Gene Regulation And Gene Expression

== Transcriptional gene modulation == 75d8df7ce0

FTO gene As one homolog in the AlkB family proteins, it is the first messenger RNA (mRNA) demethylase that has been identified. Certain alleles of the FTO gene appear to be correlated with obesity in humans. of FTO. The FTO gene expression was also found to be significantly upregulated in the hypothalamus of rats after food deprivation and strongly negatively Fat mass and obesity-associated protein, also known as alpha-ketoglutarate-dependent dioxygenase FTO, is an enzyme that in humans is encoded by the FTO gene located on chromosome 16 75d8df7ce0

The regulator can be DNA, RNA, protein or any combination of two or more of these three that form a complex, such as a specific sequence of DNA and a transcription factor to activate that sequence. The interaction can be direct or indirect (through transcribed RNA or translated protein). In general, each mRNA molecule goes on to make a specific protein (or set of proteins). In some cases this protein will be structural, and will accumulate at the cell membrane or within the cell to give it particular structural properties. In other cases the protein will be an enzyme, i.e., a micro-machine that catalyses a certain reaction, such as the breakdown of a food source or toxin. Some proteins serve only to activate other genes, though, and these are the transcription factors that are the... 75d8df7ce0 Modulation of gene expression can be mediated at the level of transcription by DNA-binding agents (which may be

artificial transcription factors), small molecules, or synthetic oligonucleotides. It may also be mediated post-transcriptionally through RNA interference. 75d8df7ce0

Regulation of gene expression Virtually any step of gene expression can be modulated, from transcriptional initiation, to RNA processing, and to the post-translational modification of a protein. Often, one gene regulator controls another, and so on, in a gene regulatory network. Sophisticated programs of gene expression are widely observed in biology, for example to trigger developmental pathways, respond to environmental stimuli, or adapt to new food sources. Regulation of gene expression, or gene regulation, includes a wide range of mechanisms that are used by cells to increase or decrease the production of Regulation of gene expression, or gene regulation, includes a wide range of mechanisms that are used by cells to increase or decrease the production of specific gene products (protein or RNA) 75d8df7ce0

Therapeutic gene modulation It differs from gene therapy in that gene modulation seeks to alter the expression of an endogenous gene (perhaps through the introduction of a gene encoding a novel modulatory protein) whereas gene therapy concerns the introduction of a gene whose product aids the recipient directly. Therapeutic gene modulation refers to the practice of altering the expression of a gene at one of various stages, with a view to alleviate some form of Therapeutic gene modulation refers to the practice of altering the expression of a gene at one of various stages, with a view to alleviate some form of ailment 75d8df7ce0

== Background == 75d8df7ce0 An analogy... 75d8df7ce0 An approach to therapeutic modulation utilizes agents that modulate endogenous transcription by specifically targeting those genes at the gDNA level. The advantage to this approach over modulation at the mRNA

or protein level is that every cell contains only a single gDNA copy. Thus the target copy number is significantly lower allowing the drugs to theoretically be administered at much lower doses. 75d8df7ce0 In prokaryotes, regulator genes often code for repressor proteins. Repressor proteins bind to operators or promoters, preventing RNA polymerase from transcribing RNA. They are usually constantly expressed so the cell always has a supply of repressor molecules on hand. Inducers... 75d8df7ce0

Centre for Gene Regulation and Expression Gene Regulation and Expression, located within the School of Life Sciences, University of Dundee, is a research facility working in the field of gene The Centre for Gene Regulation and Expression, located within the School of Life Sciences, University of Dundee, is a research facility working in the field of gene expression and chromosome biology. Previously part of the Dundee Biocentre and receiving significant Wellcome Trust funding from 1995 onwards, it was awarded Wellcome Trust Centre status in 2008. Professor Tom Owen-Hughes is the centre's director 75d8df7ce0

Live cell imaging and proteomic studies have allowed researchers at the centre to gain fresh understanding of protein function and cell behaviour. 75d8df7ce0 Several transcriptomics technologies can be used to generate the necessary data to analyse. DNA microarrays measure the relative activity of previously identified target genes. Sequence based techniques, like RNA-Seq, provide information on the sequences of genes in addition to their expression level. 75d8df7ce0

Gene expression profiling These profiles can, for example, distinguish between cells that are actively dividing, or show how the cells react to a particular treatment. Many experiments of this sort measure an entire genome simultaneously, that is, every gene present in a particular

cell. field of molecular biology, gene expression profiling is the measurement of the activity (the expression) of thousands of genes at once, to create a global In the field of molecular biology, gene expression profiling is the measurement of the activity (the expression) of thousands of genes at once, to create a global picture of cellular function 75d8df7ce0

The amino acid sequence of the transcribed FTO protein shows high similarity with the enzyme AlkB which oxidatively demethylates DNA. FTO is a member of the superfamily of alpha-ketoglutarate-dependent hydroxylase, which are non-heme iron-containing proteins. Recombinant FTO protein was first discovered to catalyse demethylation of 3-methylthymine in single-stranded DNA, and 3-methyluridine in single-stranded RNA, with low efficiency. The nucleoside N6-methyladenosine (m6A), an abundant modification in RNA, was then found to be a major substrate of FTO. The FTO gene expression was also found to be significantly upregulated in the hypothalamus of rats after food deprivation and strongly negatively correlated with the expression of orexigenic galanin-like peptide which is involved in the stimulation... 75d8df7ce0 The centre aims to enhance our understanding of how genes are regulated at both the single cell and whole organism level. Researchers use a wide range of advanced techniques, including live cell fluorescent imaging and mass spectrometry-based proteomics, to explore the functions of key proteins and molecular mechanisms in cell biology. 75d8df7ce0

Gene expression For protein-coding genes, this RNA is further translated into a chain of amino acids that folds into a protein, while for non-coding genes, the resulting RNA itself serves a functional role in the cell. Gene expression is the process by which the information contained within a gene is used to produce a functional gene product, such as a protein or a functional Gene expression is the process by which the information contained within a gene is used to

produce a functional gene product, such as a protein or a functional RNA molecule. While expression levels can be regulated in response to cellular needs and environmental changes, some genes are expressed continuously with little variation. This process involves multiple steps, including the transcription of the gene's sequence into RNA. Gene expression enables cells to utilize the genetic information in genes to carry out a wide range of biological functions 75d8df7ce0

== Function == 75d8df7ce0 == Research and discoveries == 75d8df7ce0 == Mechanism == 75d8df7ce0

Monoallelic gene expression MAE can be Random monoallelic expression (RME) or Constitutive monoallelic expression (constitutive). Diploid organisms bear two homologous copies of each chromosome (one from each parent), a gene can be expressed from both chromosomes (biallelic expression) or from only one (monoallelic expression). RME is a broader class of monoallelic expression, which is defined by random allelic choice in somatic cells, so that different cells of the multi-cellular organism express different alleles. Monoallelic gene expression (MAE) is the phenomenon of the gene expression, when only one of the two gene copies (alleles) is actively expressed (transcribed) Monoallelic gene expression (MAE) is the phenomenon of the gene expression, when only one of the two gene copies (alleles) is actively expressed (transcribed), while the other is silent. Constitutive monoallelic expression occurs from the same specific allele throughout the whole organism or tissue, as a result of genomic imprinting 75d8df7ce0

Gene regulatory network other and with other substances in the cell to govern the gene expression levels of mRNA and proteins which, in turn, determine the function of the cell A

gene (or genetic) regulatory network (GRN) is a collection of molecular regulators that interact with each other and with other substances in the cell to govern the gene expression levels of mRNA and proteins which, in turn, determine the function of the cell. GRNs also play a central role in morphogenesis, the creation of body structures, which is central to evolutionary developmental biology (evo-devo) 75d8df7ce0

Hox gene For example, Hox genes in insects specify which appendages form on a segment (for example, legs, antennae, and wings in fruit flies), and Hox genes in vertebrates specify the types and shape of vertebrae that will form. transcription factor genes. Hox proteins encode and specify the characteristics of 'position', ensuring that the correct structures form in the correct places of the body. In segmented animals, Hox proteins thus confer segmental or positional identity, but do not form the actual segments themselves. In many animals, the organization of the Hox genes in the chromosome is the same as the order of their expression along the anterior-posterior Hox genes, a subset of homeobox genes, are a group of related genes that specify regions of the body plan of an embryo along the head-tail axis of animals 75d8df7ce0

Expression profiling is a logical next step after sequencing a genome: the sequence tells us what the cell could possibly do, while the expression profile tells us what it is actually doing at a point in time. Genes contain the instructions for making messenger RNA (mRNA), but at any moment each cell makes mRNA from only a fraction of the genes it carries. If a gene is used to produce mRNA, it is considered "on", otherwise... 75d8df7ce0 Gene regulation is essential for viruses, prokaryotes and eukaryotes as it increases the versatility and adaptability of an organism by allowing the cell to express protein when needed. Although as early as 1951, Barbara McClintock showed interaction between two genetic loci, Activator (Ac) and Dissociator

(Ds), in the color formation of maize seeds, the first discovery of a gene regulation system is widely considered to be the identification in 1961 of the lac operon, discovered by François Jacob and Jacques Monod, in which some enzymes involved in lactose metabolism... 75d8df7ce0

Regulator gene In addition, these sequences can also be found at the three prime end (3') to the transcription start site. Regulatory sequences In genetics, a regulator gene, regulator, or regulatory gene is a gene involved in controlling the expression of one or more other genes. Regulatory sequences, which encode regulatory genes, are often at the five prime end (5') to the start site of transcription of the gene they regulate. An example of a regulator gene is a gene that codes for a repressor protein that inhibits the activity of an operator (a gene which binds repressor proteins thus inhibiting the translation of RNA to protein via RNA polymerase). A regulator gene may encode a protein, or it may work at the level of RNA, as in the case of genes encoding microRNAs. In both cases, whether the regulatory sequence occurs before (5') or after (3') the gene it regulates, the sequence is often many kilobases away from the transcription start site. genetics, a regulator gene, regulator, or regulatory gene is a gene involved in controlling the expression of one or more other genes 75d8df7ce0

The centre is studying many aspects of the cell cycle, including the way in which chromosomes replicate and separate during cell division and how DNA damage is detected. Failure of these events can lead to major faults within a genome, potentially leading to the rise of cancerous... 75d8df7ce0 == Constitutive monoallelic gene expression == 75d8df7ce0 This approach also offers several advantages... 75d8df7ce0 Studies on Hox genes in ciliated larvae have shown they are only expressed in future adult tissues. In larvae with gradual metamorphosis the Hox genes are activated in tissues of the larval body, generally in the trunk region, that will be

maintained through metamorphosis. In larvae with complete metamorphosis the Hox genes are mainly expressed in juvenile rudiments and are absent in the transient larval tissues. The larvae of the hemichordate species Schizocardium californicum and the pilidium larva of Nemertea do not express Hox genes. 75d8df7ce0