

Growth Hormone

Structure

Growth hormone, also known as somatotropin, is a protein hormone of about 190 amino acids.

Origin

GH is synthesised and secreted from the somatotrophs of the adenohypophysis.

Release

Growth hormone releasing hormone is released from the hypothalamic neurones that pass down the infundibulum to the median eminence, where the neurosecretion of GHRH occurs into the portal plexus originating from the superior and inferior hypophyseal artery. The GHRH passes in the portal blood to the adenohypophysis where the trophic hormone stimulates the somatotrophs to synthesise and release GH.

Pulsatile release of GHRH is necessary. It is essential for the normal function of the hypothalamic – pituitary axis. It is required like this because otherwise there would be a desensitisation and downregulation of the receptors. Continuous infusion results in decreased production from the pituitary of its hormones.

Effects

Growth hormone has two types of effect. DIRECT effects, which are the result of growth hormone binding its receptor on target tissues – e.g. adipose tissue. Alternatively there are the INDIRECT effects which are mediated primarily by insulin – like growth factor-1. This is a hormone which is secreted from the liver and other tissues in response to Growth Hormone. A majority of the growth promoting effects are actually to do with IGF-1.

It appears that IGF-1 is responsible for proliferation of chondrocytes – resulting in bone growth, and myoblast differentiation and proliferation resulting in growth of muscles.

Metabolic effects are thought to be mediated by a combination of both growth hormone itself (direct) and IGF-1 (indirect). Protein anabolism is promoted with a variety of tissues increasing amino acid uptake and protein synthesis. Triglyceride breakdown is promoted to allow increased utilisation of fat by the adipocytes. Growth hormone is seen to suppress uptake of glucose in tissues (anti insulin effect) and actually stimulates the liver to synthesise glucose.

Control of GH

There are many factors which modulate the production of growth hormone, including stress, nutrition, sleep.

GH itself can feedback onto the pituitary and hypothalamus to inhibit the secretion of GH and GHRH respectively (short negative feedback loop). Then there is the long negative feedback loop involving IGF-1 which is able to feedback onto the pituitary to inhibit somatotroph activity – as well as acting on hypothalamus to stimulate somatostatin secretion. Somatostatin is a peptide produced by several tissues in the body, including the hypothalamus. It is able to inhibit GH by reducing the activity of the somatotrophs. It is thought that Ghrelin – a peptide hormone secreted from stomach is able to increase GH secretion from somatotrophs.

