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Transcriptomics: Open Access

Commentary

Gene Transcription by Gene Microarrays and RNA Sequencing in Proteomics

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DESCRIPTION

The process of producing an RNA copy of a gene's DNA sequence is known as transcription in the field of genomics. The DNA-encoded protein information for the gene is carried by this copy, known as messenger RNA (mRNA). Messenger RNA (mRNA) is used to synthesize the encoded protein in humans and other complex organisms. It transfers from the cell nucleus to the cytoplasm (watery interior) of the cell. In prokaryotes, transcription occurs in the cytoplasm, but in eukaryotes, it occurs in the nucleus. An RNA (mRNA) molecule is generated using DNA as a template. A messenger RNA (mRNA) strand that is complementary to a DNA strand is produced during transcription.

The template for transcription is one of the two exposed DNA strands; the term "template strand" refers to this strand. The RNA product complementary to the template strands and is nearly identical to the nontemplate (or coding) strand, the other DNA strand. There is a significant distinction of the T nucleotides in the newly produced RNA are replaced by U nucleotides. The +1 site or initiation site is the location on the DNA from which the first RNA nucleotide is transcribed. Negative numbers denote the nucleotides that are upstream of the initiation site. Positive numbers denote the nucleotides that follow the initiation site and are referred to as being downstream. In the process known as translation, the RNA molecule will be read to produce a protein if the transcribed gene, as is the case with many genes, encodes a protein.

Transcription initiation

RNA polymerase binds to the DNA of a gene in a region known as the promoter to initiate transcription. The promoter basically tells the polymerase where to start transcribing on the DNA. The promoter is unique to each gene in bacteria, to each group of genes transcribed together. DNA sequences in a promoter enable RNA polymerase or its support proteins to attach to the DNA. The polymerase can begin transcription as soon as the transcription bubble has formed.

Elongation

The elongation phase of transcription can begin once RNA polymerase is present at the promoter. In essence, elongation is the stage in which the addition of new nucleotides makes the RNA strand longer. RNA polymerase "walks" along a single strand of DNA known as the template strand in the 3' to 5' direction during elongation. RNA polymerase adds a complementary (matching) RNA nucleotide to the 3' end of the RNA strand for each nucleotide in the template.

Transcription termination

RNA polymerase will continue to transcribing until it gets signs to stop. When the polymerase transcribes a DNA sequence known as a terminator, the process of terminating transcription is called termination.

High-throughput sequencing technologies are used to directly sequence transcripts in RNA-Seq. For whole-genome transcriptome profiling, it has demonstrated strong potential to replace microarrays. New transcripts, allele-specific expression and splice junctions by using RNA-Sequence to examine the fine structure of the transcriptome. Prior probe selection in RNA-Sequence is independent of genome annotation, avoiding the associated biases that are introduced during microarray hybridization. A method for determining whether a person's DNA contains mutations in genes like *BRCA1* and *BRCA2* is the DNA microarray. A plastic-encased, small glass plate makes up the chip. A few organizations produce microarrays utilizing techniques like those used to make computer microchips.

Chromosome microarray and whole-exome sequencing are two recent prenatal genetic technologies. The human genome's gains and losses of DNA can be measured using chromosomal microarray analysis.

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