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**How Genes Work**

**Research Essay**

**1. Introduction**

Protein biosynthesis, which takes place under genetic control, is only the beginning of complex, multi-stage biochemical processes of the cell. When studying vegetative propagating plants, evidence was obtained that individual parts of the body, such as a tuber, leaf, bulb, cuttings and so on, give rise to a normal plant. And this means that all the cells of this organism carry complete genetic information, as well as the original fertilized egg from which the animal develops. At the same time, any organism contains differentiated cells with a specific form and function. For example, a person has nerve, muscle, sex cells, etc. But, despite the fact that each cell of our body carries complete genetic information, that is, a complete set of genes received from parents, only certain genes function, the rest are in an inactive state (Kaiser *et al.,* 2007).

2.  **Mechanism**

Indeed, a similar regulatory mechanism was discovered in bacterial cells in 1961 by French scientists Francois Jacob and Jacques Mono. F. Jacob and J. Mono proved that not all bacterial genes are identical in purpose.

* One group is structural genes that provide information on the synthesis of certain polypeptide chains, and the other is regulatory genes that control the activity of structural genes by turning them on and off.
* Regulatory genes are represented by an operator gene directly linked to a group of structural genes and a regulatory gene, which may be located at some distance from them.
* An operator gene with a group of structural genes regulated by it was called an operon. The operon serves as a unit of transcription, that is, one molecule of i-RNA is written off from it.

·         The regulator gene does not act by direct contact with structural genes, but by means of a repressor protein. In the presence of sufficiently accumulated molecules of the synthesized substance, the protein repressor, combining with these molecules, activates and binds to the operator gene (Stotz et al., 2004). As a result, the synthesis of this substance stops. The repressor protein got its name due to the fact that it suppresses the activity of the operator gene, that is, puts it in the “off” position.  With a small number of synthesized molecules, the protein repressor remains inactive. Under such conditions, the action of the operon — the operator gene and structural genes — is not suppressed, and the synthesis will continue unhindered.

3.  **Body**

To each of our cells contains about 30,000 different genes, while certain bacteria enough only 500 genes. The genes contain codes according to which proteins are synthesized and the order of amino acids in them is determined. No matter where in the human body the cells are, they always contain the same set of genes. However, depending on the type of cells — skin cells, nerve cells or muscle cells — different genes are involved in them for the synthesis of new proteins. The long chains of DNA in the chromosomes of a cell are tightly compressed. The compact arrangement of DNA in the chromosomes is due to special proteins around which DNA strands are wound. But in the cell, there are proteins that, in order to facilitate the synthesis of new proteins according to the code contained in the DNA, transfer DNA from a compact form to an unfolded one if necessary. Under the influence of these proteins, chromosome cells preparing for division unfold and from that moment occupy 10 thousand times more space (Warnecke, F., Amann, R., & Pernthaler, J. (2004).

A gene is actively involved in the synthesis of new proteins when it transfers its RNA code using a special protein mechanism that copies the genetic code of DNA, which is a nucleotide sequence. The process of reading genetic information, called "transcription," begins with the discovery and deployment of a small part of the double helix of DNA at the end of the chromosome. The genetic codes of this chromosome region are then copied onto the RNA molecule growing as the copy process progresses; while the protein copying mechanism moves along the DNA strand. The process of transferring the genetic code ends when the so-called terminal group of amino acids is synthesized at the end of the RNA - its presence signals the end of the protein chain of this code. Many may think that after this, RNA is ready for the synthesis of the desired protein based on its matrix. However, like everything else in cells, things are not so simple (Chappell, J., Watters, K. E., Takahashi, M. K., & Lucks, J. B. 2015).

**Conclusion**

The key to understanding how living systems function is proteins and genes just provide the information by which proteins are synthesized. Knowing the structure of the human genome will tell you which proteins will be synthesized in cells, but this will not allow us to get an easy answer to the question of when and where such proteins will be synthesized in the body of a growing embryo. After all, tens of thousands of proteins constantly and continuously interact with each other inside the cell, but at the same time, the genome alone cannot determine the nature or sequence of these interactions.

**References**

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