Peptide hormones report examples

Health & Medicine, Diabetes

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1. Overview

The peptide hormones are proteinous in nature and may have 3 to 200 amino acids residues. This class of hormones includes all the hormones of the hypothalamus and pituitary, as well as insulin and glucagon of pancreas. Peptide hormones are named based on their endocrine activity rather than their chemical structure; for example, growth hormone is thus named because one of its effects is to stimulate growth. The structure of a particular peptide hormone can vary among different species, with some homology between close relatives. Some small peptides are identical; for example, GnRH is identical among mammals but different in chickens and fishes. The growth hormone from pigs and cattle are different, since they have different amino acid sequence. Peptide hormones consist of a linear chain of amino acids, with the sequence of the amino acids determining the primary structure of the protein. Short peptides can be sequenced directly, but long chains are divided up into smaller chains by enzymatic digestion to obtain overlapping fragment which are then sequenced. Peptide hormones are

often synthesized as an extended peptide, a pro-hormone (inactive) or even a pre-pro-hormone (e. g. insulin), these are stored within the cells in secretory granules, which subsequently fuse with the plasma membrane to close their contents by exocytosis. The pro-hormone must be cleaved to produce the active molecule. Peptide hormones are both degraded quickly and excreted in the urine.

Peptide hormones are produced by transcription and splicing of the resulting heterogeneous nuclear RNA followed by translation into the amino acid sequence, which frequently results in inactive precursors that require proteolytic processing to liberate the biologically active peptides. The precursors carry a signal sequence on their N terminus, which directs the ribosomes to the rough ER during synthesis. The growing peptide chain is transferred into ER, in which the signal peptide is split off by a signal peptidase. Pro-hormones are processed in the trans-Golgi network or in the later step of secretory pathways.

2. Biological pathway

Peptide hormones exert their actions on cells by binding to plasma membrane receptors which in turn are coupled to signal transduction pathways within the cell. The coupling typically involves one or more G protein acting as intermediates. Peptide hormone receptors coupled through G proteins are part of a family of receptors which share many structural and functional characteristics. Many peptide hormone receptors in polarized cells are coupled through Gs and G1 proteins to stimulate or inhibit adenylate cyclase, respectively, and the generation of the second messenger, cyclic

AMP (cAMP). Another class of peptide hormones involves the transduction of IP3 and DAG, the second messengers.

After hormone-receptor binding and activation of the adenylate cyclase system, the hormone-receptor complex may undergo a conformational change that disconnects it from the adenylate cyclase system. As a result, the cell may become refractory to further activation. The period of refractoriness may be transient, as for gonadotrophin-gonadal interaction, where the initial period of refractoriness is followed by a pronounced loss of LH receptors due to internalization and degradation of the hormone-receptor complexes. There are other ways for hormones to affect target cells, with the signal responsible in some cases for eliciting target cell responses remaining unknown. The signals mediating the reactions to insulin, growth hormone, prolactin and the growth factors have not been identified, but a peptide derived from the plasma membrane could mediate changes in intracellular enzyme activity, as for insulin.

3. Diseases

Enkephalin, a neurotransmitters and a peptide hormone that is known to act like morphine and vie with same for the binding site in brain. The enkephalin has been subject to research for its association with lipid membrane leading to transfer of transfer mediation. Debar and Benham (1983) studied this association and revealed that enkephalin binds with phospholipids present in membrane. It has been demonstrated that enkephalin augments the permeability of cerebroside and lecithin membranes for calcium and potassium ions upto three times.

The appetitie-stimulating peptide hormone ghrelin is subject to a unique lipid modification, octanolyation resulting from lipid and peptide hormone interaction. The eight carbon fatty acid octanoate is attached to ghrelin at serine 3 through an oxyester linkage (o-acylation) and is necessary for the physiological activity of the peptide. GOAT (ghrelin O-acyltransferese) is the MBOAT protein responsible for ghrelin acylation. GOAT is considered a promising therapeutic target to curb obesity. GOAT is responsible for diet induced obesity and aggravates hunger pangs in body. Several studied now link GOAT to obesity and drugs that inhibit GOAT might be able to prevent diet-induced obesity and might be effective therapy for T2DM because they increase insulin secretion and peripheral insulin secretion.

Diabetes insipidus or DI is caused due to defect in peptide hormones. There are two significant inherited forms of DI; central and nephrogenic. In central DI, there is a defect in the production of vasopressin, the anti-diuretic hormone (ADH). CDI is rarely heredity in man, usually occurring as a consequence of head trauma or diseases in the hypothalamus or pituitary gland. The expression of AQP3 is also regulated by vasopressin which implies that the expression levels of these water channels will also be decreased in patients with CDI.

Missense mutations of the vasopressin-neurophysin II gene have been identified in some families with familial DI. A single base substitution was reported in one of the two alleles of the vasopressin-neurophysin II gene in families with familial DI. These mutations result in one-amino acid

substitution in the neuropyhsin II moiety and Val to Gly at amino acid position 17 in the neurophysin II moiety.

Neurophysins bind to their associated peptide hormones, vasopressin and oxytocin, after proteolytic processing of the precursor. The amino acid substitution in neurophysin II may result in its conformational change. Such changes may impair functions of neurophysin II; the protecting action for arginine vasopressin from proteolytic degradation and the assisting action of arginine vasopressin in its axonal transport. Moreover, the mutated neurophysin II may impair the function of normal neurophysin II molecules, possibly by a heterodimer formation.

A mutation was also found in the gene region encoding the vasopressin signal peptide. A point mutation causes a substitution of threonine for alanine at the last amino acid of the signal peptide in these patients. The signal peptide directs the precursor protein to enter the endoplasmic reticulum; where the proteolytic cleavage of the precursor occurs. The amino acid change possibly alters the cleavage of the signal peptide and results in inefficient processing. Thus, autosomal dominant central diabetes insipidus is caused by many mechanisms.

4. Remediation

Central diabetes insipidus is most often a consequence of head trauma, cranial surgery, or infection at the base of the brain. There are also familial and idiopathic forms. A mild, transient form of the syndrome can be simulated by drugs that inhibit ADH release, including phenytoin and ethanol. Patients with central diabetes insipidus complain of polyuria and

poydipsia and can produce astounding urine volumes, often more than 5 to 10 liters per day. These patients characteristically crave cold water and are often able to recall precise moments when the disease commenced. During a water deprivation test, patients with central diabetes insipidus have increasing serum osmolality, persistently undetectable ADH levels, persistently low urine osmolality in response to exogenous ADH. For patients who have a completely lack of ADH, replacing the hormone is usually necessary. An ADH analog, 1-desamino-8-D-arginine vasopressin (DDAVP), has an antidiuretic-pressor activity ratio of 2000: 1 and duration of action of 6 to 12 hours when administered intranasally or intravenously. It requires only daily or twice-daily administration and is the agent of choice for treating central diabetes insipidus. An oral form is also available.

References

center, D. h., n. d. Diabetes Health Center. [Online] Available at: http://diabetes. webmd. com/central-neurogenic-diabetes-insipidus-symptoms-causes-and-treatments [Accessed 02 Oct 2011].

Chauhan, B. S., 2008. Principles of Biochemistry and Biophysics. Firewall Media.

Cooperman, M., 2011. Diabetes Insipidus. [Online] Available at: http://emedicine. medscape. com/article/117648-overview [Accessed 02 Oct 2011].

David E. Metzler & Carol M. Metzler, 2003. Biochemistry: the chemical reactions of living cells. Academic Press.

Deber, M. C. & Benham, A. B., 1984. Role of membrane Lipids in peptide hormone function: binding of enkephalins to micelles. Biochemistry,

81(January), pp. 61-65.

Gabrielian ES, Badzhinian SA & Alaverdian KG., 1983. Interaction of enkephalin with lipid components of cell membranes. Biull Eksp Biol Med, 96(7), pp. 65-67.

health, N. I. o., n. d. Diabetes insipidus. [Online] Available at: http://www. nlm. nih. gov/medlineplus/ency/article/000377. htm [Accessed 02 Oct 2011].

Hughes, A. B., 2009. Amino Acids, Peptides and Proteins in Organic Chemistry: Modified amino acids, organocatalysis and enzymes. Wiley-VCH.

Kulkarni, M. V., 2008. Biochemistry. Pragati Books Pvt. Ltd.

Mary K. Campbell & Shawn O. Farrell, 2011. Biochemistry. Cengage Learning.

MedicineNet, 2011. Diabetes Insipidus. [Online] Available at: http://www. medicinenet. com/diabetes_insipidus/article. htm [Accessed 02 Oct 2011].

R. von Eggelkraut-Gottanka & A. G. Beck-Sickinger, 2004. Biosynthesis of peptide hormones derived from precursor sequences. Current medicinal chemistry, 11(20), pp. 2651-65.

Reginald Garrett & Charles M. Grisham, 2010. Biochemistry. Cengage Learning.

Richard A. Harvey & Denise R. Ferrier, 2010. Biochemistry. Lippincott Williams & Wilkins.

Siegenthaler, W., 2007. Differential diagnosis in internal medicine: from symptom to diagnosis. Thieme.