



# APPETITE AND NUTRITION

PHAR-432

LECTURE: 4











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# Definitions

-  Hunger: is an intrinsic feeling of need for food.
-  Appetite: is the desire for specific type of food.
-  Aphagia: means complete loss of appetite.
-  Hyperphagia: means over eating (increased meal size).
-  Orexia: means increased appetite.
-  Satiety: is feeling to stop eating.
-  Food craving: is an intense desire to consume a specific food.
-  Pica: The craving of non- food items as food.
-  Polyphagia: means over eating (increased meals number).
-  Anorexia: means loss of appetite.

# Regulation of appetite

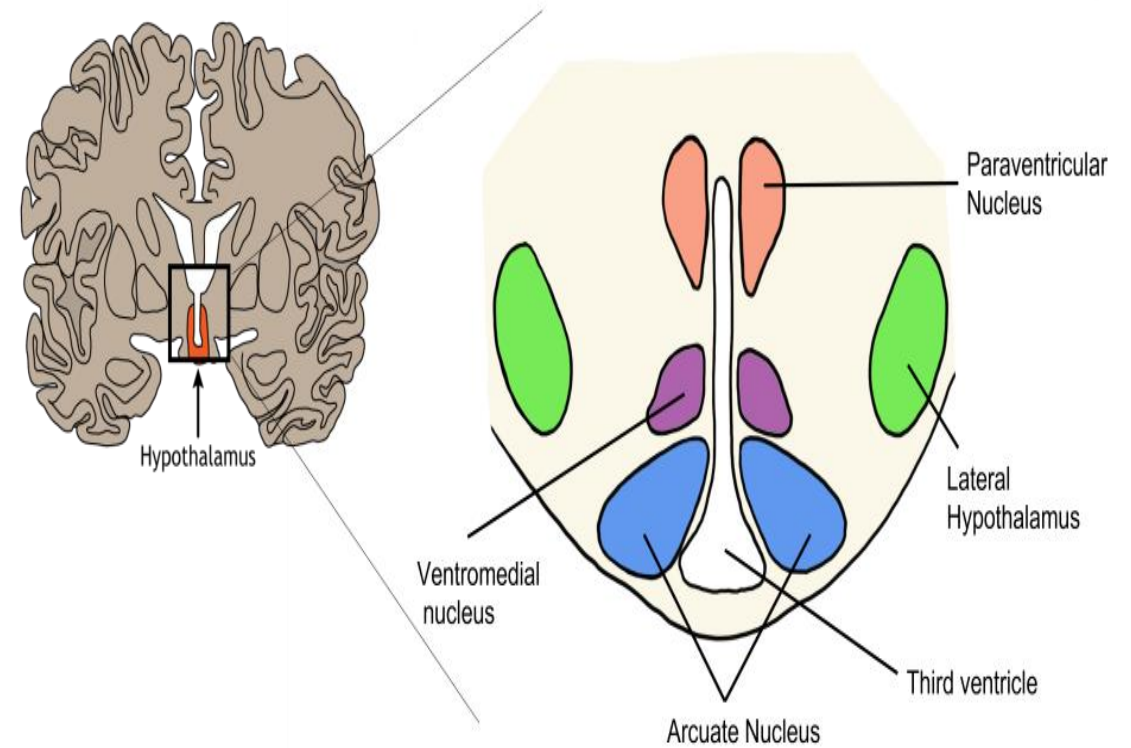
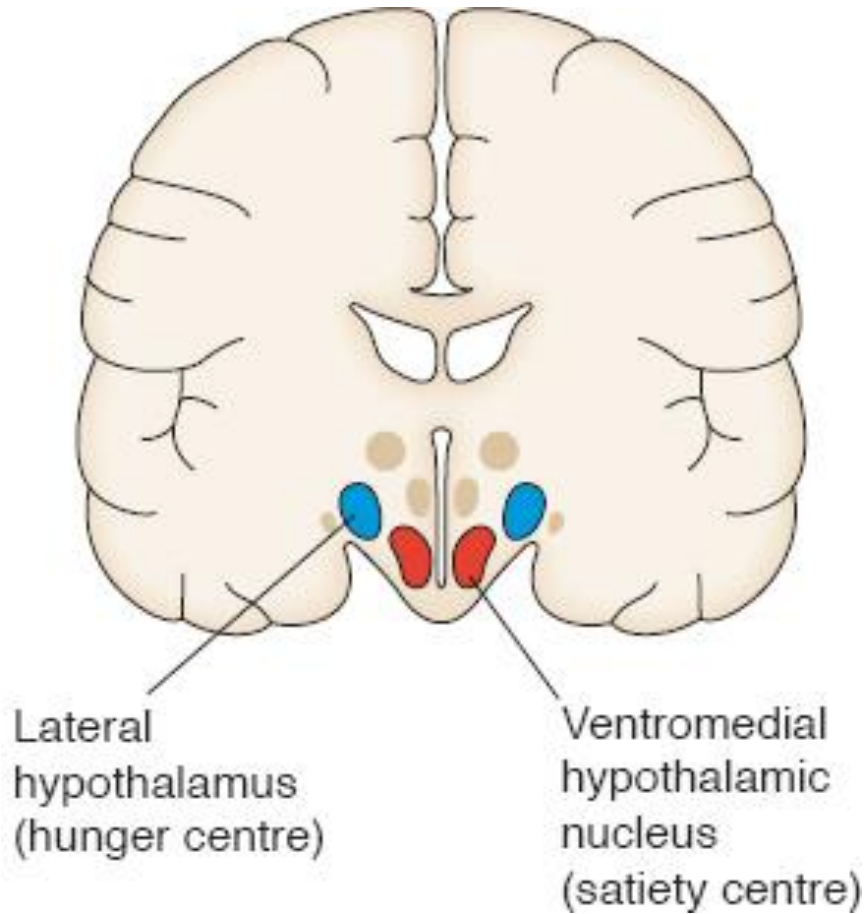
**The hypothalamus**, a part of the brain, is the main regulatory organ for the human appetite.

The neurons that regulate appetite appear to be mainly serotonergic.

The hypothalamus senses external stimuli mainly through a number of hormones such as leptin, ghrelin, PYY 3-36, orexin and cholecystokinin; all modify the hypothalamic response.

They are produced by the digestive tract and by adipose tissue.

# Hypothalamus



# Neuronal circuits

- **The Orexigenic pathway**
- **Orexigenic** neurons stimulate appetite
- The feeding or **orexigenic** system contains
  - Neuropeptide Y (NPY)
  - Agouti-related protein(AgRP)
  - Melanin concentrating hormone (MCH) and
  - Other hormones and neuronsthat signal to **increase food intake ( stimulate appetite).**



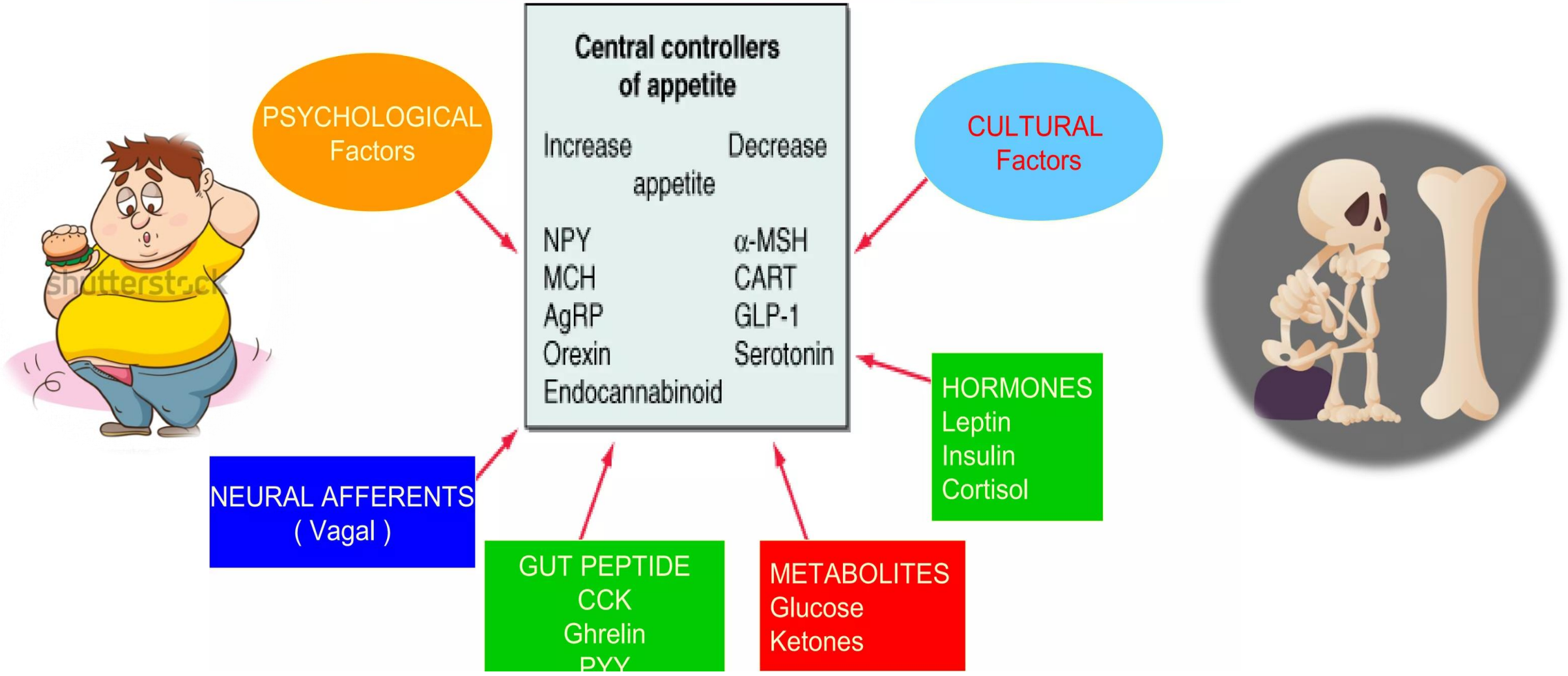


# Neuronal circuits

- The Anorectic Pathways
- **Anorexigenic** neurons promote satiety
- **POMC**: is a prohormone that gives rise to several biologically active peptides include  $\alpha$ -MSH,  $\beta$ -MSH,  $\gamma$ -MSH and ACTH.
- They are critical in the regulation of food intake and energy expenditure.
- They directly inhibit the intake of food.



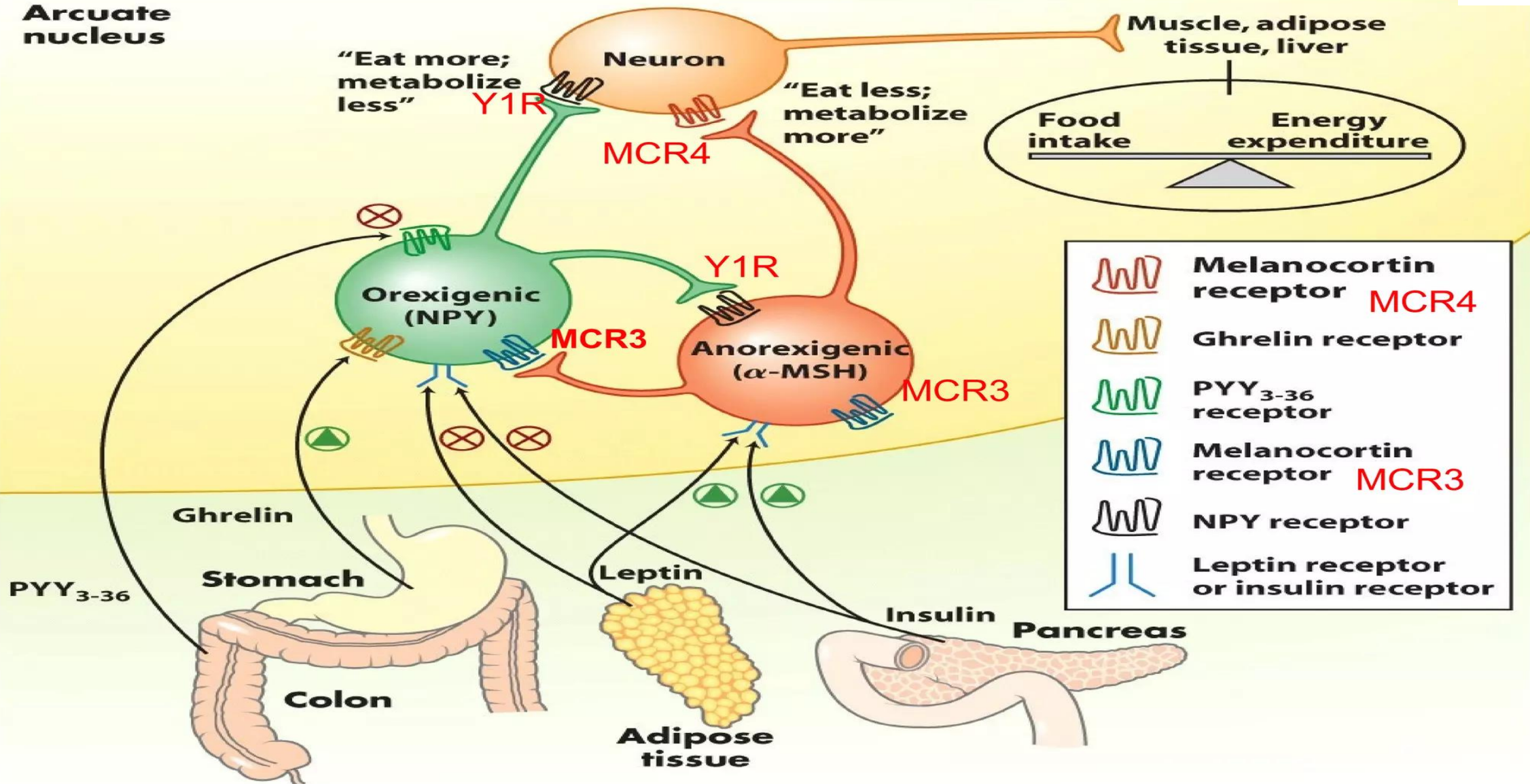
# The Factors That Regulate Appetite Through Effects On Central Neural Circuit





# HORMONAL CONTROL

**Arcuate nucleus**



# Hormones in appetite regulation



# Leptin

- Leptin **reduce appetite** and decrease food consumption.
- Secreted by adipocytes
- Low leptin means a slower metabolism and drive to increase food consumption.
- Administering leptin analogs in humans is ineffective for appetite suppression.
- Leptin exists to prevent starvation, not to lose weight. Only when leptin is provided along with amylin, slight fat loss may occur



## Insulin

- Hormone secreted by pancreas in response to rise in glucose concentration
- insulin in the brain reduces food intake,

## GLP-1

- Released when blood glucose levels are above the normal
- Secreted by cells of the gut in proportion to the amount of energy ingested
- Stimulates insulin and amylin secretion, may assist in signalling the brain to stop eating



# PYY3-36

- Produced by small and large intestines
- Suppress appetite and inhibits stomach motility while increasing water and electrolyte absorption in the colon.
- At lowest level before meal, Rises during meals and signals satiety
- Believer to be an important mealtime terminator
- Obesity seems to be a PYY 3-36 deficient state





# Ghrelin

- **Ghrelin** Secreted by cells of the stomach, pancreas, placenta, kidney, pituitary and hypothalamus
- Hunger hormone
- Stimulates release of growth hormone to encourage eating and acts to regulate energy balance.
- Hormonal clock



# Why ill people eat less?

Systemic inflammatory mediators, such as tumor necrosis factor-alpha (TNF $\alpha$ ), interleukins 1 and 6 and corticotropin-releasing hormone (CRH) influence appetite negatively

Processes from other cerebral loci, such as from the limbic system and the cerebral cortex, project on the hypothalamus and modify appetite. This explains why in clinical depression and stress, energy intake can change quite drastically.

# How to control your appetite?



- **Zinc:**

**Leptin**\_levels decrease in response to zinc depletion and increases after zinc supplementation. Adequate zinc levels reduce appetite, possibly by increasing brain sensitivity to leptin.

- **Probiotics:**

Recently a potential link between gut microbiota and obesity has emerged. Prebiotic treatment, increased gut microbiota fermentation, decreased appetite, and improved postprandial glucose responses. Furthermore plasma levels of GLP-1 and PYY were increased in subjects following prebiotic treatment.

- **Estrogen**
- Deficiency\_might result in a higher energy intake and increased body weight.
- **Testosterone**
- Have little effect on food intake, although many people supplementing anabolic doses of testosterone (e.g. bodybuilders) do report increased appetite.
- The dopaminergic system is also integral to reward- induced feeding behavior which is triggered by sugars.



- **Serotonin**

- **Serotonin** (5-HT) is a short-acting widespread neurotransmitter which acts on a number of receptor subtypes found at high density in the limbic system as well as in the hypothalamus.
- 5-HT stimulates noradrenaline release and modifies behaviour and mood.
- 5-HT shows the most consistent inhibition of food intake. Serotonin may directly influence the melanocortin pathway.



- A balanced intake of omega-6:omega-3 fats can help with appetite regulation.
- A high protein diet can reduce appetite.
- Fiber, help control appetite.
- Refined carbohydrates, on the other hand, appear to increase appetite.
- Dietary fat has mixed results; when combined with refined carbohydrate it seems to increase appetite while on its own or combined with protein, it typically decreases appetite



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