WEIGHT CONTROL AND OBESITY

The food we eat supplies us with energy; we use energy through metabolic activity and exercise. Any excess energy is stored. As a population our energy intake is going up and our energy use is going down. The result? An alarming increase in the numbers of people overweight or obese. We now know that the hypothalamus is the key weight control centre in the brain. But appetite is sensitive to many factors. How do we know when we have eaten enough? What effect does our family environment have? How are lifestyle changes affecting energy use? What if we run low on energy? And how are we affected by media representations?

In the brain...
The hypothalamus (tell area) integrates signals from the body and from other parts of the brain. Lately provides information about the body’s energy stores. Pleasure centres relay messages that contain food is enjoyable. Neural pathways encourage us to repeat actions that have been good for us in the past. Messages from the pre-frontal cortex, the ‘thinking’ part of the brain, carry our conscious desires (i.e. to resist temptation). The end result is our appetite: our drive to eat.

How all this happens is not clear. Various neurotransmitters are known to be important, either increasing or reducing hunger.

Developmental factors...
If we are very small when born (e.g. because our mother’s nutrition was poor), it seems that our hormone systems develop such that we are more likely to become obese. Other factors include a family history of obesity, and metabolic syndrome (e.g. a gene called MC4R affects weight).

Social factors...
Modern life has a strong influence on food intake and energy use. Energy-dense food is all around us and ferociously marketed. Meanwhile, our energy use has plummeted.

In the digestive system...
The stomach and digestive system sense when food has been eaten, relaying messages to the brain. The effect is a decrease in the subsequent appetite. Thus, for example, a full stomach (and dental) or, more likely, some combination of the two.

Neurotransmitters...
There are many neurotransmitters in the brain. Some stimulate appetite, others reduce it. These are the highlights:

- Serotonin
- Dopamine
- Norepinephrine
- Others

In adipose tissue...
Adipose cells are large fat molecules waiting to be mobilized and burned. Adipose tissue also releases hormones (adipokines), which affect the body’s use of energy and act on the brain to alter appetite.

In muscle cells...
Energy levels must be controlled within each individual cell and in the body as a whole. A key sensor is a molecule known as AMPK, which monitors levels of the cell’s energy currency, ATP. If ATP is running short, AMPK prompts mitochondria to make more ATP.

Glossary
Adipokines: Hormones produced by adipose tissue. There is a variety of effects on the body’s use of energy and storage. These are still being discovered.

AMPK: AMP-activated protein kinase. Intracellular enzymes, important in controlling cell’s energy use. Key link between body’s overall energy status and the activity of specific genes.

Hormones: Small molecules that travel between organs and act on target cells to control body functions.

Hypothalamus: The hormone-producing part of the brain responsible for many aspects of homeostasis. Integrates body and brain signals to control feeding.

Insulin: Hormone produced by the pancreas that regulates blood sugar levels to supply energy to body cells.

Leptin: Hormone produced by adipose tissue that regulates appetite. Has complex effects on body cells and the brain.

MC4R: Mutations in the gene MC4R are associated with an increased risk of obesity.

Neurotransmitters: Chemicals that transmit nerve signals across synapses.

Obesity: – It is a chronic condition that suppresses hunger and the urge to exercise.

Silhouette: Clearly-drawn shapes that the brain uses to regulate appetite.

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