seem to be more prone to the illnesses associated with obesity. Why this is so is "far from answered," Hirsch says, but, he remarks, "a number of labs are finding that fat cells behave differently in different parts of the body." In particular, fat cells in the abdomen seem to be metabolically more active.

The number of obese people in the United States shows no signs of diminishing. In fact, according to Theodore Van Itallie of Columbia University College of Physicians and Surgeons, there is a virtual epidemic of obesity among middle-aged black women. Sixty percent of black women between the ages of 45 and 55 are obese, as compared to 30 percent of white women in the same age range and 26 percent of the U.S. population as a whole.

Why obesity should be so prevalent among black women is unclear, but Albert Stunkart of the University of Pennsylvania School of Medicine points out that poor people are more likely to be overweight. He finds that obesity is six times more common among members of the lowest socioeconomic class as among those of the highest class and so the large numbers of obese black women may reflect the fact that these women are more likely to be poor. Stunkart and Van Itallie speculate that the incidence of obesity is kept down among more affluent people by the very strong social pressures against being fat. Such pressure does not exist among poorer people, Stunkart says.

Although the panel did not address the question of how people should lose weight, it did note that dieting is a big business in the United States and that, obviously, there are no easy answers to weight loss. In 1983 alone, Hirsch says, there were 1 billion tablets of phenylpropanolamine sold over the counter specifically as appetite suppressants. The cost of those pills is more than $150 million, and that is just one drug. More than 1 million people a week are treated in weight loss clubs such as Weight Watchers, according to Stunkart. Obesity, says Hirsch, "is a health problem that affects nearly everybody."

But even though there is no foolproof way to reduce and even though those who do lose weight frequently gain it back, the panel still feels that it is essential that overweight people make the effort to get their weight down to normal. "So much of the talk about obesity relates to vanity. We found that there are multiple health hazards at what to me are surprisingly low levels of obesity," Hirsch says. "Obesity, therefore, is a disease."—**GINA KOLATA**

Fish to Bacterium Gene Transfer

Although natural gene transfer from prokaryotes to eukaryotes is well known, and includes, for instance, the insertion into plant cells of plasmid fragments by *Agrobacterium tumefaciens* in the formation of crown gall disease, examples of the reverse transfer have remained uncertain at best. One putative such case that has been debated for some years concerns the enzyme copper/zinc superoxide dismutase in *Photobacterium leiognathi*, the gene for which has been suggested to have derived from ponyfish, with which the bacterium has a close symbiotic relationship (*1*). Rigorous analysis of the primary, secondary, and tertiary structure of the *P. leiognathi* enzyme now supports very strongly the idea of natural transfer for the origin of the bacterial gene, according to Oxford University researchers Joe Bannister and Michael Parker (*2*).

Superoxide dismutase scavenges the superoxide radical O_2^-, and therefore forms an important line of defense against this highly toxic species. The enzyme is a metalloprotein: in higher eukaryotes it contains copper and zinc, in some prokaryotes and mitochondria of eukaryotes the metal is manganese, while iron is usually present in other prokaryotes. This neat pattern was ruffled somewhat by the discovery that iron superoxide dismutase is to be found in three plant families—Gingkoaceae, Nymphaeaceae, and Cruciferae—out of a total of 43 surveyed, which observation has been interpreted to imply three separate gene transfers from bacteria to the plants. The presence of the solidly eukaryotic copper/zinc enzyme in *P. leiognathi* was again inferred to be the result of gene transfer, this time from eukaryote to prokaryote. The only other known example of a bacterium containing this enzyme—*Caulobacter crescentus*—presents a mystery as, unlike *P. leiognathi*, this organism does not regularly consort with eukaryotic organisms.

Photobacterium leiognathi, a light-producing bacterium, colonizes the luminescent organ of ponyfish, thus providing an intimacy that might permit natural gene transfer. The demonstration in 1981 that the amino acid composition of the copper/zinc enzyme from host and symbiont are much closer than either is to that of the swordfish seemed to confirm this contingency (*3*). Elucidation of the bacterial enzyme's amino acid sequence in 1983, however, revealed that it had little direct identity with several eukaryotic comparisons, and the idea of natural gene transfer fell into disfavor (*4*).

In spite of this, Bannister decided to pursue the issue further and, with Parker, embarked on an in-depth structural analysis. It turns out that although direct identity is in the region of 25 percent or so, when constraints on mutation are taken into account a figure for weighted sequence similarity of 44 percent is obtained, which is much more indicative of a homologous relationship. In spite of the differences in primary structure, the *P. leiognathi* enzyme yields a secondary structure prediction closely similar to that from eukaryotes. Studies on the crystal structure of the bovine enzyme (the only one for which such information is available) shows the tertiary structure to be comprised of eight antiparallel β-strands that form a flattened cylinder plus three external loops. The question was, could the features of the bacterial enzyme be "squeezed" into a comparable three-dimensional configuration, using computerized model building? Again, although some modification was necessary, there was an impressive conservation of overall structure.

Bannister and Parker point out that although convergent evolution in terms of function in the biochemical realm is common, as in many of the oxygen-binding proteins for example, convergence on structure is not. The structural similarities they see between the bacterial and eukaryotic enzymes in this case, they conclude, strongly indicate, if not prove, homology.—**ROGER LEWIN**

References

1. R. Lewin, *Science* **217**, 42 (1982).
2. J. V. Bannister and M. W. Parker, *Proc. Natl. Acad. Sci. U.S.A.* **82**, 149 (1985).
3. J. P. Martin and I. Fridovich, *J. Biol. Chem.* **256**, 6080 (1981).
4. G. J. Steffens *et al.*, *Hoppe-Seyler's Z. Physiol. Chem.* **364**, 675 (1983).