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BOOK REVIEWS

Bacteria for Breakfast: Probiotics for Good Health
By Kelly Dowhower Karpa PhD RPh. Published by Trafford Publishing, Victoria, British Columbia, Canada, 2003. ISBN 1-4120-0925-0. Paperbound, 319 pp. (23 × 15 cm), $27.50. www.trafford.com

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Bacteria for Breakfast: Probiotics for Good Health is a unique gem in its field. The book reads easily in both scientific and common prose. It should prove to be a classic not only for the interested layman, but also for medical students, their professors, and indeed all healthcare practitioners.

Dr. Karpa's interest in the field of probiotics, which she defines as the feeding of "live microorganisms that have potential to benefit the host," stems not from her previous academic training, but rather from her yearlong struggle with a sick child. In the best tradition of the creative American mind that was prepared in basic science, she turned a mother's fervor to cure a sick child into a fascinating story that describes a fundamental, very important therapy. Her child's illness, chronic *Clostridium difficile* diarrhea, was neglected by most physicians who seemed ill-informed not only about its proper therapy, but also about the scientific basis of its etiology. Her book, then, was motivated by her desire not only to help other sufferers, but also to educate us in a woefully neglected area: probiotics. In this, she not only succeeded brilliantly, but also contributed original material.

Probiotics is merely a modern rename for an ancient medical practice that has been, ironically, only recently rediscovered. The term "probiotics" stems from the Latin "pro" or "for" and "bio" or "life." Contrast "for life" with "against life" or anti-biotic. As she explains our present-day concept of feeding live bacteria, "this notion runs counter-intuitive to what we have been taught for nearly a century." Paradoxically, it is the discovery and use of antibiotics that have provoked renewed interest in this ancient practice. Only when her son received a proper probiotic preparation containing live friendly bacteria, including *Lactobacillus acidophilus*, *Bifidobacterium bifidum*, and several other important commensuals, did he finally and permanently recover. Antibiotics alone, while they temporarily improve the situation, do nothing to prevent a recurrence, which usually returns with a vengeance.

The famous Russian medical scientist, Eli Mechnikoff, won the Nobel prize in 1903 for his pioneering work in probiotics, even though the scientific term "probiotics" does not appear in the modern scientific literature until 1957, when it surfaced in agricultural studies that described the increased weight gain in cattle fed live "healthy" bacteria. *Salmonella* epidemics in poultry were controlled by spraying newly hatched chicks with a normal chicken strain of *Escherichia coli* which, when chicks pecked it off each other, immediately colonized their gastrointestinal tracts before the *Salmonella* species could gain a foothold.

Mechnikoff had observed that certain people from the Caucasus mountain area who ate a diet high in fermented foods, especially fermented milk, had a low incidence of intestinal disorders and lived extremely long lives. He isolated bacteria strains, including *Lactobacillus bulgaricus* (which remains today as a staple of many commercial probiotic products), from both their intestines and their fermented foods. Next, he fed these bacteria to patients with a variety of gastrointestinal diseases. This successful treatment resulted in the proliferation of many health resorts in Europe in the early 1900s, each with their own secret and unique "garnish" of specially cultured bacteria, usually a *Lactobacillus* species.

Replacing an abnormal bowel flora, a dysbiosis, with a normal flora, is the rationale for probiotic therapy. Among the causes for the increased incidence of gastrointestinal disorders in the last 50 years has been the liberal use of antibiotics. For example, both Crohn's disease and ulcerative colitis have increased in incidence severalfold since the inaugural of the antibiotic area. Antibiotics, which kill not only pathogens but also the healthy flora, allow for other airborne opportunists, especially toxin-producing *Clostridium* species, and many other antibiotic-resistant species to take up residence in the bowel niche previously reserved for "healthy" flora. This healthy flora is naturally selected over millions of years during human evolution to live in symbiosis with its host and to protect it from their other natural enemies. Good health depends not only on the nutrients ingested with our food, but also the nutrients produced by the bowel flora. Many other health functions, including detoxification, protein digestion, and immune functions, are carried out by this huge symbiotic organ: our normal bowel flora. One can only imagine the carnage created by the dumping of more and more human-engineered toxins (antibiotics) into this ancient symbiotic biosystem. Dr. Karpa's book makes a scientific reevaluation of modern dogma.

Chapter 1, "Bacteria Within," presents 37 pages of the best summary of the basic physiology of the gastrointestinal tract and the interrelated influence of the bacterial flora. The author does not talk down to her readers. Rather, she uses proper scientific terminology, which is decoded in an alphabetical glossary in the appendix.

The author begins in Chapter 2 with the examination of basic pathophysiologic mechanisms, "When Digestive Functions Go Amiss," and expands upon this in Chapter 3 with a brilliant discussion of the important immune function of not only the gastrointestinal tract per se, but also the role of the flora itself, "Bacterial Instant Messaging: The Gut as an Immune Organ." She successfully conveys the important message that the many living microbial cells that live in the lumen of the gut (which not incidentally outnumber by manyfold the total number of cells in the entire human body) comprise a separate but integrated "organ" in itself with functions equally as important as any other organ in the body.

Having firmly established the normal workings of this extra and often neglected organ system, the gastrointestinal flora, the author now develops a rationale for manipulating it therapeutically. In Chapter 4, "The

Bacterial Balancing Act: Dysbiosis and the Immune System," she discusses how the communication between gut bacteria and the immune system may go awry or fail to develop altogether. Drawing from a vast literature review and experimental results in Crohn's disease and ulcerative colitis as models, she summarizes the latest understanding of the complex signaling of cytokines and chemokines, the pro- and anti-inflammatory controls. Some of these important control molecules, such as interleukins, are produced by bacteria, while others are produced by epithelial cells and lymphocytes under genetic control. The author helps to simplify the understanding of this extremely complex field of immunology, the fine-tuning of which is still rapidly developing.

After nearly half the book as background, the author now launches into the meat of her book in Chapter 5, "A Gut-Wrenching Experience: Probiotics and Diarrhea." Here she vividly describes actual case histories of *C. difficile* diarrhea. One agonizes over the needless suffering of these patients with recurrent, debilitating diarrhea. Patients are not just sick for a predicted time period, as occurs in other infectious diseases, such as chicken pox and bacterial pneumonia. Rather, they are incapacitated for months or even years. To make us understand this difference was the reason for the long explanatory basic science prolog in Chapters 1 through 4. Another most important disease system, that of common allergies, also seems to be increasing in modern times. That there could be a direct and ignored connection between disturbances of bowel flora early in life and the rise in incidence and prevalence of allergies, especially food allergy, eczema, and asthma, is a fascinating hypothesis. Some of this evidence is explored and case histories are presented. It makes for a very convincing story.

When disruptive, toxin-producing bacteria, especially *C. difficile*, replace the healthy commensuals in the upper small bowel, the tight junctions between endocytes are made permeable. This allows undigested proteins and large polypeptides, normally broken down into smaller peptides and amino acids, to be absorbed directly into systemic vascular circulation. These 5–10 000 molecular weight peptides, such as horse serum or egg albumin, can then be absorbed directly into the blood. This rapid, incomplete absorption bypasses the normal digestive processes performed over time by the pancreatic and gastric enzymes, as well as those of the endocytes and the bacteria themselves. The explanation of the "permeable" gut, so important in the development of the allergic diseases, can be attributed directly to the lack of healthy bowel flora. (This does not exclude the direct effect of the food allergen per se on gut endothelial inflammation, thus perpetuating the "leaky gut.") The controlled studies from Scandinavia by Erika Isolauri and colleagues, as well as Agnes Wold, have proven the important role and beneficial effects of probiotic bacteria in eczema due to milk allergy and in predicting an increase in other allergic diseases. Further evidence of this direct connection can be had by the reduced incidence of these diseases in less "Westernized" or more primitive natural societies.

The importance of "prebiotics," or the special nutrients that select one bacterial strain above another, is touched upon in Chapter 10. The almost limitless area of future study and application or probiotics in Chapter 11 give the impression that we have barely scratched the surface of this exciting field of study.

If one understands the principles of *Lebensraum*, the living space required by all living organisms including intestinal bacteria, one quickly arrives at the rationale for the use, no, necessity for use, of probiotic treatment in certain illnesses. It is really quite simple. First, the physician successfully kills off a pathologic organism such as *C. difficile* with an antibiotic. Then he waits. The patient improves. But unlike antibiotic therapy for other infectious diseases, such as pneumonia, where the invader does not belong in the bronchial passages of the lung, *C. difficile* in small numbers is a perfectly benign commensual of the gut, living happily in symbiosis with a host of neighbors. It is an opportunist like any other organism, taking over space outside its normal limited niche when the opportunity presents itself. Now, when the antibiotic has been discontinued, it invades the territory of its benign neighbors, also killed off by the antibiotic. It is all about numbers, who got there first, rapidity of reproduction, and, therefore, successful competition. *C. difficile*, an anaerobe, is a fierce competitor and colonizer. The disease returns with a vengeance. Retreatment results in the same see-saw: recovery and exacerbation. Enter probiotic therapy. When sufficient large doses of healthy bacteria are given either concomitantly with or very soon after the antibiotic, the *Lebensraum* is used up and the re-emerging *C. difficile* has no place to propagate. It is just this simple principle, so effective clinically, that Dr. Karpa is trying to publicize.

One looks forward to her second edition when more data are available about the quality of these over-the-counter products. They are available in profusion, but, unfortunately for the public, the products are not Food and Drug Administration supervised. This has allowed shoddy, unreliable, and contaminated products to be sold alongside other very reliable, potent, and pure products. To her credit, the author does not delve into the sticky problem, which is one reason that the field of probiotics has not risen to accepted medical practice. One can forgive the stubborn physician who refuses to take a fresh look at an old reliable therapy, indeed the only effective therapy for certain stubborn diseases—the unpredicted results of diseases of medical progress. In time, this attitude must certainly change. To expedite this day, we can thank the dedication of such brilliant scientific writers as Dr. Karpa, whose insight was gained through suffering, but whose prepared mind was nimble enough to make a significant contribution to modern scientific medicine.

I can find little to criticize. The title, *Bacteria for Breakfast,* is catchy but detracts from the serious scientific message. The subtitle, *Probiotics for Good Health,* likewise gives the impression, perhaps influenced by the propaganda of the many commercial companies now emerging, that a daily dose of bacteria is somehow necessary for good health in the normal healthy individual. In contrast to the patient with dysbiosis, once a normal flora is established in any one individual, there is yet no scientific evidence that additional "healthy" bacteria can alter or improve upon it. The exceptions to this are the proven benefits of prophylactic daily probiotics in preventing travelers diarrhea and also treating and preventing certain specific viral causes of gastroenteritis. In Europe, pediatricians for decades have published studies of serious infectious disease prevention in newborn babies, studies almost totally ignored in this country. This may be the most important future application of this preventive medicine, feeding a healthy flora in the first days of life.

Until the modern scientific community can catch up with, either to prove or disprove, the alternative care practitioner's many health claims (cancer cures or prevention) that cannot yet be substantiated, the practitioner rightly should approach the area of probiotics with a strong dose of skepticism. A number of unsubstantiated claims have turned off the traditional mainstream physician. However, Dr. Karpa has gone to some lengths to distance herself from the nonscientific health claims made by unscrupulous companies and has concentrated on the proven, solid science. Historically, probiotic therapy has survived in the realm of alternative practitioners, but Dr. Karpa makes a strong case that it now belongs back in the texts of mainstream medicine. Perhaps her volume II could be retitled *Mechnikoff Rediscovered: The Return of Probiotics to Mainstream Medicine*. I highly recommend this book.

Michael L McCann MD FAAP AAAAI, ACAAI (ret)
Chetek, Wisconsin

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