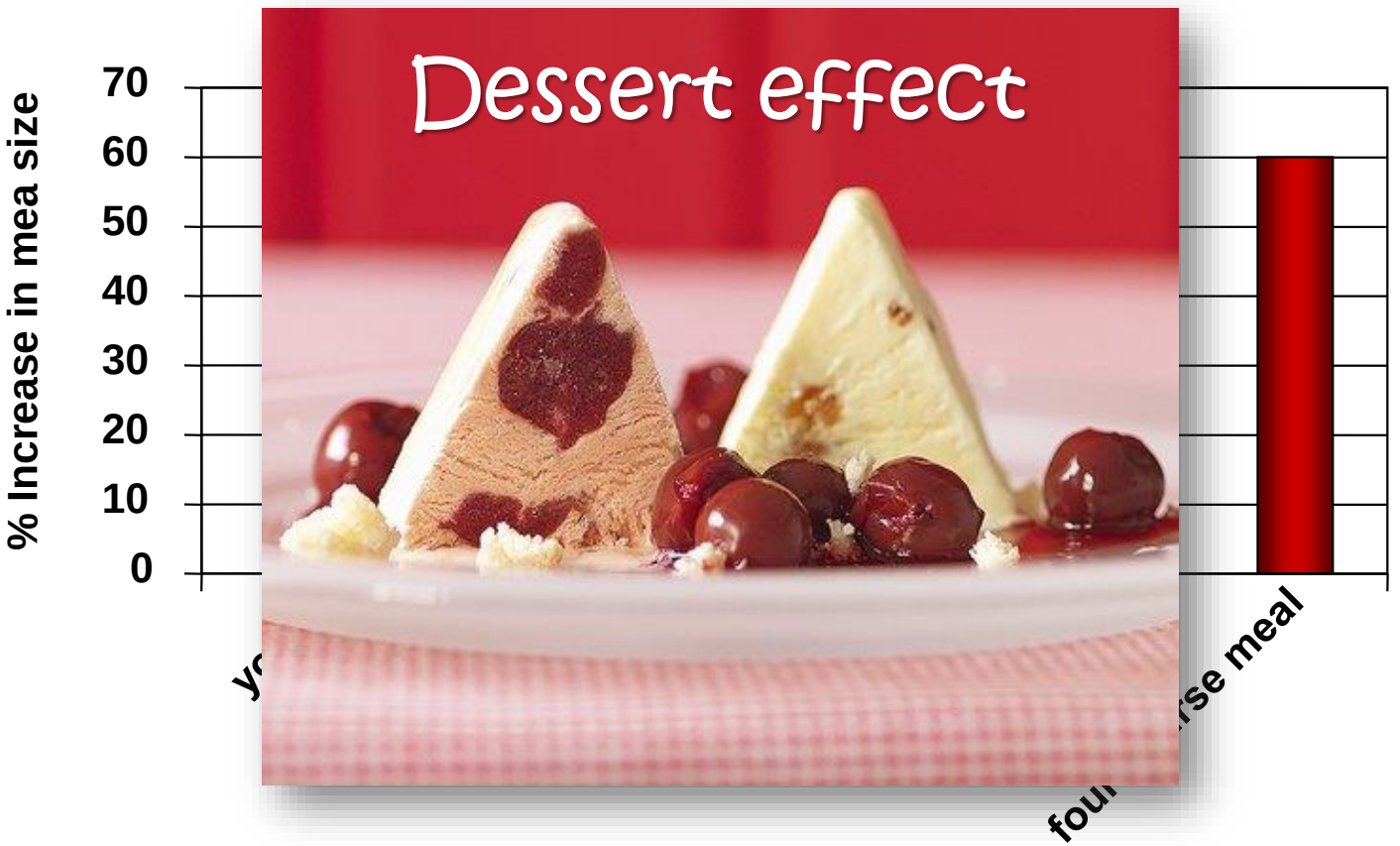


(Courtesy of J. De Castro)

Sensory-specific satiety
(palatability decreases during eating)



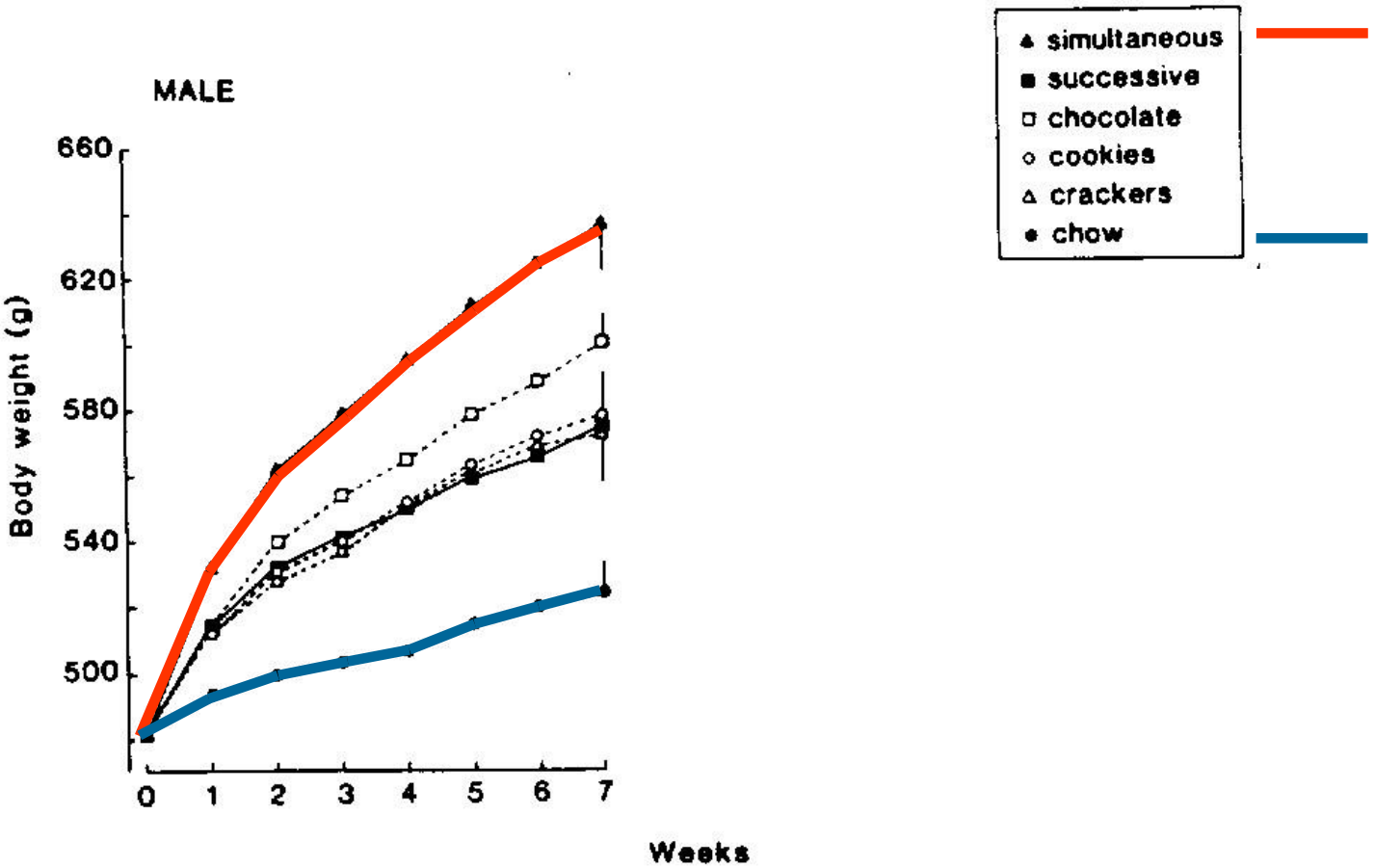
Variety within a meal increases (pleasure and) meal size



(Rolls and Hetherington, Psychophysiology of human eating, 1989)

Variety in a diet can increase body weight

(effect of a cafeteria diet)



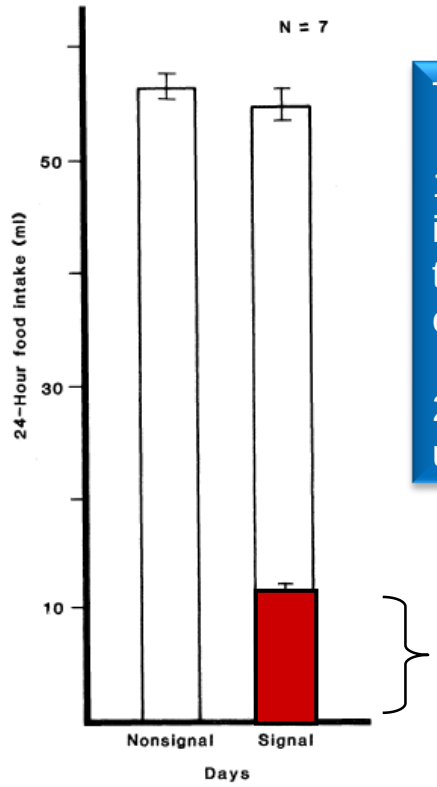
(Rolls et al., 1983)

The Pleasure of Eating…

… comprises more than variety in the food…

Warum wir essen...?
2. Konditionierung, Lernprozesse
(Carl Warner)

Eating can be elicited in satiated rats by a conditioned stimulus



Two important points:

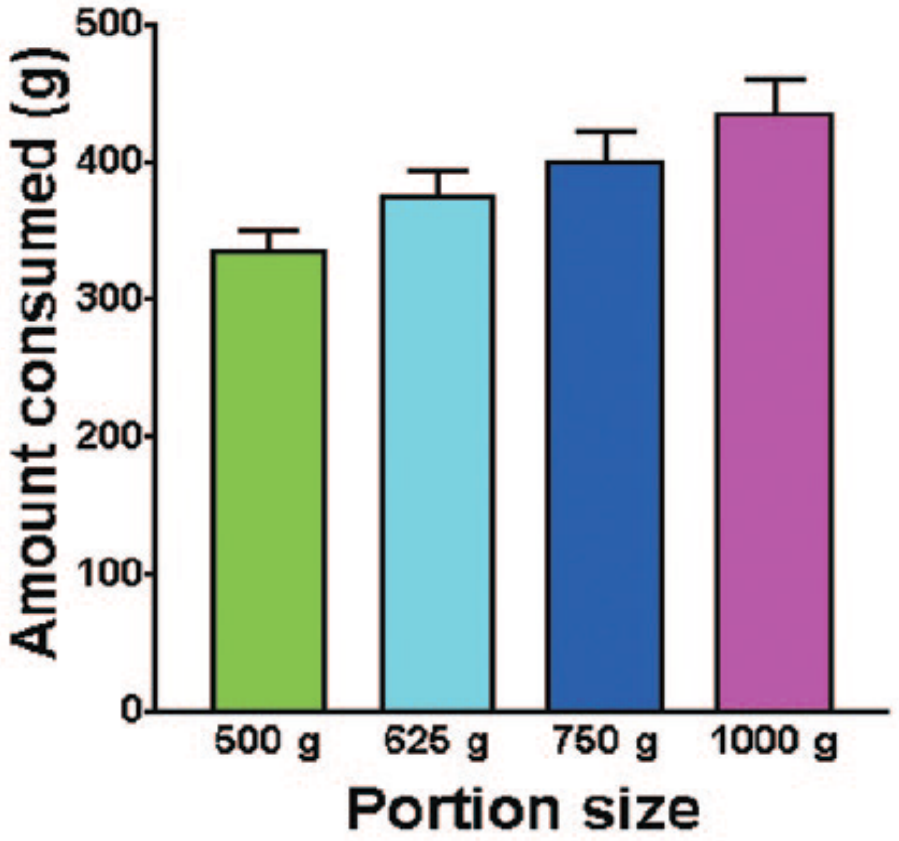
1) The conditioned ingestion in this experiment amounted to almost 20% of total daily energy intake

2) Daily energy intake remained unchanged

Amount of food consumed in the conditioned meal

(Weingarten, Science 220:431-433,1983)

Portion size and meal size are directly correlated



(Rolls et al., Am. J. Clin. Nutr. 2002)

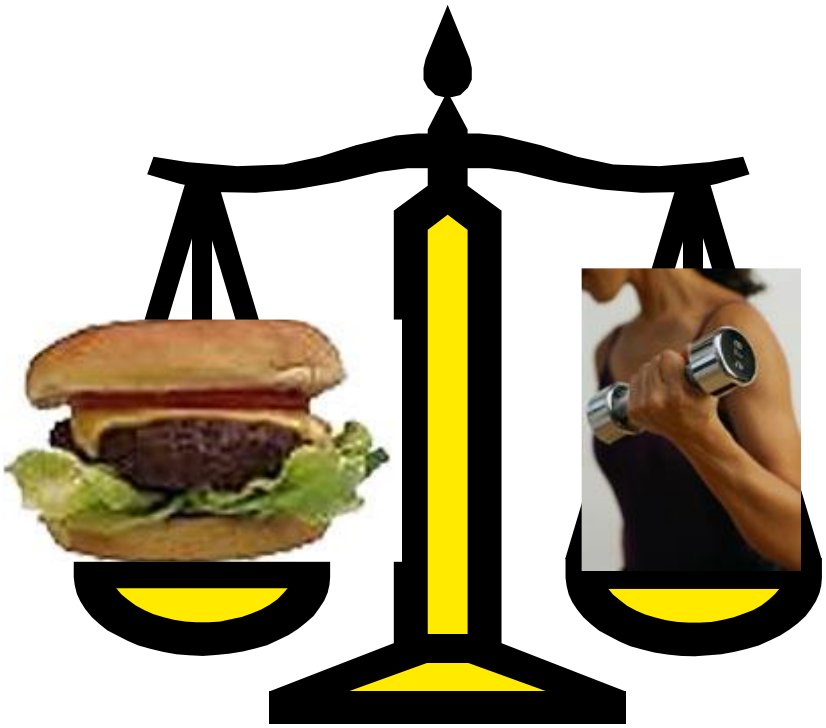
Portion sizes…

1989

333 Kcal

2009

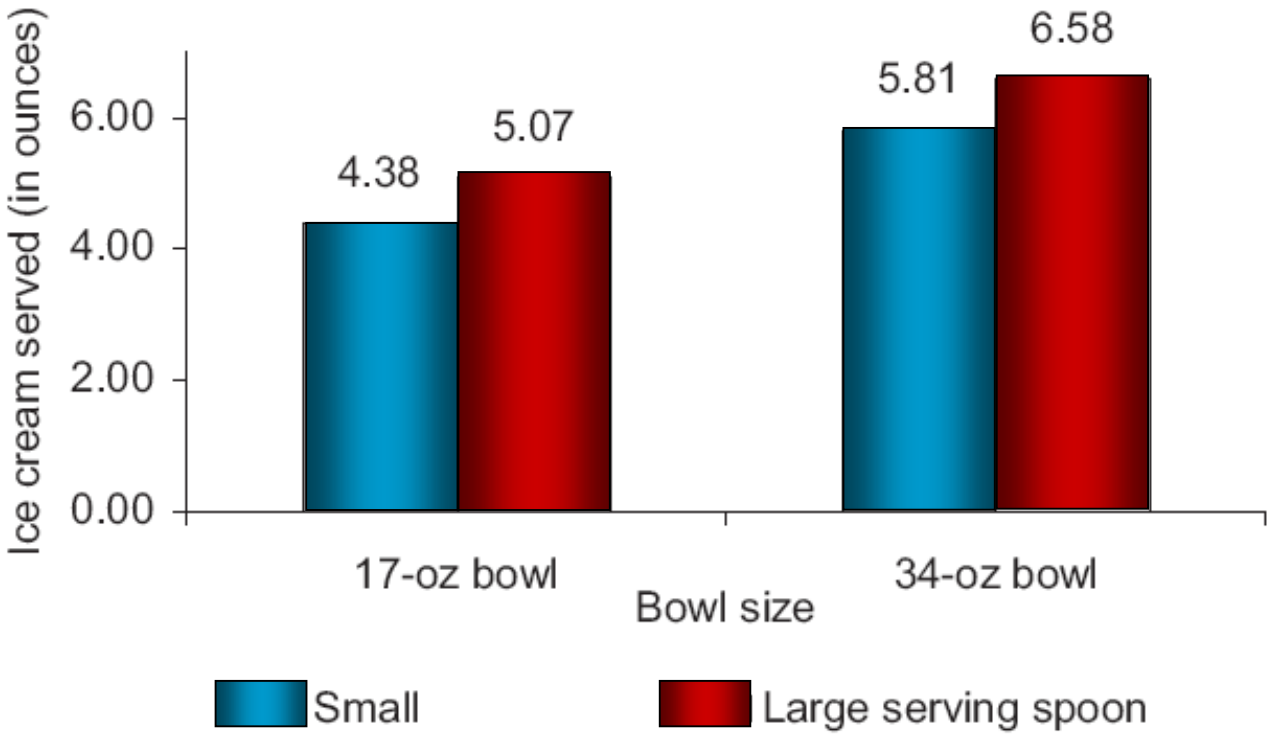
590 Kcal



Difference: 257 Kcal

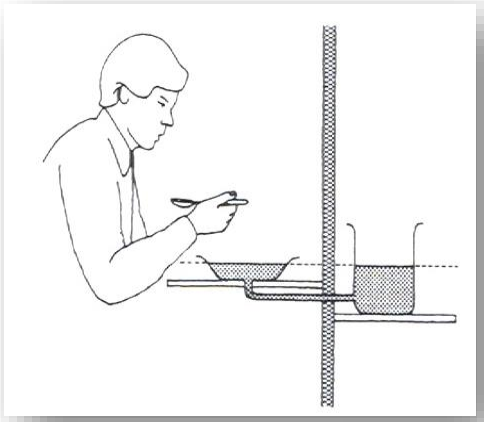
90 min weight lifting is equivalent to about 257 Kcal for a 70 kg person !

Icecreme-Illusions“

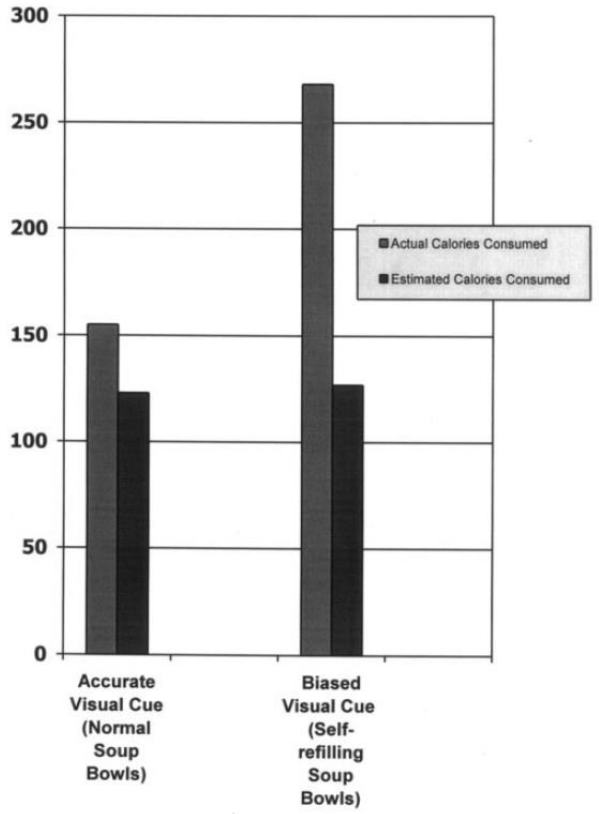


(Wansink et al., Am. J. Prev. Med. 31:240–243, 2006)

Effect of self-refilling soup bowls

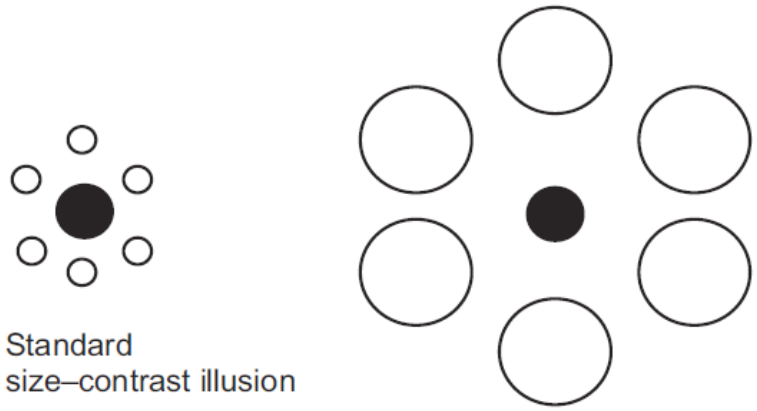


Biased visual cues provided by self-refilling soup bowls increased intake but not the perception of intake



(Wansink et al., Obes Res. 13:93–100, 2005)

Contextual stimuli may influence how much we serve and/or eat

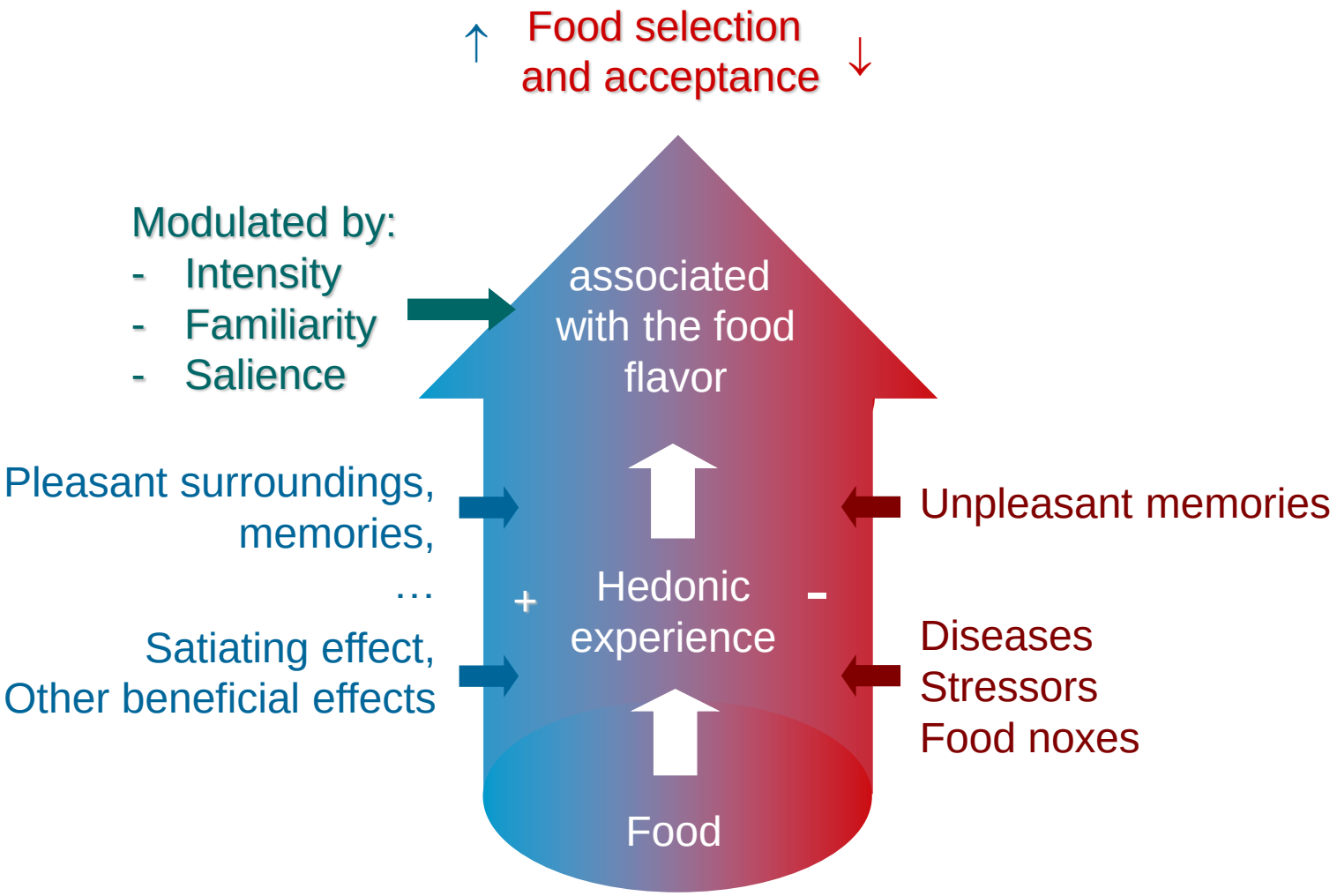


Standard
size–contrast illusion

The black center circle appears slightly larger when surrounded by smaller circles and slightly smaller when surrounded by larger circles.

The size of the black circle on the right needs to increase in diameter by 20% before the two black circles appear to be of equal size in their different contexts.

Learning in food selection



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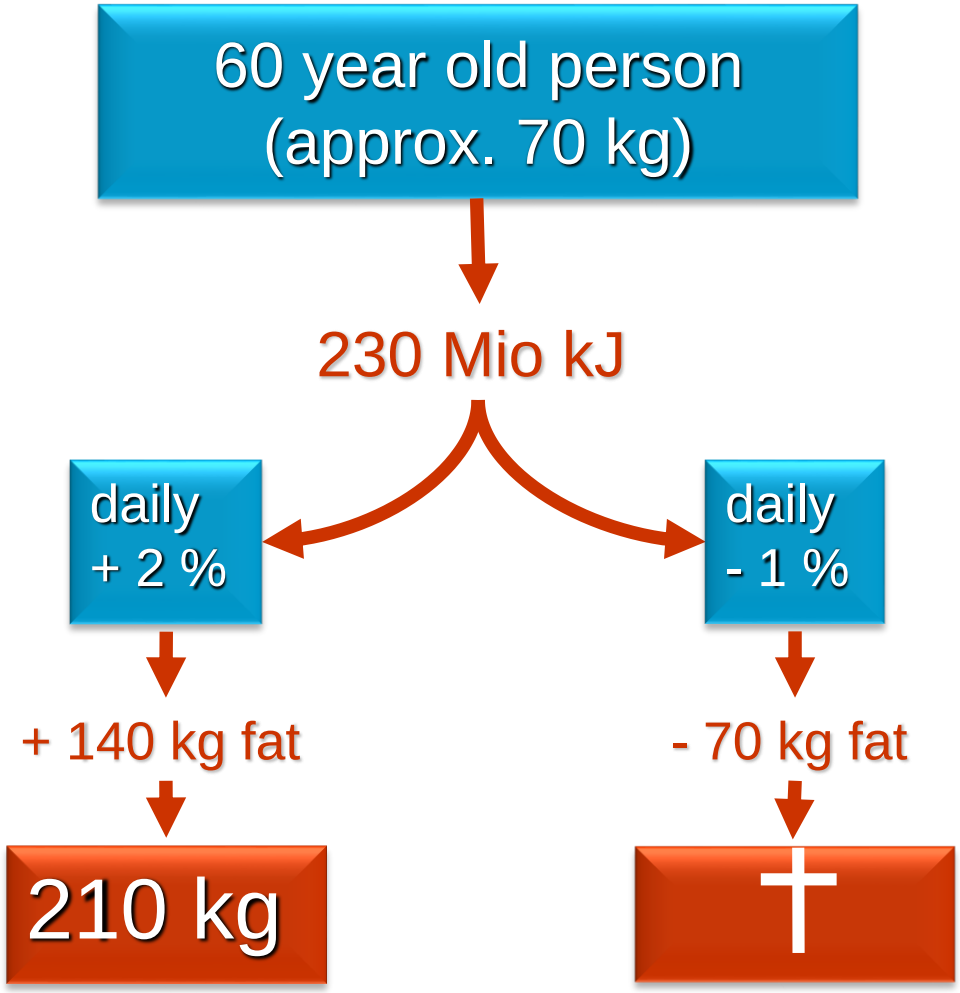
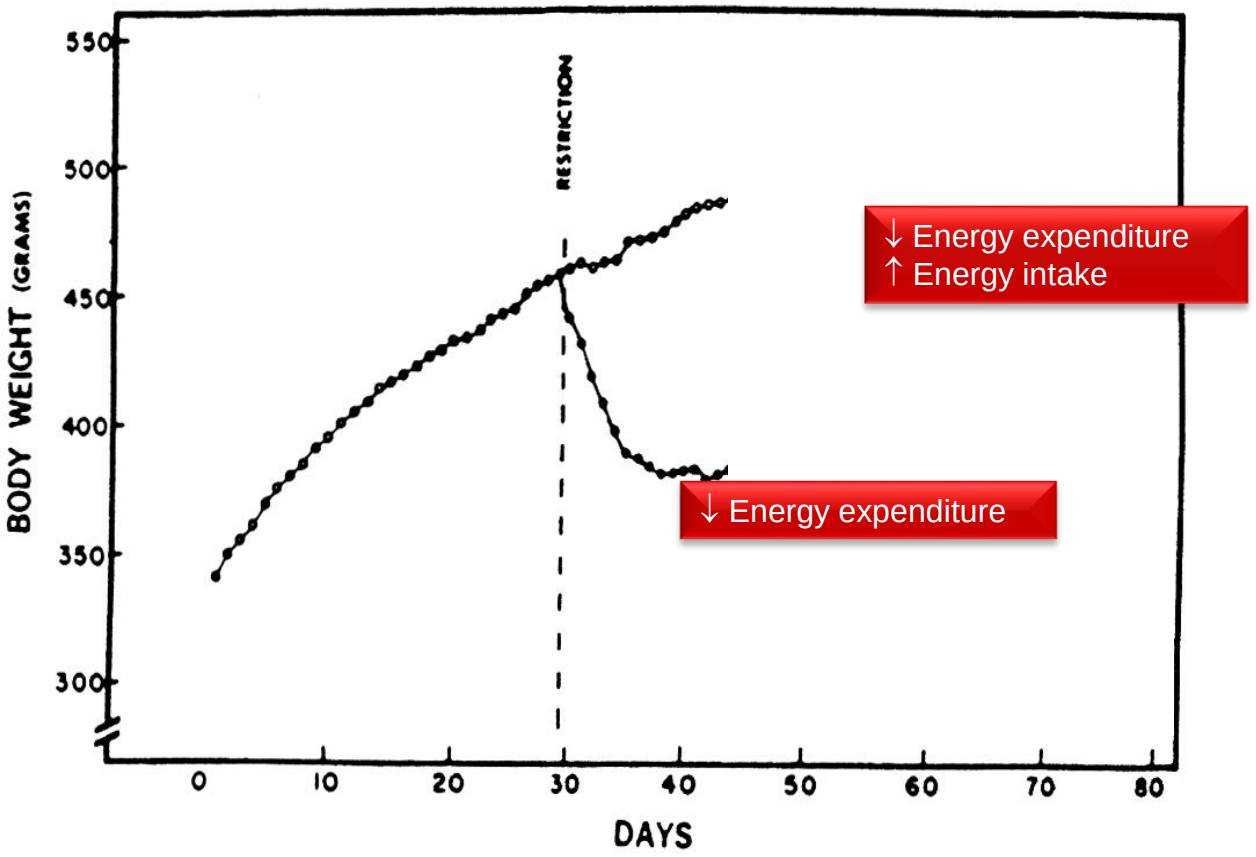
- **Wird das Körpergewicht reguliert?**
- Empfehlungen

Is body weight regulated ?

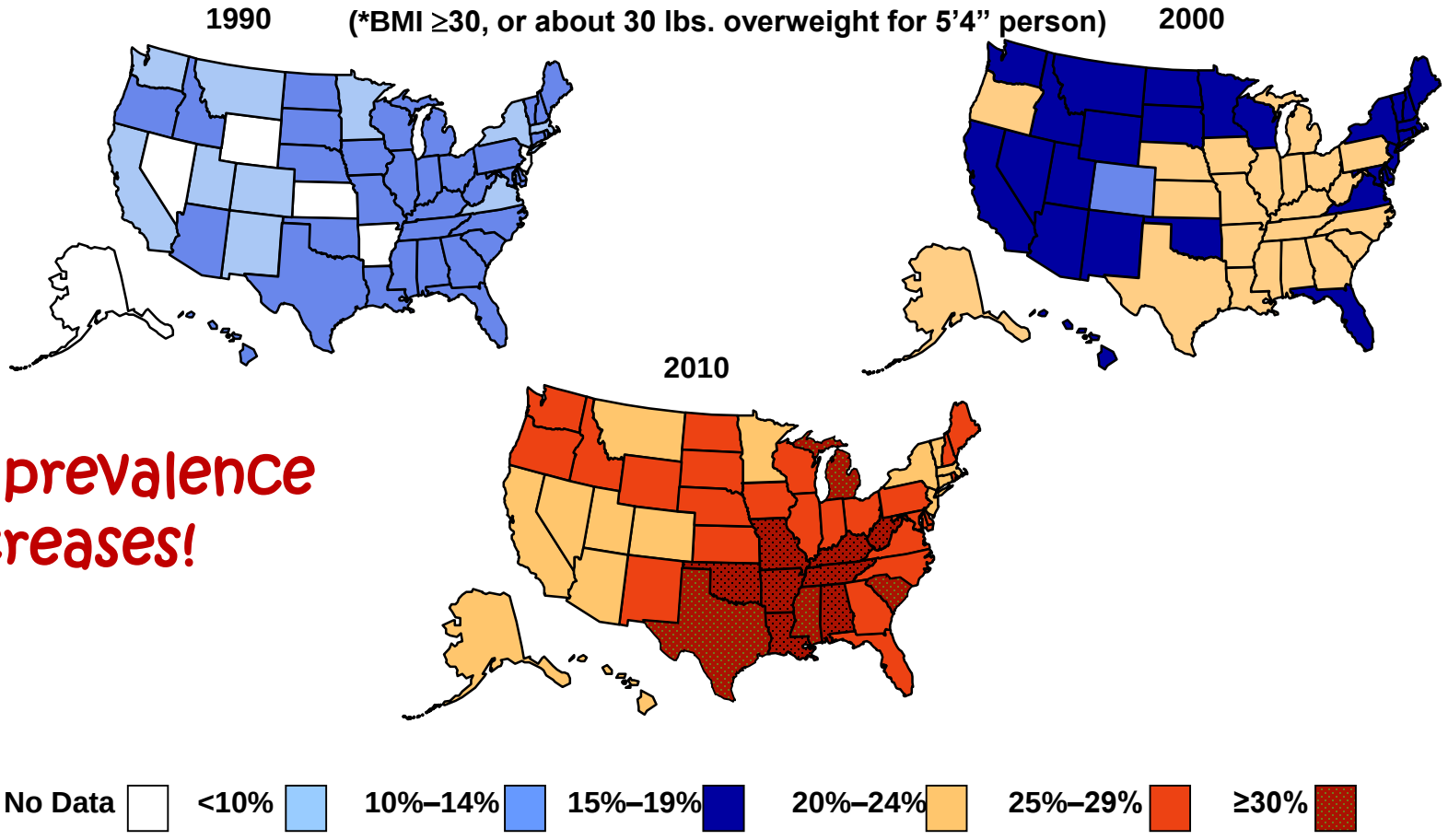


Rats‘ body weight after a period of caloric restriction



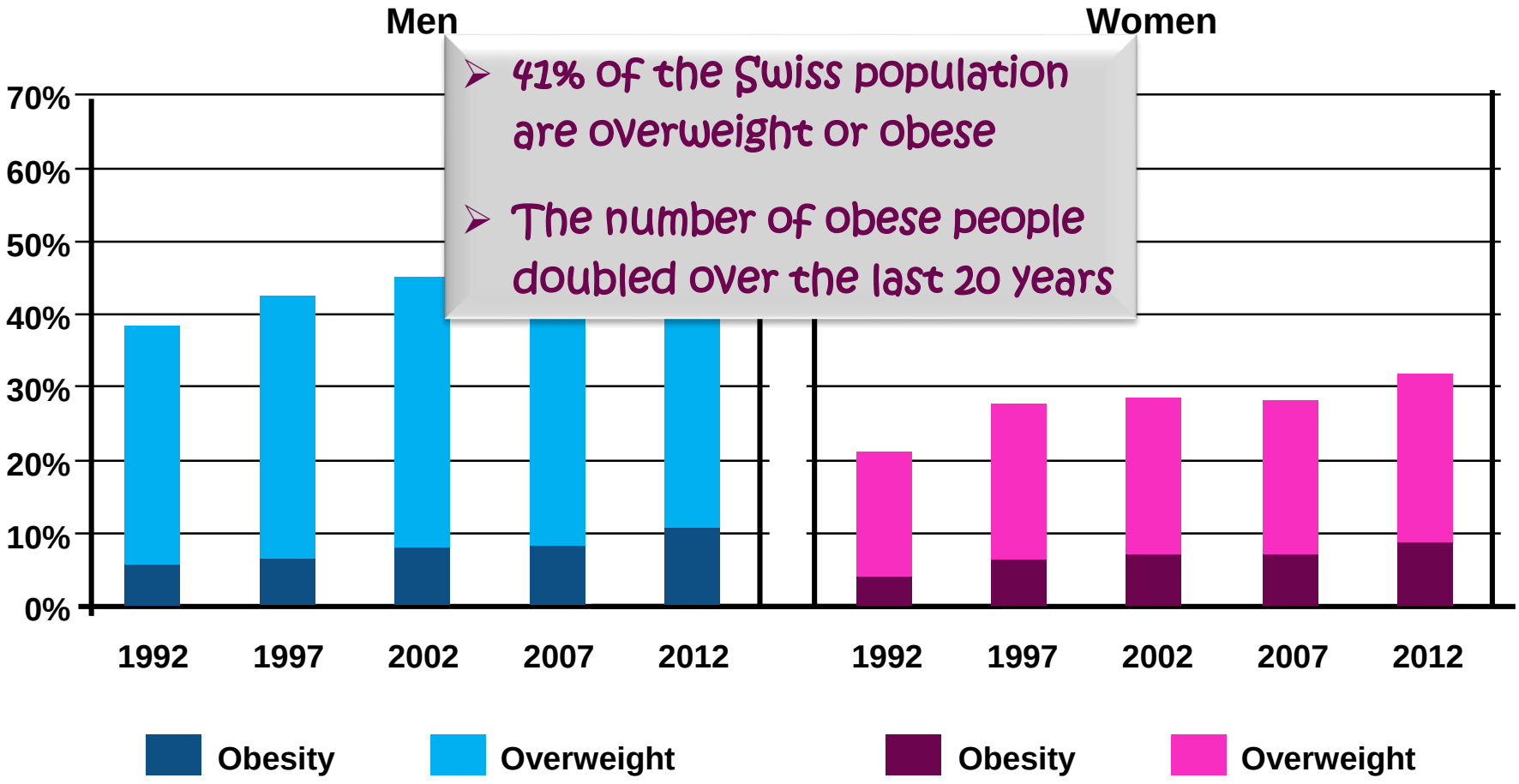
(Keesey and Hirvonen, J. Nutr. 127:1875S-1883S, 1997)

Obesity Trends* Among U.S. Adults
BRFSS, 1990, 2000, 2010



Its prevalence Increases!

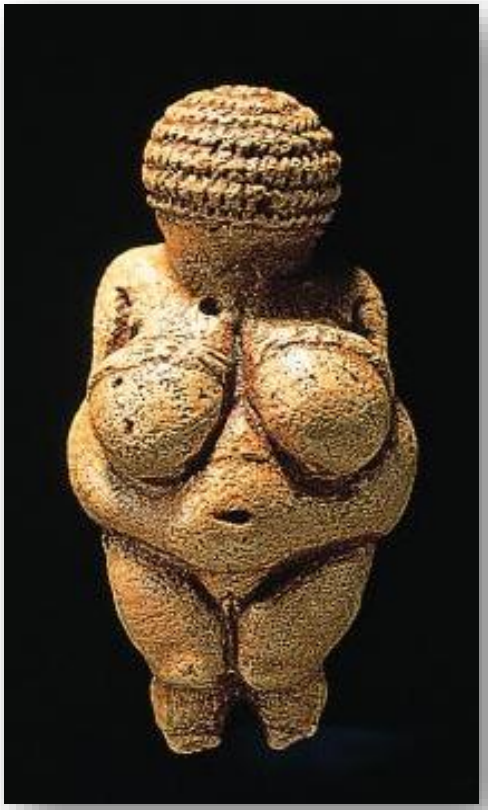
Overweight and obesity in Switzerland



(Swiss Federal Office of Statistics (BFS))

It is not a novel condition!

Venus of Willendorf ~25‘000 BC



Venus of Dolní Věstonice ~29’000 BC

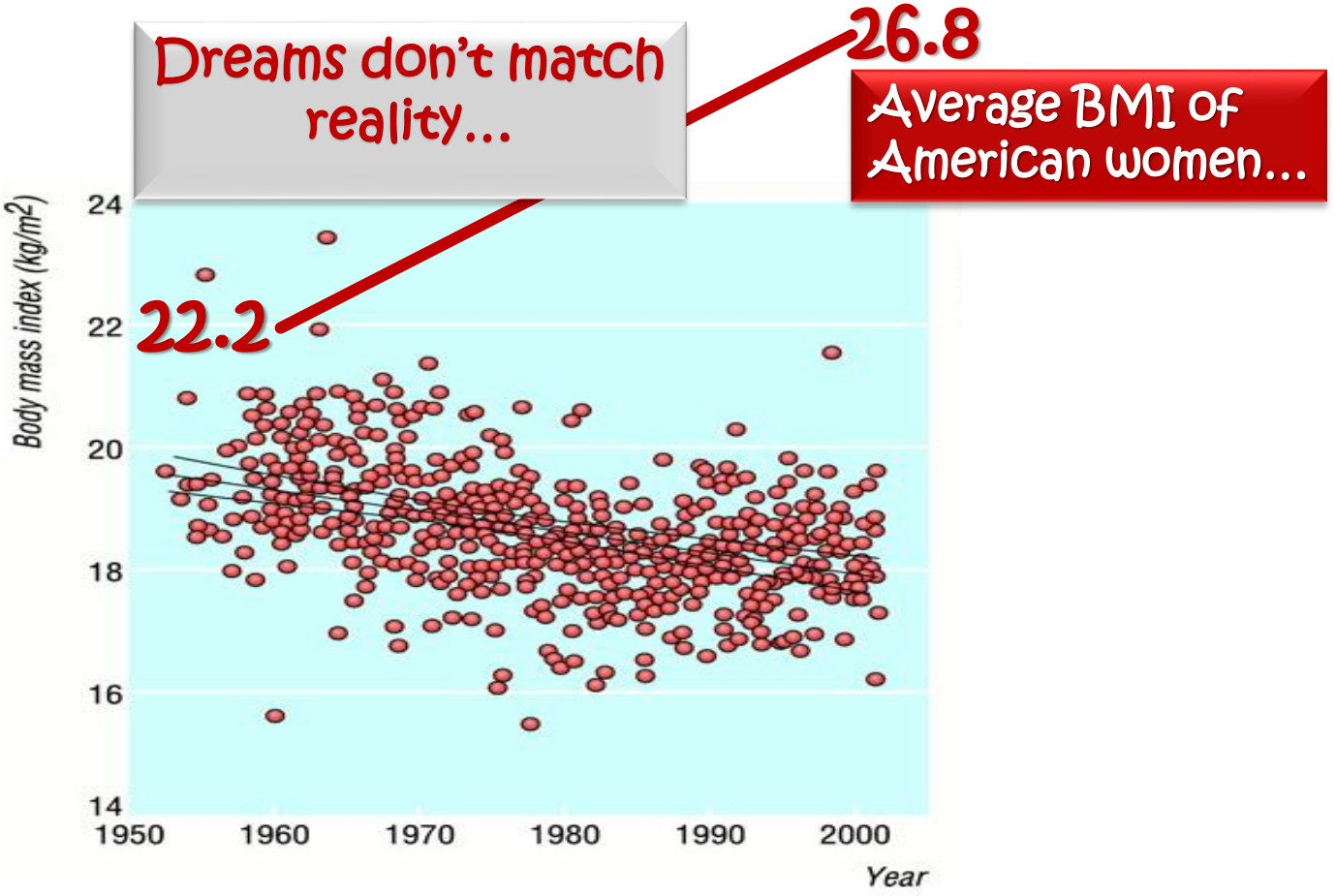
Change in the „ideal“ body image

Twiggy in the mid 60s

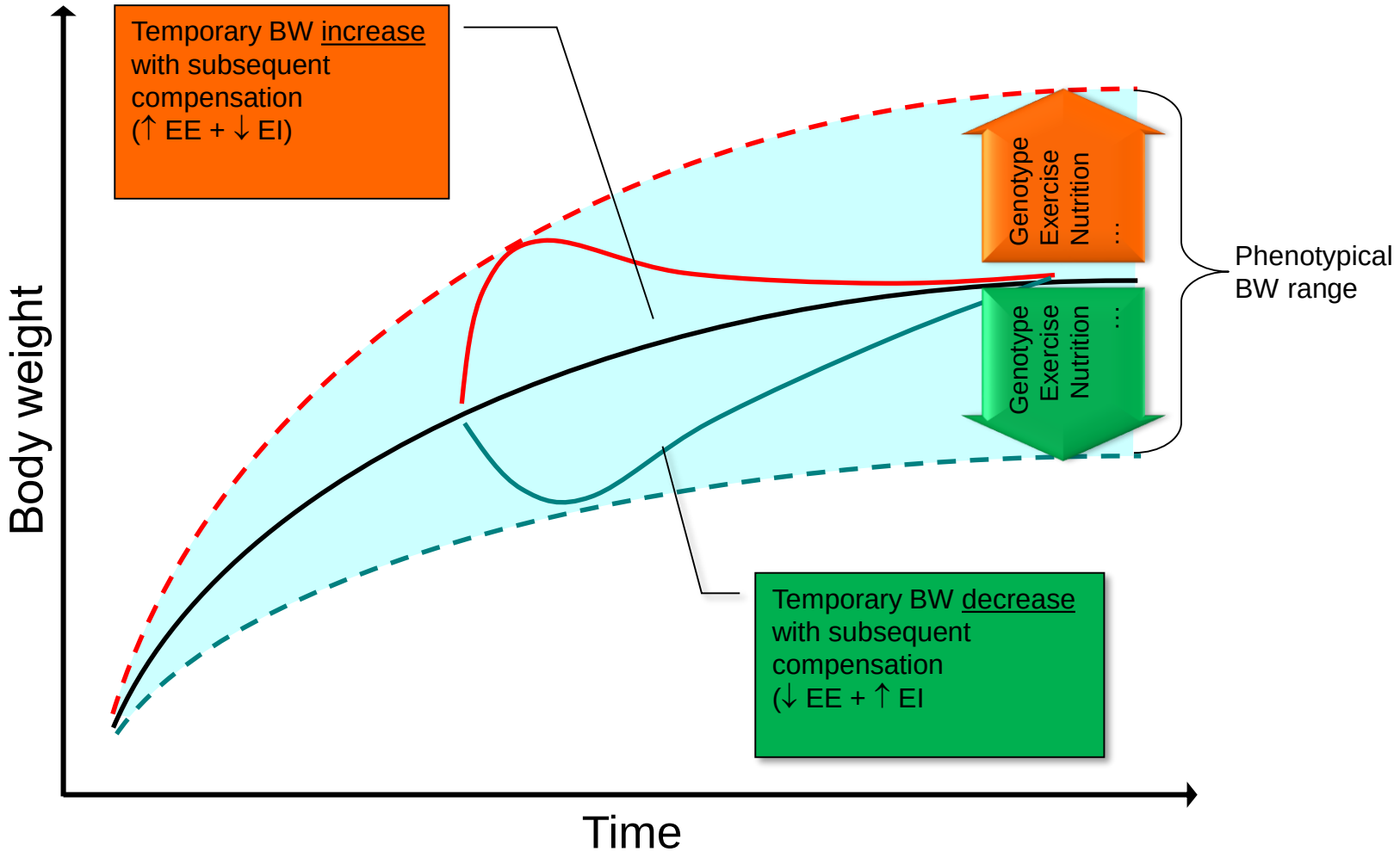
Since then, millions of women have been trying to reach a BMI of 18.5 or lower…

Decreasing BMI of Playboy "Centerfold Girl"

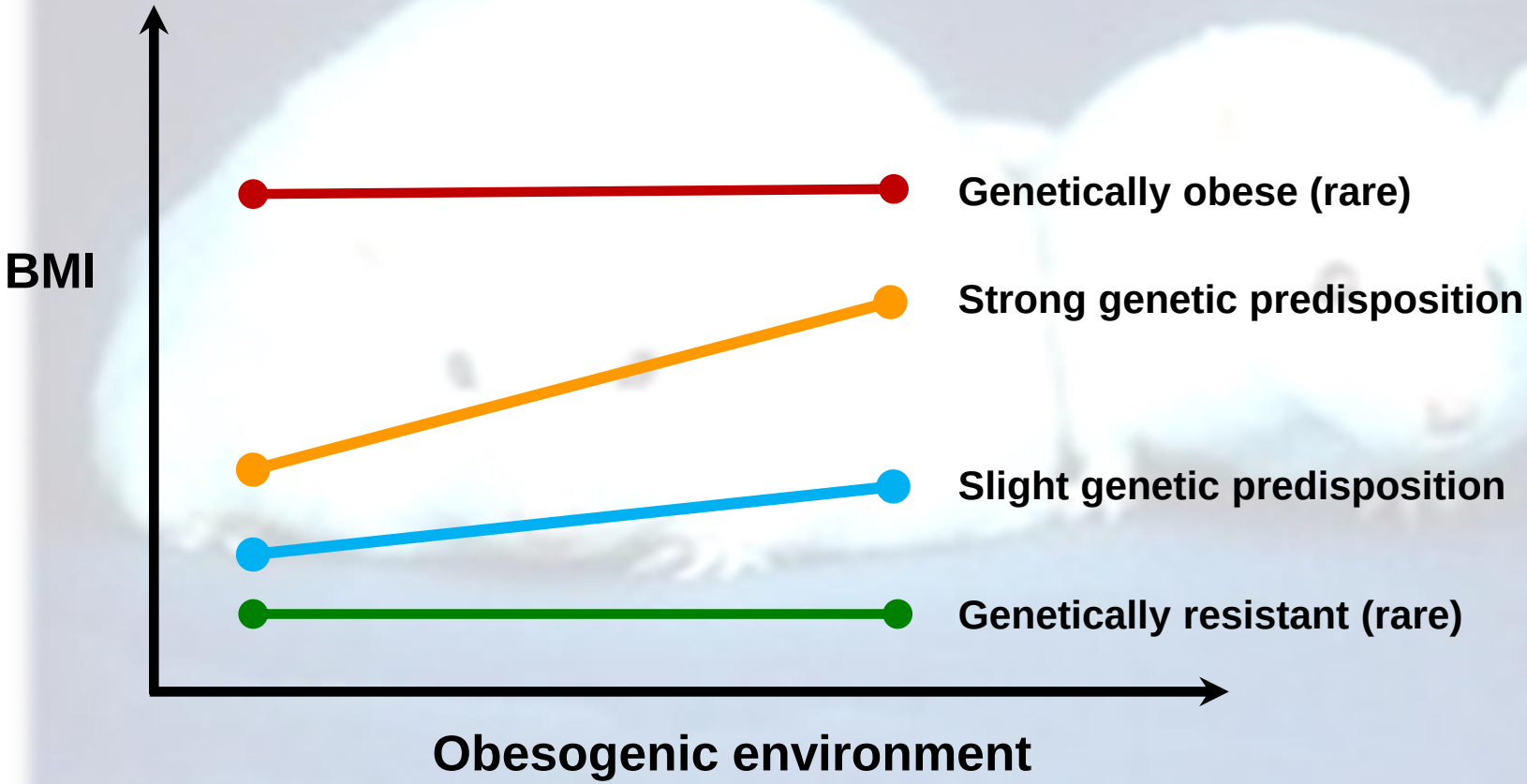
(Voracek & Fisher, BMJ, 2002)



Body weight regulation



Gene-environment interaction



Loos & Bouchard (2003) J Intern Med

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- **Empfehlungen**

"Two hundred years of medical progress and all you can do is to tell me to eat less?"

Empfehlungen?
Abstimmen auf Erkenntnisse der Physiologie und Psychologie
→ beim Verhalten dort ansetzen, wo relativ leicht möglich (Energiedichte, Portionsgrösse, Zwischenmahlzeiten, Süssstoffe, flexible Kontrolle, Bewegung im Alltag, …)
(Carl Warner)

Keine rigide Kontrolle !!!

„Ich esse **nie mehr** Schokolade“

„Ich esse **nur noch** Vollkornbrot“

„Ab morgen radle **ich jeden** Tag“

„**Ab sofort** mache ich FdH“

„Ich kaufe **nie mehr** Kuchen und esse **nur noch** Knäckebrot“

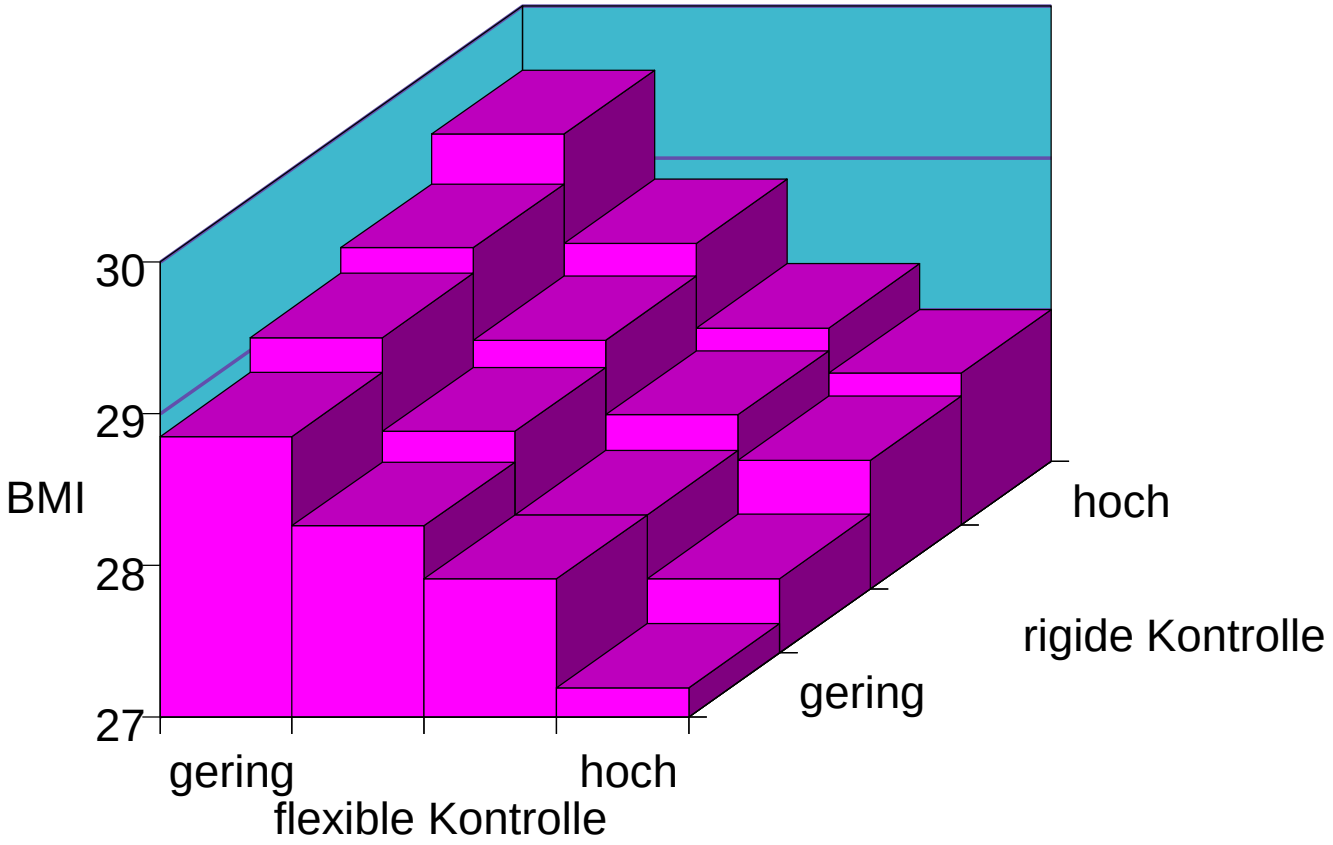
…

(Carl Warner)

Alles oder nichts
Vorsätze führen zu
Gegenregulation:
Ein eigentlich
unbedeutendes Ereignis lässt die
gesamte Verhaltenskontrolle
zusammenbrechen !
(Carl Warner)

Flexible Kontrolle:
Regulation über einen überschaubaren Zeitraum mit der Möglichkeit einer Verhaltenskorrektur
(Carl Warner)

BMI dependent on flexible or rigid control



(Pudel & Westenhoefer, 1992)

Empfehlungen ?

Weniger Verhaltens- und mehr Verhältnisprävention (Essens- und Bewegungsangebote optimieren in Kindergärten, Schulen, Betrieben, etc.)

(Carl Warner)