

## References

1. Enzyme. In: Thomas C, ed. *Taber's® Cyclopedic Medical Dictionary*. 14th ed. Philadelphia, PA: F.A. Davis; 1982: 484-6.
2. Lee L., Turner L, Goldberg B. Enzymes. In: *The Enzyme Cure*. Tiburon, CA: Future Medicine Publishing, Inc.;1998: 19.
3. Food Allergies. In: Murray MT, Pizzorno JE, eds. *Textbook of Natural Medicine*, Vol 1. 2nd ed. Edinburgh; New York: Churchill Livingstone; 1999: 454.
4. Porth C. Digestion and Absorption. In: *Pathophysiology: Concepts of Altered Health States*. 5th ed. New York, NY:Lippincott;1998: 715-718.
5. Sanders M. Probiotics. *Food Technology*. 1999; 11:67-77.
6. Famularo C, Moretti S, Marcellini, De Simone C. Stimulation of immunity by probiotics. In: Fuller, R ed. *Probiotics 2 Applications and Practical Aspects*. London, England: Chapman & Hall; 1997:133-161.
7. Hilton E, Isenberg HD, Alperstein P, France K, Borenstein MT. Ingestion of yogurt containing *Lactobacillus acidophilus* as prophylaxis for candidal vaginitis. *Ann Intern Med*. 1992;116:353-357.
8. Lidbeck A, Nord CE, Gustafsson JA, Rafter J. Lactobacilli, anticarcinogenic activities and human intestinal microflora. *Eur J Cancer Prev*. 1992;1:341-53. Abstract.
9. Macfarlane GT, Cummings JH. Probiotics and prebiotics: can regulating the activities of intestinal bacteria benefit health? *BMJ*.1999;318:999-1003.
10. Fuller R. Introduction. In: Fuller, R ed. *Probiotics 2 Applications and Practical Aspects*. London, England: Chapman & Hall; 1997:1-9.
11. Lactose. *On-line medical dictionary*. Available at: <http://www.graylab.ac.uk/cgi-bin/omd?query=lactose&action=Search+OMD>. Accessed February 9, 2000.
12. Tortora GJ, Grabowski SR. The digestive system. In: *Principles of Anatomy and Physiology*. 8th ed. Menlo Park, Calif: HarperCollins College Publishers;1996: 752-805.
13. Marteau P, Vesa T, Rambaud JC. Lactose maldigestion. In: Fuller, R ed. *Probiotics 2 Applications and Practical Aspects*. London, England: Chapman & Hall; 1997:65-88.
14. Vernia P, Di Camillo M, Marinaro V. Lactose malabsorption, irritable bowel syndrome and self-reported milk intolerance. *Dig Liver Dis*. 2001;33:234-239.
15. Gismondo MR, Drago L, Lombardi A. Review of probiotics available to modify gastrointestinal flora. *Int J Antimicrob Agents*. 1999;12:287-292
16. Garman J, Coolbear T, Smart J. The effect of cations on the hydrolysis of lactose and the transferase reactions catalysed by beta-galactosidase from six strains of lactic acid bacteria. *Appl Microbiol Biotechnol*. 1996;46:22-27.

## Resources

Martini MC, Lerebours EC, Lin WJ, et al. Strains and species of lactic acid bacteria in fermented milks (yogurts): effect on in vivo lactose digestion. *Am J Clin Nutr*. 1991;54:1041-1046.

Jiang T, Mustapha A, Savaiano DA. Improvement of lactose digestion in humans by ingestion of unfermented milk containing *Bifidobacterium longum*. *J Dairy Sci*. 1996;79:750-757.

Macfarlane GT, Cummings JH. Probiotics and prebiotics: can regulating the activities of intestinal bacteria benefit health? *BMJ*. 1999;318:999-1003.

Gismondo MR, Drago L, Lombardi A. Review of probiotics available to modify gastrointestinal flora. *Int J Antimicrob Agents*. 1999;12:287-292.

Your Digestive System. Mayo Clinic Website. Available at: [www.mayohealth.org](http://www.mayohealth.org). Accessed on September 28, 2001.

Porth C. Digestion and Absorption. In: *Pathophysiology: Concepts of Altered Health States*. 5th ed. New York, NY:Lippincott;1998: 766-769.

ASK THE  
DOCTOR  
Answers to Your Health Questions

# ASK THE DOCTOR

Answers to Your Health Questions

Gaetano A. Morello, BSc., N.D.



Dr. Gaetano Morello is a naturopathic physician practicing in West Vancouver, Canada. He received his Bachelor of Science degree from the University of British Columbia and his Doctor of Naturopathic Medicine from Bastyr University of Natural Health Sciences in Seattle, Washington.

For the past 15 years, Dr. Morello has been training and educating physicians, pharmacists and health experts on the scientific use of natural medicines in the fields of cardiology, immunology, gastroenterology, anti-aging and detoxification. Contributing author to the authoritative text on Alternative Medicine, A Textbook of Natural Medicine, he is also author of The Fiber Miracle. Lecturer and regular contributor to a number of magazines, journals and publications, Dr. Morello has hosted and appeared on numerous television and radio shows discussing the power of natural medicine.

*Ask the Doctor*® is published by  
Enzymatic Therapy, Inc.,  
825 Challenger Drive,  
Green Bay, Wisconsin, 54311-8328,  
[enzy.com](http://enzy.com), 800.225.9245

Dr. Gaetano Morello is affiliated with  
Enzymatic Therapy, Inc.

*Ask the Doctor* publications are  
available on the Internet at:  
[www.ATDonline.org](http://www.ATDonline.org)

## Digestive Health

### Enzymes and Probiotics are Keys to Healthy Digestion

The gastrointestinal system is a complex network of organs and glands that helps us break down and absorb nutrients. The food we consume is processed by the gastrointestinal system in six phases:

- I. Mental Preparation: prepares the stomach for the food being consumed.
- II. Ingestion: the actual consumption of food (eating).
- III. Peristalsis: the movement of food through the gastrointestinal (GI) tract.
- IV. Digestion: the breakdown of food by both mechanical and chemical processes.
- V. Absorption: the passage of digested food from the digestive tract into the vascular and lymphatic systems for distribution to the cells.
- VI. Elimination: the elimination of indigestible substances and waste products from the body.

Digestion itself is divided into two categories: mechanical and chemical. Mechanical digestion refers to the physical movement that aids chemical digestion. After the initial breakdown by chewing, food is churned by the smooth muscles of the stomach and the small intestine. This step also introduces enzymes and the start of chemical digestion.

Chemical digestion is a series of complex chemical reactions that break down large carbohydrate, lipid, and protein molecules into molecules small enough to enter the blood vessels. Chemical digestion occurs through the action of several different enzymes, such as amylases, proteases, and lipases.

For optimal digestion to occur, all these processes must work together in a synchronized fashion. If any part of this complex system is out of balance, physiological problems result that may eventually lead to an array of chronic conditions.

**Q. How important are enzymes to digestion?**

A. Without enzymes, digestion could not take place and the food we eat could not be absorbed and utilized by our bodies. Enzymes are complex proteins produced by living cells and they start chemical reactions in the body.<sup>1</sup> Enzymes are present in the digestive juices. The pancreas secretes nearly 1.5 quarts of pancreatic juice into the small intestine daily. Within this juice we find enzymes that act upon food, breaking it down into simpler components the body can use for energy.<sup>2</sup>

**Q. What happens if digestive enzymes don't work adequately?**

A. Inadequate digestion is thought to be a significant cause of food allergies.<sup>3</sup> When not digested completely, food can initiate allergic reactions in the body, causing inflammation and immune sensitivity.<sup>3</sup> This can lead to chronic inflammatory conditions and certain types of autoimmune diseases, such as rheumatoid arthritis.

**Q. What enzymes are involved in the digestion process?**

A. Although many enzymes are part of the digestion process, the three main ones are amylase, protease, and lipase. Other enzymes, such as sucrase, lactase, and maltase, have a significant secondary function in digestion.

Amylase breaks down carbohydrates. Saliva contains amylase, which initiates the digestion of dietary starches. Pancreatic secretions also contain amylase, which breaks down starch into several disaccharides (simpler molecules).<sup>4</sup>

Disaccharides, which include lactose, maltose, and sucrose, are further broken down into simple sugars by the enzymes lactase, maltase, and sucrase respectively. These simple sugars can

**HEALTH FACT:**

Plant enzymes are able to survive a broader range of pH differences and provide a wider range of activity throughout the gastrointestinal tract.

then be absorbed through the small intestine to help energy production.<sup>4</sup>

Proteases break down protein. Protein digestion begins in the stomach with the action of the protease, pepsin. The stomach's acidic environment activates this enzyme. Pepsin is deactivated in the alkaline environment of the intestine.<sup>4</sup> However, certain plant based proteases remain active even in more alkaline environments.

Proteins are further broken down by pancreatic enzymes in the alkaline environment of the intestine. Most proteins are ultimately broken down into amino acids, the building blocks of life.<sup>4</sup>

Lipases break down fat. Fat digestion accelerates in the second part of the small intestine with the action of the pancreatic lipases. These enzymes break down fat into essential fatty acids. The lipase enzymes, along with bile salts, are responsible for the absorption of the fat-soluble vitamins: A, D, E, and K.<sup>4</sup>

**Q. What is the difference between plant enzymes and animal enzymes?**

A. Animal enzymes, particularly porcine-derived enzymes, closely resemble human digestive enzymes. For this reason, many experts believe animal enzymes are effective for specific applications. In general, animal enzymes are more sensitive to pH extremes. To compensate for this pH sensitivity, many of the animal enzyme formulas sold as dietary supplements contain bicarbonates to protect the enzymes from stomach acid.

Plant enzymes are derived from fungal or botanical sources. These enzymes are

able to survive a broader range of pH differences and provide a wider range of activity throughout the gastrointestinal tract.

Also, plant enzymes may be preferred by people who wish to avoid animal-derived products.

**Q. What other dietary supplements or enzymes could support digestive health?**

A. There are many dietary supplements effective at supporting digestive health. Probiotic supplements, in particular, offer a myriad of health benefits.

**Q. What are probiotics?**

A. Probiotics are beneficial nontoxic live bacteria that are necessary for life and do not cause disease (non-pathogenic).<sup>5</sup> The probiotic bacteria most commonly studied include members of the Lactobacillus and Bifidobacterium group. Because of the Lactobacillus and Bifidobacterium's ability to break down lactose, these probiotic bacteria are also known as lactic acid bacteria. Both of these probiotic bacteria are well-studied and are available in foods and dietary supplements.<sup>5</sup>

**Q. Why are probiotic bacteria important for digestive health?**

A. Colonies of bacteria in the intestine are called "microflora". While a normal microflora is associated with good health, changes in intestinal health are associated with weakened immune function. An imbalance in the natural microflora is frequently associated with various disease states such as yeast infections and colon cancer.<sup>6-8</sup>

Oral ingestion of probiotic bacteria helps support and modify the composition and metabolic activities of the large intestine microflora.<sup>9</sup> Microflora of the large intestine assist digestion through

fermentation (lowering the pH of the intestine, making it more acidic and inhospitable to invading species); protect against disease causing bacteria; and stimulate the development of certain immune system components.<sup>6</sup> Lactic acid bacteria have a central role in the gut flora enabling them to influence the composition of the flora for health benefits.<sup>10</sup>

**HEALTH FACT:**

Probiotic bacteria need to be ingested regularly for their health-promoting effects to persist.

Probiotic bacteria also have been demonstrated to have anti-cancer properties. In a study, colon cancer patients given L. acidophilus fermented milk showed significantly increased numbers of intestinal Lactobacilli and decreased risk factors associated with colon cancer.<sup>8</sup>

Lactose is an important sugar that is converted to lactic acid by lactic acid bacteria.<sup>11</sup> Lactose intolerance results from an inability to digest lactose, due to the failure of small intestine mucosal cells to produce lactase, an enzyme needed to digest lactose.<sup>12</sup> This often results because of genetics, gastrointestinal disease, or because of the decline in the amount of intestinal lactase levels associated with aging.<sup>13</sup> Lactase deficient people accumulate nonabsorbed lactose in the gastrointestinal tract, which draws water and electrolytes into the gut and accelerates transit time, leading to bloating, cramping, diarrhea, and malabsorption of nutrients.<sup>14</sup> Lactic acid bacteria have been shown to support the breakdown of lactose, specifically by enhancing the activity of lactase (beta galactosidase), which improves lactose digestion and tolerance.<sup>15,16</sup>

**Q. How often should probiotics be taken to ensure optimal support of the digestion system?**

A. Although probiotic bacteria may survive passage through the stomach, they do not permanently colonize in the body and need to be replenished. Therefore, they need to be ingested regularly for their health-promoting effects to persist.

**Conclusion**

Everything our body has ever been or ever will be is dependent upon nutrition. Every building block, every bone cell, even the sheen of our hair, is the result of the food we eat. But what good does it do to select high quality food if its nutrients are not fully absorbed?

Enzymes that assure greater levels of digestion and absorption of your food, and probiotic bacteria that keep problems in check, can make a huge difference in your health. Try a broad spectrum, plant-based, pure enzyme product from a quality manufacturer with each meal for one week. Or, for enzymes that more closely resemble those naturally found in your digestive tract, consider pancreatic enzymes that deliver ten times the digestive power than the minimum activity specified by the United States Pharmacopeia (USP). You'll feel an immediate difference.

Couple the enzyme product with a quality probiotic product that contains both Lactobacillus and Bifidobacteria. A product that must be refrigerated is not convenient, especially for people who must spend a lot of time traveling.

How do you know the bacteria are still alive? Look at the bottle. If there is no date stamped, put it down. If it says the company guarantees there was a certain number alive at the time of manufacture, put it down. This means the company is not willing to claim the bacteria are alive when it reaches you. If the product must be constantly refrigerated, put it down.

Find a probiotic that says the bacteria are guaranteed to be alive in the numbers stated on the label until the date printed on the bottle. The bacteria should also be encapsulated in a coating that will protect them from stomach acid so that they reach your intestines alive and ready to go to work. Again, try these two kinds of supplements for even a week. As good as the short-term results are, the long term results are even better.

