

Cellular Metabolism

Nutritional supplements given regularly or for recovery can help repair cells and maintain cellular integrity.

By Tom Cameron, DVM
For Veterinary Practice News

The study of veterinary nutrition has traditionally concentrated on macro-nutrients (proteins, fats, carbohydrates, vitamins and minerals) and the determination of the minimum requirements of these individual nutrients to prevent overt disease.

New areas of study looking at the broad-reaching effects of foods, such as nutrigenomics, metabolomics, nutrigenetics, etc., have shown that overall health can be positively influenced by “optimizing nutrient levels to the life stage, lifestyle and breed of the individual animal.”¹ A wide range of food-based nutritional supplements has appeared in the veterinary market in response to this trend.

Every cell in the body performs one or more functions. Some cells secrete hormones, some clear antigens from the circulation and others produce enzymes for use in metabolic reactions. These cellular activities are for the most part continuous, taking place around the clock, and vary in response to the body’s metabolic needs.

Each function a cell performs involves a number of steps. These can include:

- * Taking in nutrients through the cell membrane.
- * Transporting these nutrients to different sites within the cell.
- * Using nutrients to produce a product (hormone, enzyme, protein, etc.).
- * Delivering products to sites within or outside of the cell.
- * Participating in inter- and intra-cellular signaling.
- * Clearing waste products from the cell.

All these steps require energy. For a cell to continue this flow of activity, it must have a steady supply of fuel and other materials needed to perform its specific functions. In other words, each cell requires a certain quantity and quality of nutrition to perform optimally. If the flow of nutrients to a cell is restricted in any way, some or all of that cell’s ability to perform will be affected. A compromised cell:

- * Cannot respond to the body’s needs.
- * Cannot protect itself.
- * Can negatively affect other cells around it.
- * Can experience buildup of waste products, heavy metals and toxins.
- * May be at increased risk of attack by viruses, bacteria and parasites.

When enough cells are compromised, the body develops symptoms such as lethargy, fever, nausea and diarrhea. As clinicians, our typical approach is to prescribe the appropriate pharmaceutical. This is an obvious choice, as we must address clinical symptoms and patient comfort. But drugs address symptoms, not cell function. Nutrition supplies the energy and building blocks for repair, regeneration, healing and return to function.

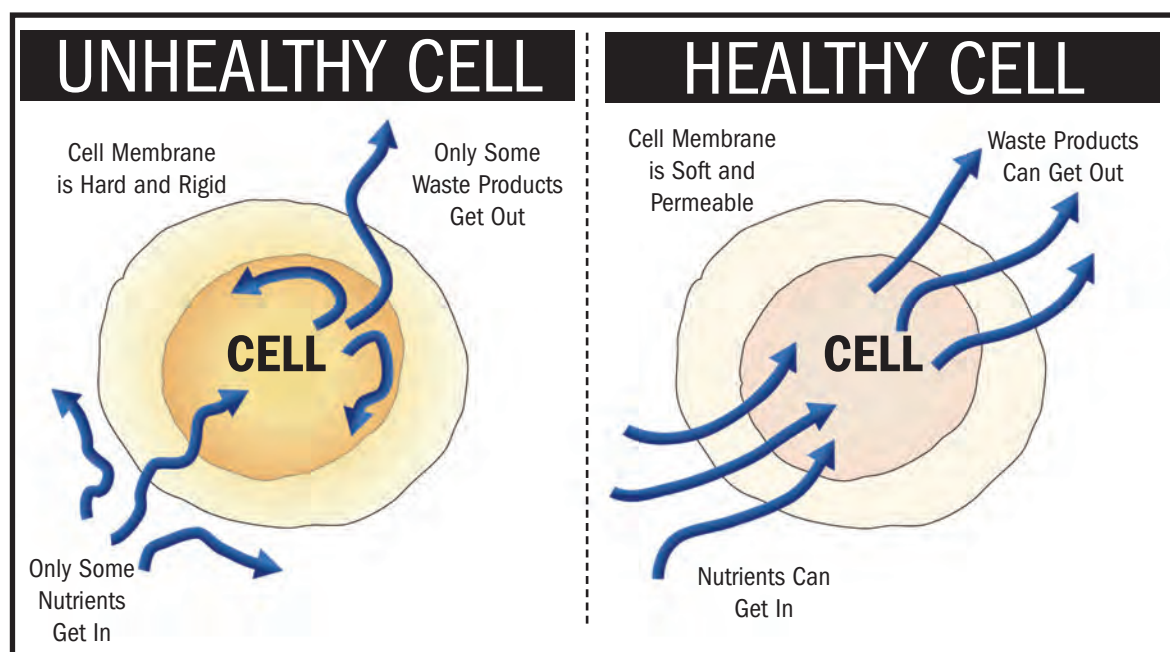
Without proper nutritional support, healing can be delayed or incomplete. Thus, every case has a nutritional component.

Like a house that has been damaged by a tornado, a damaged cell needs the resources to:

- * Remove damaged materials.
- * Repair structural damage.
- * Utilize greater amounts of high-quality fuel for both repair and maintenance.

Physical or chemical stress causes upregulation of metabolic pathways necessary for repair and cleanup, and downregulation of less critical metabolic pathways (e.g., housekeeping activities). Damaged cells require increased metabolic activity to remove debris and to rebuild cell structures. Upregulation of metabolic pathways leads to an increased uptake of nutrients when repairs are needed.

One way to provide the materials needed for cell recovery is using nutritional supplements. As the name implies, nutritional supplements are “supplemental” to the diet, providing nutrient levels over and above those needed for



daily maintenance. Nutritional supplements can be given during the recovery period to support adequate rebuilding, or they can be given on a regular basis, based on individual need.

Nutritional supplements can include:

- * Functional foods—foods that have been shown to have specific health benefits (e.g. milk thistle as a hepatoprotective, promoting liver cell regeneration).
- * Veterinary nutraceuticals—“a non-drug substance that is produced in purified or extracted form and administered orally to patients to provide agents required for normal body structure and function, and administered with the intent of improving the health and well being of animals.”^{2,3}
- * Synthetic compounds—ascorbic acid, alpha tocopherol, beta-carotene.
- * Herbs.
- * Phytonutrients.
- * Trace minerals.

The current trend in nutritional supplementation places a greater emphasis on ingredients from whole foods. While a detailed discussion on this topic is beyond the scope of this article, two main points address this trend:

* There is a growing focus on the fact that food (in its original state, as it grew on the vine or on the hoof) is much more complex than a simple mixture of proteins, fats, carbohydrates, vitamins and minerals. Food consists of a complex, interactive group of ingredients which include vitamins, enzymes, hormones, trace minerals, coenzymes, sterols, nucleotides, phytochemicals, and other currently unidentified micronutrients. This complex grouping of nutrients (known as the “food matrix”) provides a synergistic effect that exceeds that of any individual ingredient.

* Recent clinical trials of dietary supplements, focused on single macronutrients, have failed to show a reduced risk for chronic disease, and in some cases, have shown increased risk.

With this in mind, more supplement content is shifting toward ingredients comprising foods, rather than their separate components. Within the scientific community there is interest in shifting the research focus from single nutrients to whole foods to better understand the relationship between nutrition and health. ●

FOOTNOTES...

- 1 Kirk CA, Bartges JW. *Veterinary Clinics of North America* 36 (2006), xi-xiii.
- 2 Boothe DM. 1997. Nutraceuticals in Veterinary Medicine. Part I. Definitions and Regulations. *Comp Cont Ed Pract Vet* 19:1248-1255.
- 3 Dzanis DA. Nutraceuticals in Veterinary Medicine. *Aus Vet J.* 1999;77(4):238-239.

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