

Neuro-endocrinology

14 BRIEFINGS

IS THERE SUCH A THING AS A HEALTHY APPETITE?

SUMMARY

Not surprisingly, since we have a need to live, grow and reproduce, evolution has equipped us with a powerful drive to seek food and devour it. If that is not enough, our hedonistic emotions have made eating and drinking a pleasurable experience. So, what tells us to stop eating? Have we evolved systems to do so effectively? The ever increasing problems of excess weight and obesity would suggest not.

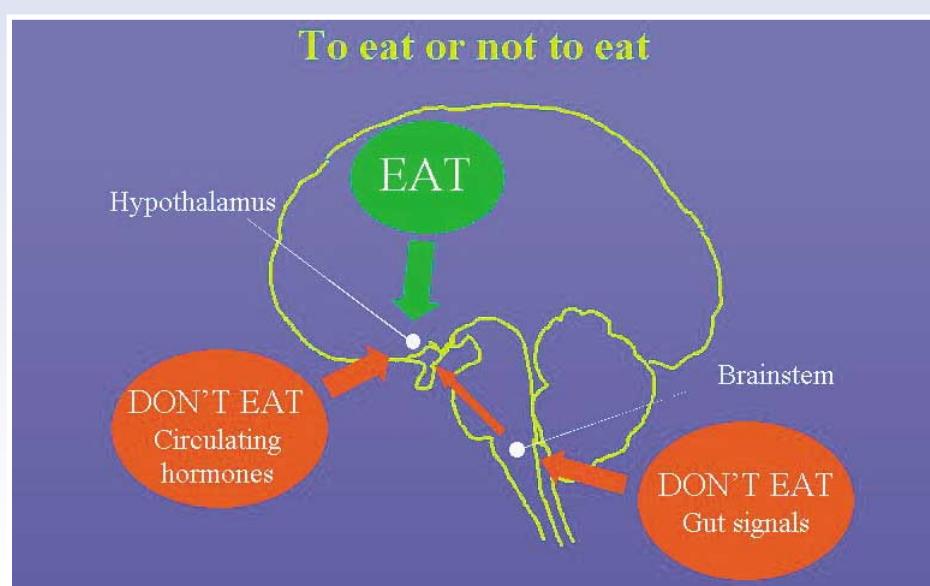
Our innate drive to eat is balanced by competing signals from the body indicating satiety, our fat reserves and overall energy status.

“Another bite and I’ll burst”

When we eat a meal our bodies experience what is termed gastric satiety. Nerve terminals in the stomach and intestine, that act as stretch and chemical receptors, send electrical signals to the lower part of the brain, called the brainstem. The information is processed by the brainstem and its reciprocal connections with the gut act to control the rate at which food passes through the stomach, but also to activate other neural connections that will stop eating behaviour and terminate a meal. It is possible for the brainstem to carry out these functions without the sensation of satiety ever reaching our consciousness. However, this mechanism is there also to protect the body from

ingesting something undesirable or simply from eating too much. Activation of the same or parallel pathways will induce nausea and trigger vomiting to eject the offending material. In these circumstances we are aware of the sensation of fullness or nausea, but there is little that we can do to regulate our reflex response.

These pathways are not involved in the maintenance of a constant body weight as they do not accurately monitor caloric intake. Artificial stimulation of the system that signals to the brainstem will cause a reduction in meal size. However, the body then compensates for the lack of food intake by initiating more meals. This compensatory mechanism is determined by an area at the base of the forebrain, the hypothalamus.



Neuro-endocrinology Briefing 14: Is there such a thing as a healthy appetite?

Body weight – a fine balancing act

The hypothalamus functions to control body weight by balancing energy intake to energy requirements. The areas of the hypothalamus involved in body weight regulation have been known for some time, but it was the discovery of the hormone, leptin, that provided a key to unlock its complex circuitry. Leptin is produced by adipose tissue, where most fat is stored, and its blood level indicates to the hypothalamus the body's overall energy status. Leptin does not fluctuate with meals, but it is a longer-term indicator of body weight. Nerve cells in the hypothalamus integrate the long-term energy signals (leptin and other hormones) with short-term signals concerning changing levels of nutrients (sugars and fats) in the bloodstream, and also with information from the brainstem concerning satiety. In order to balance the body's stores, the hypothalamus can stimulate the expenditure of energy by activating the peripheral nervous system. This will mobilise stored fat and convert it to useable sugars that can be burned like fuel so that energy is lost as heat.

Born to eat, not to diet

The reaction of the hypothalamus to excess nutrients is akin to the fight or flight response engendered by stress. But are these mechanisms effective in situations, such as obesity, where there is a chronic need to lose weight? The concept of there being too much food is alien to most animals and indeed to the majority of the human race. Therefore, it is reasonable to suggest

"Our bodies signal frantically to the hypothalamus that energy stores are replete"

that the systems that are required to lose weight over the long term may not have evolved. Thus, signals like the hormone leptin are not present to warn of obesity but, instead, their absence warns of low body weight. By monitoring these signals, the hypothalamus determines whether an animal is fit for other functions, for example reproduction and growth, that will be suspended in an undernourished individual until a sufficient energy status has been re-established. Similarly, it is probable that these signals are required in the young to indicate adequate body development and allow entry into puberty.

How do we deal with fatness?

There is no doubt that an appetite for a balanced diet is healthy. However, in our present society it is becoming more difficult to achieve this ideal. There are the lucky few who seem to stay slim without effort while, for the rest of us, our appetites are proving unhealthy. As we become overweight our bodies signal frantically to the hypothalamus that energy stores are replete, but these signals are not strong enough to turn off the innate drive to eat.

So, what hope for the overweight? It is already apparent that there are few genetic factors in the human population that can be isolated to explain individual cases of obesity and, therefore, quick-fix interventions, perhaps by replacement of a single element in

a complex mechanism, are unlikely to succeed. There may be a host of genes which, if expressed in particular ratios, may make an individual susceptible or not to weight gain. Perhaps in the future, by genetic profiling, we may be able to target susceptible individuals with personalised treatments and lifestyle programmes. In truth, our best chance may be to block our "unhealthy" appetites either therapeutically or through education. In the meantime, before I drive home, tuck into a energy-dense supper and crash in front of the TV, my advice, and personal resolution, is to eat less and get more exercise!

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