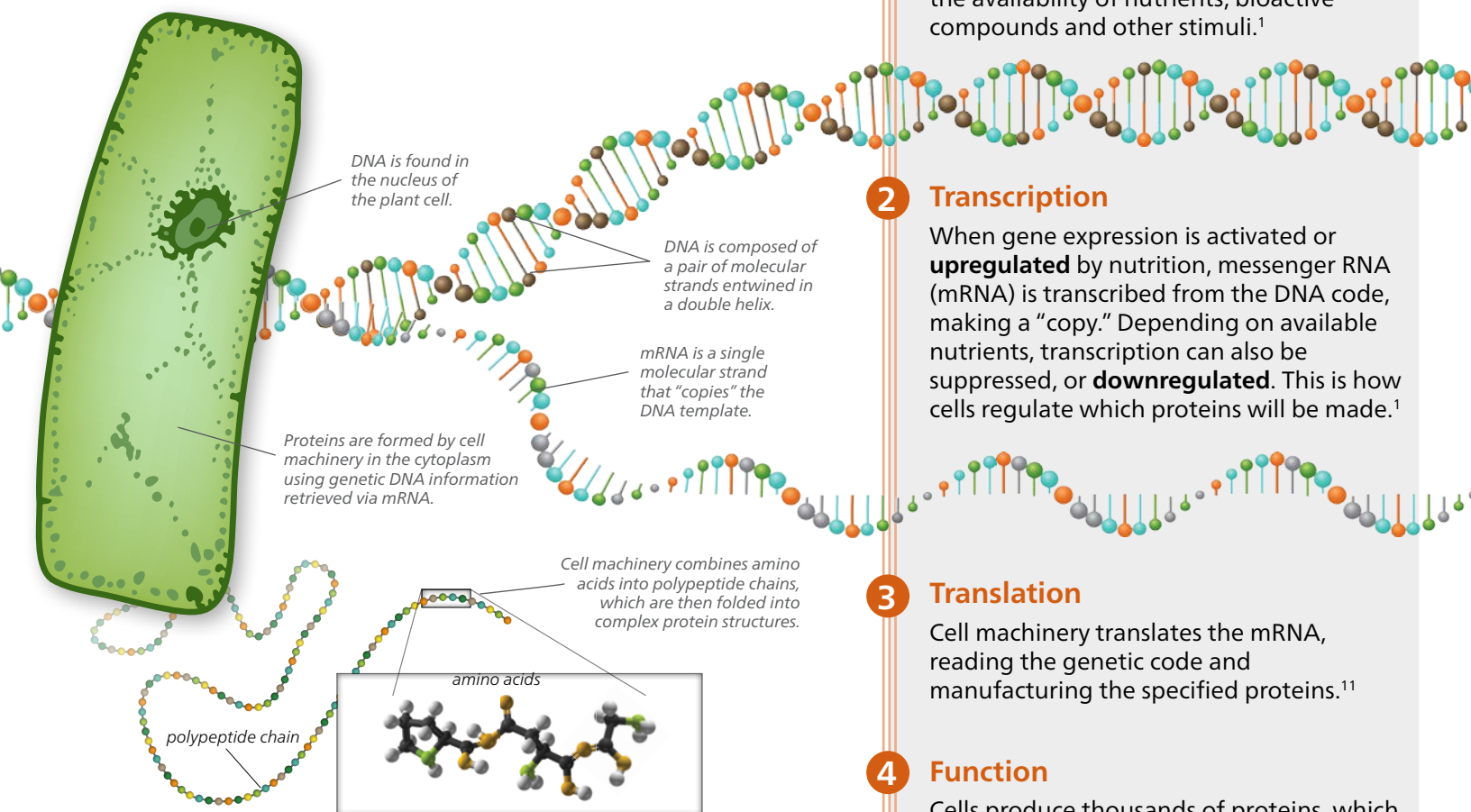


YOU ARE WHAT YOU EAT: THE SCIENCE BEHIND NUTRIGENOMICS

The basic unit of every living organism is the cell. At the center of each cell is the nucleus, containing the genetic material known as DNA (deoxyribonucleic acid), the blueprint for all components necessary to build and maintain cells. DNA is made up of genes, which allow for the production of specific proteins that carry out the biological work of the cell.¹¹

A cell contains the genes for thousands of proteins. Cells of similar structure and function are organized into tissues (vascular, epidermal, ground and meristematic) that form roots, stems, leaves, flowers, seeds and fruits. Each part of a plant performs a specific function, allowing it to live and grow. Because cells are constantly growing, dying and being replaced, new proteins must be generated continuously.



Steps in Gene Expression

1 DNA

Each gene within a cell carries the code for a specific protein. Although all cells contain the complete genetic code, only a fraction of the genes are “switched on” or expressed, depending on cell type and the availability of nutrients, bioactive compounds and other stimuli.¹

2 Transcription

When gene expression is activated or **upregulated** by nutrition, messenger RNA (mRNA) is transcribed from the DNA code, making a “copy.” Depending on available nutrients, transcription can also be suppressed, or **downregulated**. This is how cells regulate which proteins will be made.¹

3 Translation

Cell machinery translates the mRNA, reading the genetic code and manufacturing the specified proteins.¹¹

4 Function

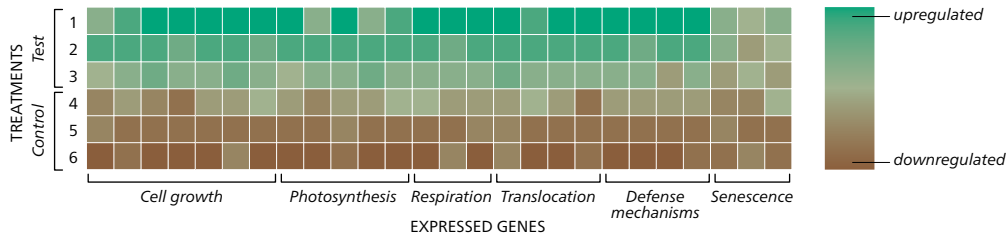
Cells produce thousands of proteins, which act and interact in specific ways as part of larger biological functions (growth, reproduction, photosynthesis and so on). Regulating gene expression influences these biological functions.¹

“Look deep, deep into nature, and then you will understand everything better.”

—Albert Einstein

Nutrigenomics is the study of how nutrition affects gene expression.³

Visualization of gene expression in plant cells by nutritive treatment



Over the past two decades, important advancements have been made in the fields of molecular biology and genetic research, beginning with the Human Genome Project.⁸

Completed in 2003, this international project mapped all 20,000-25,000 protein-coding genes in human DNA. Similar initiatives have led to the sequencing of genomes in species ranging from microbes to mice, cows, chickens and many plants.^{1,2}

How is this science applied?

An analytical tool called the microarray or gene chip lets researchers compare the effects of diet on gene expression.⁶

Knowing which genes are being upregulated or downregulated offers a window into understanding changes in growth and performance.⁴ Sophisticated analysis of this information provides important clues about how to optimize plant function and health.

Is nutrigenomics like genetic modification?

No. Genetic modification involves the *alteration* of an organism's genetic code. Nutrigenomics studies how the existing genes can be influenced through nutrition, bioactive compounds and other stimuli.⁴

While custom arrays can be created, plant genomes currently available commercially include:²

- Arabidopsis
- Barley
- Citrus
- Cotton
- Corn
- Grape
- Medicago
- Rice
- Soybean
- Sugarcane
- Tomato
- Wheat

"Today's science is tomorrow's technology."
—Edward Teller

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Alltech is a **global leader in biotechnology** whose mission is to improve the **health and performance of people, animals, and plants** through natural nutrition and scientific innovation.



Alltech is an industry leader in animal and plant nutrigenomic research and applies this science to understand how nutrients and novel bioactive compounds influence gene expression. Understanding the effects these nutrients have at the genetic level allows Alltech to design and formulate solutions that optimize plant health and performance.

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