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The Cell Part 1: In the Beginning...

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The Basic Unit of Life

The cell is the basic structural and functional unit of all known living things. It is the building block of more complex organisms. Some living things such as bacteria have only one cell while others have many cells.

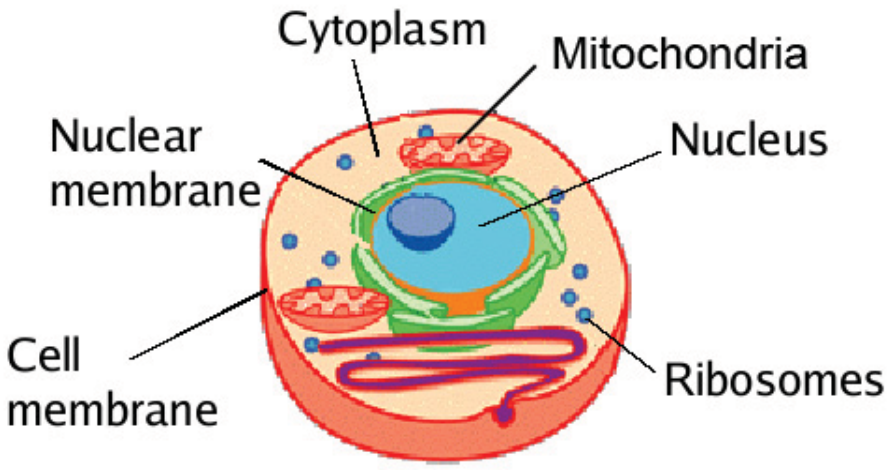
The human body consists of approximately 100 trillion cells. It is only possible to evaluate the nutritional requirements of the body as a whole in the light of the needs of the individual cells. Dr. Douglas Brodie summarized the issue concisely in his book on cancer. He wrote, "*The health of every cell in the body is the key to the health of the body itself.*"

Dr. Roger Williams pioneered the idea that health or disease is determined not only by genetics but also by the quality of one's nutritional intake. He coined the term "genetotropic" to convey this concept. This is a combination of the word for genes (geneto) and the Greek word for feeding (tropic).

> ***"The health of every cell in the body is the key to the health of the body itself."***
>
> ***—Douglas Brodie, M.D.***

Dr. Williams felt strongly that understanding the requirements of the cells was the key which unlocked the puzzle of the nutritional requirements of living things. He wrote, "So far as I know, I am the only scientist of my own generation who was initiated into research by studying the nutrition of single-celled organisms. No doubt this predisposes me to think in terms of cellular nutrition and to apply the genetotropic concept upwards, through groups of cells and multicelled organisms, all the way to that complex congeries (or collection) of cells we call man."

He then continues, "But predispositions apart, at every stage I have found this concept to be wholly applicable and verified by laboratory experiment. That malnutrition—unbalanced or inadequate nutrition—at the cellular level should be thought of as a major cause of human disease seems crystal clear to me. It is the inevitable conclusion to be drawn from the facts produced by decades of biochemical research."



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Complexity of the Cell

We think of the cell as simple, but in reality the cell is quite complex. Denton writes, "To grasp the reality of life as it has been revealed by molecular biology, we must magnify a cell a thousand million times until it is twenty kilometers in diameter and resembles a giant airship large enough to cover a great city like London or New York. What we would then see would be an object of unparalleled complexity and adaptive design. On the surface of the cell we would see millions of openings, like the port holes of a vast space ship, opening and closing to allow a continual stream of materials to flow in and out. If we were to enter one of these openings we would

find ourselves in a world of supreme technology and bewildering complexity. We would see endless highly organized corridors and conduits branching in every direction away from the perimeter of the cell, some leading to the central memory bank in the nucleus and others to assembly plants and processing units."

While the structure of the cell is complex, the nutritional requirements of the cell are rather simple. All this complexity is supported and sustained by a relatively simple collection of essential nutrients.

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Denton, Michael, *Evolution: A Theory In Crisis*, Bethesda, MD.: Adler and Adler, 328-329.

Nutrient Categories

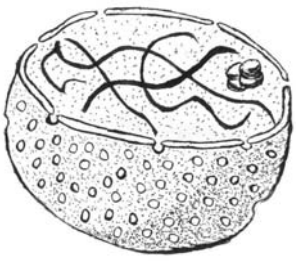
Denton likens the cell to a city. Let us use this analogy to consider the different functions nutrients can perform.

Building Materials

No city is built without *building materials*. A modern city requires lumber, steel, glass and a myriad of other structural materials. The cell has a similar requirement for structural materials. The two primary building materials of the cell are amino acids, the building blocks of protein, and lipids and sterols, the building blocks of fatty acids. Some minerals play a structural role. For example, calcium is important for the strength of the bones and teeth.

Protection

A city also needs *protection* once it is constructed. A city can face a wide variety of internal and external threats. Internal threats would include riots, pollution, fire, decay, and accumulation of wastes. External threats to the city would include war, earthquake, and weather events like floods and hurricanes.



The cell faces similar challenges. Internal stresses would include oxidative damage and inflammation. External threats would be physical trauma and injury and invasion by bacteria, viruses, and fungi.

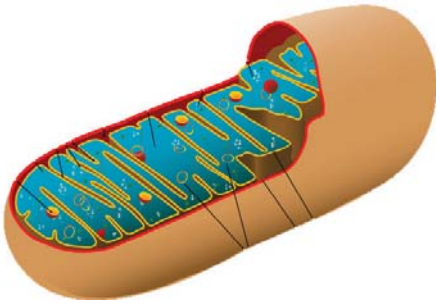
A city protects itself with a police force, a fire department, and maintenance crews. The cell protects itself with antioxidant nutrients such as carotenoids and polyphenols as well as maintenance and repair mechanisms which are nutrient dependent.

The throbbing life of a city requires not only the structural materials to build the city, but also energy to power the city and protective activity such as police and fire departments. In the same manner, a city requires nutrients to construct healthy tissues, energy to fuel life activities, and antioxidants to protect essential structures within the cell.

Energy

A city also requires a *power supply or energy* in order to function and become alive. Power failure can cripple a modern city. Power failure in a city can block communication, transportation, and maintenance activities. One of the most important characteristics of a power supply is that it be continuously available. When power supply is lost, even temporarily, everything comes to a halt. Severe damage can result.

A cell also requires a consistent power supply. This is the primary role many vitamins and minerals play in the maintenance of health. They provide the keys to unlock the energy from the fats, proteins and carbohydrates we consume.



Schutte wrote, "Nutrients have a number of functions to carry out. One of the most obvious is to supply energy to the living organism. All forms of life need a constant supply of energy to stay alive, because life is always active....The amount of energy that all living matter requires is large. Even plants, which are normally regarded as being inactive when compared to animals, utilize a great deal in growth. One has only got to see grass splitting a pavement, or a poplar tree cracking a wall, to realize how much energy is involved."

REFERENCES:

Schutte, Karl H., and Myers, John A., *Metabolic Aspects of Health*, Kentfield, CA: Discovery Press, 1979, 1-2.

Primary Structures

The cell has three primary structures and a number of secondary structures. Each of the primary structures is surrounded by a protective wall or membrane which also plays a central role in the proper functioning of the structure.

Nucleus

The first primary structure of the cell is the *nucleus*. The nucleus is the storage facility for the genetic information or DNA of the cell. The nucleus has been referred to as the gonad or reproductive machinery of the cell. The nucleus of the cell requires protein and defects in protein intake can seriously harm the functioning and repair activities of the DNA. Cooking can alter the structure of proteins limiting their quality as structural materi-

als. Digestive difficulties can readily hinder protein breakdown and utilization leading to a shortage of proper building materials.

Mitochondrion

The second primary structure of the cell is the *mitochondrion*. The mitochondria are the "power stations" of the cell. It is in the mitochondria that food is converted to energy for use by the cell. Power generation entails production of large quantities of free radicals. Antioxidant deficiencies can seriously hamper the cell's power production and lead to damage of the "power stations." B complex vitamins and magnesium play a key role in the energy production process and deficiencies can restrain or hinder cellular power output.

Cell Wall

The third primary structure of the cell is the outer *bounding membrane or cell wall*. This has been likened to the brain of the cell. Many cell structures contain membranes, but the outer bounding membrane of the cell protects the entirety of the cell. It must also allow nutrients into the cell and allow for the elimination of waste products. The cell membrane also controls the fluid balance of the cell.

Cell membranes are composed primarily of lipids and sterols which are dotted with protein structures. Intake of undesirable fats will alter both the structure and functioning of cell membranes contributing to a wide variety of disfunctions and degenerative conditions. Unfortunately deficiency of lipids from grains, legumes and fish is common due to poor food choices and an economy based upon foods with a long shelf life. Quality fats are readily destroyed when exposed to oxygen.

A cell has three primary structures. The nucleus contains the reproductive machinery of the cell. The mitochondria house the energy producing equipment. The cell wall or bounding membrane is the brain of the cell. It surrounds and protects the entirety of the cell and determines how the cell relates to its environment. The cell membrane allows the passage of nutrients into the cell and the removal of wastes from the cell's interior.

General Nutrition

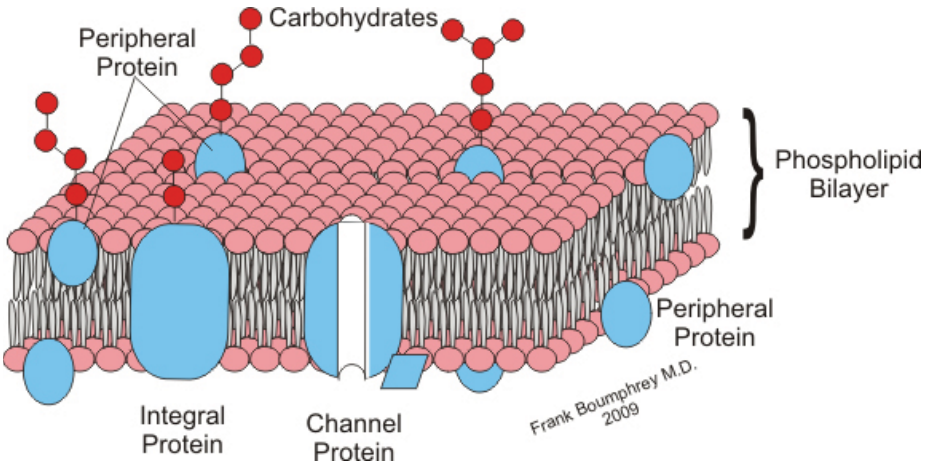
Cells require food or nutrition. One scientist writes, "The fact that food is necessary for life and that the nature of the food that an animal or human consumes is reflected in his behavior and degree of well-being is well known."

Important factors to consider in nutritional provision include consistency of provision, the full spectrum of nutrient intake, and density of nutrient provision. A balanced intake of nutrients can also be crucial.

The truth is that "*All living organisms* require a regular supply of nutrients. This is as true for microbes as it is for man. If there is a deficiency, or an excess, in fact if there is an imbalance of nutrients, then normal development will cease, and abnormal development will result. If the imbalance is severe death will eventually result."

The requirement for completeness of nutrition at the cellular level is best grasped with the aid of Roger Williams conception of the "chain of life." Williams wrote, "The chain representation is used to emphasize the fact that all links are needed; if even one link is missing or weak, the whole chain is weak and the favorable environment disappears."

Dr. Roger Williams wrote, "Nature is also on our side in that healthy cells and tissues have ways of crying out for what they need..." Individual cells directly seek specific nutrients they need. Multicellular organisms have special regulatory cells that drive us to eat when we need specific nutrients and appear to drive us to specific foods which contain these nutrients unless the apparatus is malfunctioning due to poor food choices or inadequate nutrition which does not allow optimal functioning. Sugar intake can disturb the internal program of cells to seek out optimal nutritional intake.



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Williams, Roger, *Nutrition Against Disease*, New York: Pitman Publishing Corporation, 1971, 46-48.

Individuality

Both single cell and multicellular organisms possess individual and unique nutritional requirements. Requirements vary not only between

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different organisms, but also between organisms of the same type.

One reason for nutritional variability is nutritional history. Lack of adequate nutrient intake may not manifest itself for two or three generations. Schutte wrote, "It is quite impossible to deplete the stock of nutrients completely in living matter, and it may require growing the material for two or three generations on really deficient substrates before really acute deficiency symptoms set in. This is true for animals as for plants and it took Hill and his co-workers three generations to deplete the manganese reserves of rats on a deficient diet so that the animals showed clear symptoms of manganese deficiency."

This creates a practical problem. How can one assess whether nutritional requirements are being met or not if obvious deficiency symptoms may not even appear until a subsequent generation is born? It may not be possible to easily assess how well the nutritional requirements of the cells of a life form are being met by examination of a single generation. Invisible and undetectable impairments precede obvious damage resulting from nutritional inadequacy.

The work of Francis M. Pottenger, Jr. demonstrated that simply cooking the food of cats impaired the adequacy of nutrient supply sufficiently to result in widespread symptoms of deficiency *in the second and third generations*.

Cellular health can not be maintained without a consistent supply of the building materials, energy supplying nutrients, and protective factors which are called the "chain of life."

Human observers have noted a decline in the vitality and stamina of the human population since the introduction of processed foods which have depleted the supply of amino acids, essential fats, vitamins and minerals from staple foodstuffs. The average individual today would find it impossible to do the physical labor required of our ancestors as they cleared forests, built dams, and constructed railroads across a new continent.

Modern man is plagued by malnutrition which afflicts a significant proportion of most modern populations with visible and invisible damage.

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Schutte, Karl H., and Myers, John A., *Metabolic Aspects of Health*, Kentfield, CA: Discovery Press, 1979, 10.

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