

## The approaching crisis: Infectious Disease

**Food** and waterborne diseases are a worldwide present-day concern. Gastrointestinal diseases in the US are on the increase. **The result of globalization is that harmful microbes travel with the world commerce.** Mexico, Central America and South America have become major exporters of food to the USA. The risk and vulnerability is exemplified in the 1996 outbreak of Cyclosporiasis that affected large numbers of people in the United States and Canada. This epidemic gave rise to a fair amount of panic until it was established that *Cyclospora* is a food borne agent of diarrheal disease and was being spread by Guatemalan raspberries. New outbreaks of *Cyclospora* have occurred: one was spread by mesclun lettuce and another by fresh basil in pesto sauce. The fact that much of the foods that we obtain from the developing world are vegetables and fruits magnifies the risk. Surveillance is questionable because medical laboratories do not routinely test for some of the microbes that are known to cause food or waterborne disease, and because medical research science has not yet identified all of the responsible organisms. 80% of American chickens now arrive in supermarkets contaminated with *Campylobacter*, a bug that can cause diarrhea, vomiting and in people with a compromised immune system, a lethal infection of the blood. Eggs often contain *Salmonella*. Over half of the herds of pigs in the United States now carry *Toxoplasma gondii*. Food borne diseases have escalated as the frequency of people eating out in restaurants or buying "take-out" has increased. The challenge of providing public health education for the over nine million people employed as food handlers many of whom do not speak English compounds the exposure to diverse and toxic pathogens.

Infections: One of the basic physiological functions of the resident microbiota flora) is that it functions as a microbial barrier against microbial pathogens, In European studies, published through FEMS Microbiology Letters, *Salmonella typhimurium* and enteropathogenic *Escherichia coli* were found to adhere to the brush border of differentiated human intestinal Caco-2 cells in culture, whereas *Yersinia pseudotuberculosis* and *Listeria monocytogenes* adhered to the periphery of undifferentiated Caco-2 cells. These aggressive enterovirulent strains invaded the Caco-2 cells. *Lactobacillus acidophilus* inhibited both cell association and invasion of Caco-2 cells by enterovirulent bacteria in a concentration-dependent manner. The mechanism of inhibition of both adhesion and invasion appear to be due to both steric hindrance of human enterocytic pathogen receptors by whole-cell *Lactobacillus acidophilus* rather than to a specific blockade of receptors and by the production of a bactericidal substance by the *Lactobacillus*. The ability of enteroinvasive pathogens to disseminate into the deep tissues by cellular apoptosis induction is well documented. *Streptococcus thermophilus* were able to inhibit the apoptosis of macrophages induced by *Salmonella*. The result suggests that *S. thermophilus* can play a role in apoptotic mechanisms, as the inhibition of apoptosis would avoid pathogen dissemination. Verocytotoxin producing *Escherichia coli*, such as *E. coli* O157 are emerging food borne pathogens worldwide. They are responsible for a range of illnesses in humans from mild diarrhea to hemorrhagic colitis and hemolytic uremic syndrome in humans. *Bifida longum* was found to neutralize *E. coli*. Oral administration of *B. longum* exerts marked inhibitory effects on ulcerative colitis in mice. Administration of methotrexate to rats on an elemental diet results in severe enterocolitis and death. *Lactobacillus plantarum*, an integral part of the healthy gastrointestinal micro ecology, provided therapeutic benefits to help in the recovery from enterocolitis, *L. plantarum* reduces the number of infections in patients after liver transplantation. *L. plantarum* fermented oat given to healthy volunteers significantly reduces the gut content of potentially pathogenic microorganisms such as *Enterobacteriaceae*, *S. aureus* and *enterococci*. The microbiota mix in the synbiotic formulas was chosen for the specific purpose of preventing pathogenic bacteria from growing, invading and causing disease.

