The human large intestine harbors a complex community of microorganisms (microbiota) that affect many aspects of our physiology and health (1). Numerous lines of evidence, particularly from rodent models, have suggested that the intestinal microbiota may play a role in the development of obesity. On page 1079 of this issue, Ridaura et al. (2) demonstrate that the microbiota from lean or obese humans induces similar phenotypes in mice and, more remarkably, that the microbiota from lean donors can invade and reduce adiposity gain in the obese-recipient mice if the mice are fed an appropriate diet.

Ridaura et al. recruited four human female twin pairs discordant for obesity and transferred the intestinal microbiota in fecal samples from each of them into the intestines of germ-free mice. Animals receiving a transplant from the obese (Ob) twin donors developed increased adiposity compared to those receiving transplants from lean (Ln) twin donors. Differences in mouse adiposity could also be reproduced after inoculation of germ-free mice with collections of cultured bacteria from an obese twin (Ob) with mice harboring cultured bacteria from a lean twin (Ln) prevented the development of increased adiposity in the Ob mice. This occurred in tandem with successful colonization of Ob intestines by bacteria from the Ln mice. By contrast, Ob microbes did not transmit to Ln mice, and these animals remained lean. This indicated that transmissibility of intestinal microbes and adiposity phenotype were tightly linked.

Analysis of the bacterial communities showed that members of the Bacteroidetes phylum, particularly Bacteroides spp., could pass from the Ln mice and colonize the Ob mice, suggesting that these bacteria were largely responsible for protection against increased adiposity. However, cohousing of Ob mice with lean mice inoculated with a relatively simple mix of just 39 defined bacterial strains, including many of the Bacteroides species that were previously correlated with reduced adiposity, did not reduce adiposity in the Ob mice. This indicates that more complex bacterial interactions underlie protection against increased body mass and associated metabolic disturbance.

Ridaura et al. also identified diet as an important factor in the transmission of microbiota and associated host phenotype. Lean twin–derived bacterial strains effectively colonized and ameliorated excess adiposity in Ob mice when the recipients were fed a low-fat, high-fiber diet. This was not the case when the mice were fed a diet that was high in saturated fat but low in fiber.

The findings support some emerging hypotheses regarding potential mechanisms by which the microbiota can affect host weight gain. One of the main activities of the intestinal microbiota is to break down and ferment dietary fibers into short-chain fatty acids (SCFAs) such as acetate, propionate, and butyrate. The host absorbs these acids, and humans obtain perhaps 5 to 10% of daily energy requirements from them (3). Ridaura et al. show that the microbiota in Ln mice produces greater amounts of SCFAs, particularly propionate and butyrate, and digests more of the plant fiber present in the mouse’s diet. 

Please pass the microbiota. (A) Germ-free mice inoculated with microbiota from obese or lean human twins take on the microbiota characteristics of the donor. Those receiving the obese microbiota (red outline) had an increase in adiposity, whereas those receiving the lean microbiota (blue outline) remained lean. (B) If fed an appropriate diet, mice harboring the obese microbiota, when cohoused with mice harboring the lean microbiota, are invaded by the lean microbiota and do not develop increased adiposity (blue and red outline). By contrast, the obese microbiota does not effectively colonize mice harboring the lean microbiota, and these mice remain lean.
Reducing Earthquake Risk

Brian E. Tucker

The preceding Perspectives in this series (1–4) provide snapshots of the earthquake and tsunami risks, hazard monitoring and risk mitigation activities, and current research questions concerning some of the world’s seismic hot spots—South Central Asia, the Caribbean, Turkey, Tokyo, and Santiago. The image that emerges is one of considerable progress in reducing losses due to earthquakes and tsunamis in some places but of growing and evolving risks in others.

In the past two decades, the prevailing approach to reducing the consequences of earthquakes and tsunamis has emphasized raising awareness of these hazards, promoting methods of reducing their associated risk, and incorporating the results of Earth science and earthquake engineering research into post-earthquake reconstruction. The United Nations (UN) International Strategies for Disaster Reduction serves as a platform to coordinate these efforts and, through its Hyogo Framework for Action, has declared the goal “to substantially reduce disaster losses by 2015 by building the resilience of nations and communities to disasters” (5).

Despite these diverse and sustained efforts, human and economic losses due to earthquakes are increasing and are projected to continue to rise in the future (6, 7). The past decade (2001 to 2012) saw more than three times as many earthquake-related deaths as the preceding two decades (1981 to 2000) (8). These losses are increasingly concentrated in developing countries because of differences in urban population growth (see the figure) and the quality of seismic-resistant construction (9–11).

How can a higher level of earthquake preparedness be achieved, particularly in developing nations?

The Importance of Being Prepared

One reason is that historically, far fewer resources have been invested in pre-earthquake preparedness and risk reduction than in post-earthquake response, reconstruction, and recovery; this is particularly true in developing countries. One study (12) suggests that only 1% of all international aid for humanitarian assistance, less than 10% is directed to disaster prevention; a more recent study (13) estimates that this figure is only 1%. Post-disaster activities are important and reliably garner generous support among individuals, governments, and nonprofit organizations, appealing to the human impulse to help those in need. Yet a comparison of the consequences of recent earthquakes in developing countries, where preparedness is rare, and industrialized countries, where it is much more common, sug-