Gut Microbiota, Host Factors Affect Malnutrition in Poor

The microorganisms of the gastrointestinal (GI) tract contribute to malnutrition among poor populations in developing countries, according to several experts who spoke during the symposium “Malnutrition, Gut-Microbial Interactions and Mucosal Immunity to Vaccines,” that was held in New Delhi, India, last November.

Repeated bouts of infectious diseases that disrupt the GI tract, particularly among children, are an important factor underlying this pervasive public health problem, in addition to simple poverty and lack of food, according to the scientists. For example, children who are exposed repeatedly to enterohemorrhagic pathogens, including strains of *Escherichia coli*, *Salmonella*, *Shigella*, and *Yersinia*, appear to be especially vulnerable to malnutrition, even after they clear their GI infections, according to symposium participant Gail Hecht of the University of Illinois, Chicago.

Enteric bacterial pathogens exhibit several distinctive means for thwarting key host cell functions, including maintenance of tight junction barriers, active transport of electrolytes and solutes, and innate immune responses, Hecht continues. Additionally, some pathogens deliver deleterious molecules into intestinal epithelial cells, sometimes secreting toxins that host cells take up via absorption mechanisms and other times injecting effector molecules directly into host cells. “These [latter] microorganisms express and build systems, like little syringes, allowing bacteria to inject their own proteins into our epithelial cells,” she says. “Even if the infection is gone, the epithelium has been reprogrammed, and if a child is infected multiple times before two years old, there may be lifelong consequences such as stunting and reduced intelligence quotient.”

Hecht’s explanation finds support in other recently published findings regarding a protein, called P 40, that prevents apoptosis, referring to Brent Polk and his colleagues at Vanderbilt University in Memphis, Tenn., she says. “Those researchers have gone down to the protein level, and explored how that protein protects the intestine from inflammation. Most work is not at that level yet.”

Intestinal microbiota affect diarrhea in such children and thus also contribute to malnutrition, according to Honorine Ward, of Boston University in Boston, Mass., who is analyzing how GI microbiota patterns change with time among children at urban and rural sites in Pakistan. For example, during a two-year period, *Actinobacteria* levels dropped, while *Firmicutes* and *Bacteroidetes* increased, she says. “The bacteria were in a steady state between the age of one and two years.” At 12 months, diarrhea was more prevalent among children living at the rural rather than the urban site, although the latter was “more crowded and unhygienic,” she adds, noting that both helpful and harmful bacteria appear to play a role in malnutrition.

Molecular techniques enabled researchers to identify six parts of the human genome that differ in well-nourished versus malnourished chil-
children, suggesting that host factors also play a role making some children more susceptible to malnutrition, according to another symposium participant, William A. Petri, Jr., of the University of Virginia Health System in Charlottesville, who is following a group of 2,000 children in Bangladesh. “In three of these areas, there are obvious genes, all of which are involved in lipid metabolism,” he says, cautioning that these findings are preliminary.

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Invasive Dinoflagellates May Signal Rise in Ocean Temperatures

Several species of nonindigenous epiphytic dinoflagellates that were newly identified in temperate waters off Jeju Island, South Korea, may signal rising global water temperatures and also present an increased risk to the local fishing industry, according to marine researcher Wonhoo Yih of Kunsan National University and his collaborators there and the Research Institute of Fisheries Technology, both in Kunsan, and at Seoul National University, all in the Republic of Korea. Ordinarily, these dinoflagellates are found in tropical or subtropical waters, they point out in the September 2011 *Ocean Science Journal* (46:205–209; http://dx.doi.org/10.1007/s12601-011-0016-9).

“Our results essentially imply that the environmental conditions in the study area were at a suboptimal level for five epiphytic dinoflagellate genera, which seem to be settling down and adapting themselves to increased coastal water temperatures,” Yih says. These dinoflagellates, a division of Pyrrhophyta in the class Dinophyceae, are phytoplankton found in both fresh and marine waters. Some of the latter produce neurotoxins associated with red tides. “The occurrence of epiphytic dinoflagellates in Korean waters is of concern to scientists, the aquaculture industry, and especially to the government due to their toxicity to marine organisms and humans,” he says. For example, some dinoflagellates produce potent neurotoxins such as ciguatoxins and maitotoxins, which can contaminate fish. When ingested by consumers, such neurotoxins can cause severe gastrointestinal and neurological symptoms as well as death. “Since their discovery it has become a major concern, as fish is one of the main staples of the Korean diet,” Yih says. “However, with the establishment

Recent Developments Involving Vaccines

Recent developments involving vaccine development, efforts to evaluate their safety and efficacy, and analysis to determine how they can be used most effectively, include:

- A vaccine interfering with the malaria parasite binding to the “basigin” receptor on human red blood cells has the potential to neutralize “all strains” of *Plasmodium falciparum*, according to Simon Draper of the Jenner Institute at Oxford University in Oxford, England, and his collaborators. Details appear in December 20, 2011 *Nature Communications* (2:601; doi:10.1038/ncomms1615).

- Several vaccine combinations partly protect rhesus monkeys against simian immunodeficiency virus, suggesting that similar combination products are likely to protect humans against HIV, according to Nelson Michael of the Walter Reed Army Institute of Research near Washington, D.C., and his collaborators. Details appear in the January 4, 2012 *Nature* (doi:10.1038/nature10766).

- An experimental vaccine partly protects women against herpes simplex virus type 1, which causes genital lesions, but not type 2, which causes mouth sores, according to Robert Belshe of Saint Louis University in St. Louis, Mo., and his collaborators. Their findings appear in the January 5, 2012 *New England Journal of Medicine* (366:34–43).

- An adenovirus that infects chimpanzees appears promising as a vaccine vector because humans are unlikely to have been exposed to and thus to mount immune responses against it, according to Stefano Colloca at Okairos in Rome, Italy, Eleanor Barnes at University of Oxford in Oxford, England, and their respective collaborators at those and additional institutions. Details appear in several papers in the January 4, 2012 *Science Translational Medicine* (doi: 10.1126/scitranslmed.3002925).

- Modeling suggests that vaccines to protect against the human papilloma virus (HPV) will be more effective if administered only to women (or to men if their likely infection rates are higher) rather than to both genders, according to Johannes Bogaards of VU University in Amsterdam, the Netherlands. Details appear in the December 20, 2011 *PLoS Medicine* (doi:10.1371/journal.pmed.1001147).