Food for Thought

Research to promote a balanced diet, prevent obesity, and curb world hunger

COLLEGE OF AGRICULTURAL, CONSUMER AND ENVIRONMENTAL SCIENCES
FINDING SOLUTIONS TO THE WORLD'S MOST CRITICAL CHALLENGES
Tortilla Bake

This easy-to-assemble layered casserole includes textured soy protein in place of ground meat, reducing the overall calories, fat, and cholesterol while providing an excellent source of protein.

2 medium onions, peeled and ends removed, then chopped
1 green bell pepper, stemmed and seeded, then chopped
1/2 cup mild salsa
2 15.5-ounce cans chili beans (do not drain)
1 8-ounce can tomato sauce
1 cup textured soy protein (TSP)
1 cup corn kernels
3/4 cup water
1 2.25-ounce can sliced black olives, drained
1 Tablespoon chili powder
18 6-inch corn tortillas
1 cup shredded Mexican or cheddar cheese

Optional garnishes: chopped tomatoes, additional sliced olives, avocado chunks

1. Preheat the oven to 350 degrees F. Coat a 9-by-13-inch baking dish with cooking spray.
2. Combine all ingredients but the tortillas in a large saucepan and bring to a boil. Reduce heat and simmer for 10 minutes, stirring occasionally.
3. Spread about one quarter of the chili mixture on the bottom of the prepared baking dish. Top with 6 of the tortillas, overlapping and/or cutting to fit. Top with another quarter of the chili mixture and a third of the cheese. Repeat for 2 more layers of tortillas, chili mixture, and cheese.
4. Cover and bake for 30 to 35 minutes, until heated through. Garnish with tomatoes, olives, and avocado, if desired.

Makes 12 servings. Per serving: 260 calories, 16 g protein, 41 g carbohydrate, 5 g fat (2.0 g saturated), 10 mg cholesterol.
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The participants were divided between two eating plans. The plans were equal in calories, but half the group followed a moderate-protein diet (40 percent carbohydrates, 30 percent protein, 30 percent fat) while the other half followed a diet based on USDA’s food-guide pyramid (55 percent carbohydrates, 15 percent protein, 30 percent fat).

“Persons in the first group ate twice the amount of protein as the second group,” said Layman.

And the difference in protein made all the difference in improved body composition and body lipids, he said.

Although the amount of weight lost by all participants was similar, at 4 months those in the moderate-protein group had lost 22 percent more body fat. At 12 months, that advantage had grown to 38 percent.

“The additional protein helped dieters preserve muscle. That’s important for long-term weight loss because muscle burns calories—if you lose muscle, and you used to be able to consume 2,000 calories without gaining weight, you’ll find that now you can only eat, say, 1,800 calories without weight gain,” Layman said.

What were the effects on lipids? Although at 4 months the food-guide pyramid diet appeared to be more effective in lowering LDL (“bad”) and total cholesterol levels, at 12 months that group’s LDL cholesterol came back up, showing the two diets to be equally effective, Layman said.

“This is the first study to show that short-term changes in LDL cholesterol are not maintained with long-term weight loss. Most scientists believe that high cholesterol is more a factor of genetics than of diet,” he said.

But the moderate-protein diet had by far the bigger effect on lowering triglycerides, and that lasted as long as individuals remained on the diet.
Of the two types of lipid problems, high triglycerides pose a greater risk for heart disease. Approximately twice as many people have high triglycerides, and people with this condition are approximately four times more likely to die from heart disease, Layman said.

To ensure compliance, participants met every week for weigh-ins and nutrition instruction. “We taught participants how to follow their diet, how to shop for groceries, and how to prepare the meals. They also measured everything they ate three days a week.”

“Our latest study shows you have a better chance of achieving all these goals if you follow a diet that is moderately high in protein and lower in carbohydrates,” Layman said.

“Studies that report there is no difference among diets also report that subjects were not carefully following the diets,” said Layman. “It’s very important to realize the difference between diet compliance and diet effectiveness.”

The moderate-protein diet was easier to follow and maintain long-term, with 64 percent of those dieters completing the study compared to 45 percent of dieters eating the high-carbohydrate diet, Layman said.

“Subjects on the moderate-protein diet reported that they weren’t as interested in snacks or desserts, and they didn’t have food cravings. When you eat protein, you feel full longer.”

Average weight loss for the moderate-protein group was 23 percent higher, with 31 percent of “completers” losing more than 10 percent of their initial body weight compared with 21 percent of the food-pyramid group.

“Unfortunately, American women tend not to eat much protein, especially when they’re trying to cut calories,” said researcher Don Layman. “But it’s easy to add protein powder to a smoothie or eat a high-protein snack and incorporate a healthier diet into a busy lifestyle.”

In both groups, strength decreased as weight decreased. However, the study suggests that a higher amount of muscle relative to fat had beneficial effects on balance and performance.

Women who ate more protein lost 3.9 percent more weight and had a relative gain of 5.8 percent more thigh muscle volume than women who did not.

In both groups, strength decreased as weight decreased. However, the study suggests that a higher amount of muscle relative to fat had beneficial effects on balance and performance, Evans noted.

And even though weight loss in these older women had a negative effect on strength, their reduced weight helped with other aspects of physical function, Evans said.

The research was published in the *Journal of Gerontology*. 
A new study says that soluble fiber—found in oats, apples, and nuts, for starters—can reduce the inflammation associated with obesity-related diseases and strengthens the immune system.

“Soluble fiber changes the personality of immune cells. They go from being pro-inflammatory, angry cells to anti-inflammatory, healing cells that help us recover faster from infection,” said researcher Gregory G. Freund. “This happens because soluble fiber causes increased production of an anti-inflammatory protein called interleukin-4.”

In the experiment, laboratory mice consumed two low-fat diets that were identical except in containing either soluble or insoluble fiber. After six weeks on the diet, the animals had distinctly different responses when the scientists induced illness by introducing a substance (lipopolysaccharide) that causes the body to mimic a bacterial infection.

Two hours after lipopolysaccharide injection, the mice fed soluble fiber were only half as sick as the other group, and they recovered 50 percent sooner. And the differences between the groups continued to be pronounced all the way out to 24 hours. In only six weeks, these animals had profound, positive changes in their immune systems.

Now Freund has a new question: Could soluble fiber offset some of the negative effects of a high-fat diet, essentially immunizing obese persons against the harmful effects of fat?

Scientists have long known that obesity is linked to inflammatory conditions, such as diabetes and heart disease. But another study demonstrated that fat tissue produces hormones that appear to compensate for this inflammation.

“There are significant anti-inflammatory components in fat tissue and, if they were strategically unleashed, they could potentially protect obese people from further inflammatory insults, such as a heart attack or stroke. In obese animals, you can see the body compensating in an effort to protect itself,” Freund said.
Not all fat is bad, the researcher noted. The Mediterranean diet, which receives high marks for its health benefits, includes such foods as olive oil; salmon, tuna, sardines, and trout (which contain important omega-3 and omega-6 fatty acids); and plant sources of fat, such as flaxseed.

"Now we'd like to find a way to keep some of the anti-inflammatory, positive effects that develop over time with a high-fat diet while reducing that diet's negative effects, such as high blood glucose and high triglycerides. It's possible that supplementing a high-fat diet with soluble fiber could do that, even delaying the onset of diabetes," Freund said.

This study is one of the first to provide two valuable lessons. The first, already noted, is that soluble fiber has direct anti-inflammatory effects and builds up the immune system. The second is that the amount of soluble fiber necessary to achieve these health benefits is a reasonable, not a pharmacological, amount.

The recommended daily dietary recommendation is 28 to 35 grams of total fiber. Good sources of soluble fiber are oat bran, barley, nuts, seeds, lentils, citrus fruits, apples, strawberries, and carrots.

Insoluble fiber, found in whole wheat and whole-grain products, wheat bran, and green, leafy vegetables, is also valuable for providing bulk and helping food move through the digestive system, but it doesn't provide the boost to the immune system that soluble fiber provides.

The study was published in Brain, Behavior, and Immunity.

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Secret of safe sprout production is very clean seeds

A study using new technology to assess and compare the safety of radish, broccoli, and alfalfa sprouts concludes that the secret to keeping sprouts free of foodborne pathogens lies in industry's intense attention to seed cleanliness.

"Once seeds have germinated, it's too late. Sprouts are extremely complex structures with a forest-like root system that conceals microorganisms. Just a few E. coli cells can grow to a substantial population during germination and sprouting, and it's very difficult to get rid of them all," said Hao Feng, an associate professor of food and bioprocess engineering.

Feng used both the FDA-recommended dose of chlorine to kill microorganisms and a new sanitizer that combines surfactant and organic acid. He used a laser-scanning confocal microscope to look at micro-slices of seed surfaces, then employed computer software to get a three-dimensional view of their surface structure. This allowed him to calculate each seed's surface roughness.

Although E. coli could be eliminated on the alfalfa seeds because of their relatively smooth surface, broccoli and radish seeds have rough surfaces. Their texture renders these rougher seeds more susceptible to the attachment of pathogens and makes microorganisms very difficult to remove, Feng said.

Low doses of irradiation can be successfully used on broccoli and radish seeds, but that treatment risks diminishing sprouts' quality and nutritional value. And sprouts do have immense nutritional value, he noted. Broccoli sprouts have been linked to cancer prevention, while radish sprouts have lots of vitamins A and C.

Feng also found that better results were achieved with broccoli sprouts when the sanitizer is used on small batches rather than large ones.

He assures consumers that sprouts are carefully tested for the presence of pathogens. "When there is one positive result, the entire batch is thrown out."

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A FOOD FOR THOUGHT
Moderate amounts of exercise alone can reduce the inflammation in visceral fat—belly fat, if you will—that has been linked with metabolic syndrome, a group of risk factors that predict heart disease and Type 2 diabetes.

“In our study the benefits of exercise were apparent, even without a change in diet. We saw improvements in insulin sensitivity, less fat in the liver, and less inflammation in belly fat,” said Jeffrey Woods, a professor of kinesiology and community health and faculty member in the Division of Nutritional Sciences and the Integrative Immunology and Behavior Program.

Belly fat is particularly dangerous because it produces inflammatory molecules that enter the bloodstream and increase the risk of heart disease and diabetes, he said.

“Scientists now know that obesity is associated with a low-grade systemic inflammation. Obese people have higher levels of circulating inflammatory markers, such as C-reactive protein (CRP), which are produced and secreted by fat tissue. This inflammation then triggers the systemic diseases linked with metabolic syndrome, such as Type 2 diabetes and heart disease,” Woods said.

Woods and his colleagues examined the effects of diet and exercise on the inflammation of visceral fat tissue in mice. A high-fat diet was first used to induce obesity in the animals. After 6 weeks, mice were assigned to either a sedentary group, an exercise group, a low-fat diet group, or a group that combined a low-fat diet with exercise for 6 or 12 weeks so the scientists could compare the effects in both the short and long term.

“The surprise was that the combination of diet and exercise didn’t yield dramatically different and better results than diet or exercise alone,” said Vicki Vieira, the lead author of the study.

“Unexpectedly, the only significant increase from 6 to 12 weeks in belly fat—the type of fat that triggers these inflammatory diseases—was in the mice that were sedentary, which suggests that exercise is an effective behavioral approach to reduce the accumulation of visceral fat, even when fat in the diet is high,” she said.

Woods says that is a promising finding. “The benefits of exercise were apparent even if the animals were still eating a high-fat diet. That tells me that exercise could decrease or prevent these life-threatening diseases by reducing inflammation even when obesity is still present.”

“The good news is that this was a very modest exercise program. The mice ran on a treadmill only about one-fourth of a mile five days a week. For humans, that would probably translate into walking 30 to 45 minutes a day five days a week,” he noted.

“Even if you struggle with dieting, we believe you can still reduce the likelihood of developing obesity-related inflammatory diseases, such as Type 2 diabetes and...”
heart disease, by adding a modest amount of exercise to your life,” said Woods.

These results were reinforced by the scientists’ study of sedentary older adults published in *Brain, Behavior and Immunity*. In that 10-month study, one group participated in three 45- to 60-minute cardiovascular exercise sessions per week, while another group focused on exercises to improve non-cardiovascular flexibility and balance for 75 minutes twice a week.

“At the end of the study, the ‘cardio’ group had lower levels of CRP, less belly fat, and improved general fitness compared with the ‘flex’ group,” said Ph.D. candidate Vieira.

“The lower CRP levels were partially mediated by the reduction in trunk fat,” she explained.

The mouse study was published in the *American Journal of Physiology, Endocrinology and Metabolism*.

Researchers have developed a test to assess learning and memory in neonatal piglets. As a result, these piglets can provide critical information that could directly benefit human health.

“Inadequate nutrition, stress, and infection leave fingerprints in early brain development that can make a person more vulnerable to behavior disorders later in life,” said Rodney Johnson, professor of animal sciences and director of the Division of Nutritional Sciences.

The use of the pig in neuroscience research is gaining popularity because pigs are anatomically similar to humans, and many of their organ systems grow and develop similarly as well.

“Most important, the pig brain’s growth spurt occurs perinatally—a little before and a little after birth,” Johnson said. “In contrast, in rodents the brain growth spurt occurs after birth, and in some nonhuman primates it occurs before birth, making them less ideal to study and compare to humans.”

The brain’s rapid growth spurt is a critical period, Johnson said.

“We know that if something goes wrong during this developmental period, the brain can be permanently altered,” he said. “We believe that events occurring during this period may underlie some of the behavioral problems that emerge later in life.”

In the study, piglets were weaned from their mothers at 2 days of age and set up with a milk system that delivered 14 small meals a day, mimicking what they’d receive from their mother.

At two weeks of age, piglets were trained to locate a milk reward in an eight-arm radial maze.

“The piglets learned quickly where to find their reward,” Johnson said. “But then we did a reversal learning test; the colored cues were changed, requiring piglets to alter their search strategy. This was more complicated, because the piglets had to extinguish the memory of the first color cue and learn to associate the new color cue with the milk reward. It required a greater cognitive load, but it was one that they learned over time.”

Results of this research were published in *Brain, Behavior, and Immunity*. 

Piglets open doors to studying infant brain development
A high-fat diet during pregnancy may program a woman’s baby for future diabetes, even if she herself is not obese or diabetic, says a new study.

“We found that exposure to a high-fat diet before birth modifies gene expression in the livers of offspring so they are more likely to overproduce glucose, which can cause early insulin resistance and diabetes,” said Yuan-Xiang Pan, a professor of nutrition.

The high-fat diet that caused these changes was a typical Western diet that contained 45 percent fat, which is not at all unusual, Pan said.

“In recent years, the American diet has shifted to include many high-energy, high-fat cafeteria-type and fast foods,” he noted.

Because the epigenetic marks can be easily evaluated, Pan hopes that the study will give doctors a diagnostic tool to screen newborns born with this propensity so they can help children keep blood sugar in a normal range and give them the best chance of avoiding diabetes.

Pan and doctoral student Rita Strakovsky fed obesity-resistant rats either a high-fat or a control diet from the first day of gestation. Because the animals were not obese before the study began, the scientists were able to determine that diet alone had produced these effects.

“At birth, offspring in the high-fat group had blood sugar levels that were twice as high as those in the control group, even though their mothers had normal levels,” Strakovsky said.

The high-fat offspring also had epigenetic modifications to genes that regulate glucose metabolism. One of these modifications, the acetylation of histones, acts by loosening the DNA, making it easier for the gene to be transcribed, she said.

Pan said these epigenetic marks would not be erased easily. However, if people were aware of them, they could change their diet and lifestyle to compensate for their predisposition, delaying or even preventing the development of diabetes.

“We’d like to see if diet after birth could alleviate this problem that was programmed before birth,” he said.

Although their study points to using epigenetics as a diagnostic tool, Strakovsky stressed the importance of making dietary recommendations for pregnant women more available so they are able to prevent this health problem.

“Obstetrics patients rarely see a dietitian unless they’re having medical problems like gestational diabetes or preeclampsia. Doctors now tend to focus on how much weight a woman should gain in a healthy pregnancy. Although healthy weight gain is extremely important, nutritional guidance could be invaluable for all pregnant women and their babies,” she said.

Pregnant women should consume a balanced diet low in saturated fats, which are usually found in fattier cuts of meat, fast foods, pastries, and desserts. But they should also consume appropriate amounts of healthy fats, including good sources of omega-3 and omega-6 fatty acids, which are important for a baby’s brain and neuron development.

Cold-water fish that are low in mercury, flaxseeds and flaxseed oil, soybean and cod liver oils, walnuts, and winter squash are good sources of omega-3 fatty acids. Eggs, corn oil, whole-grain bread, poultry, and sunflower seeds and oil provide omega-6 fatty acids.

“Until now we didn’t realize that a mother’s diet during pregnancy had a long-term effect on the metabolic pathways that affect her child’s glucose production,” Pan said.

“Now that we know this, we urge pregnant women to eat a balanced low-fat diet that follows government guidelines. Then a woman can prime her child for a healthy life instead of future medical struggles.”

The research was published in the Journal of Physiology.
Although both breast-fed and formula-fed babies gain weight, and they seem to develop similarly, scientists have known for a long time that breast milk contains immune-protective components that reduce a breast-fed infant’s risk for all kinds of illnesses. Now researchers have learned more about why.

“For the first time, we can see that breast milk induces genetic pathways that are quite different from those in formula-fed infants. Although formula makers have tried to develop a product that’s as much like breast milk as possible, hundreds of genes were expressed differently in the breast-fed and formula-fed groups,” said Sharon Donovan, a professor of nutrition.

“The intestinal tract of the newborn undergoes marked changes in response to feeding. And the response to human milk exceeds that of formula, suggesting that the bioactive components in breast milk are important in this response,” she noted.

“What we haven’t known is how breast milk protects the infant and particularly how it regulates the development of the intestine.”

Understanding those differences should help formula makers develop a product that is more like the real thing, she said. The scientists hope to develop a signature gene or group of genes to use as a biomarker for breast-fed infants.

Many of the differences found by the scientists were in fundamental genes that regulate the development of the intestine and provide immune defense for the infant.

“An infant’s gut has to adapt very quickly. A new baby is coming out of a sterile environment and starts to become colonized with bacteria, so it’s very important that the gut learns what’s good and what’s bad. But it also needs to recognize that even though a food protein is foreign, that protein is okay, and the body doesn’t want to develop an immune response to it,” Donovan said.

“If anything goes wrong at this stage,” she added, “babies can develop food allergies, inflammatory bowel disease, and even asthma.”
Has your toddler eaten fish today? Food science professor Susan Brewer has two important reasons for including seafood in a young child’s diet, reasons that have motivated her work in developing a tasty, nutritious salmon food for toddlers.

“First, babies need a lot of the omega-3 fatty acids found in fish for brain, nerve, and eye development, and when they switch from breast milk or formula to solid food, most of them don’t get nearly enough,” said Brewer, who is also a registered dietitian.

“Second, children’s food preferences are largely developed by the time they’re five, so I urge parents to help their kids develop a taste for seafood early,” she said.

Fish that are high in omega-3 fatty acids, such as salmon, have huge health benefits and help prevent coronary artery disease, but most adults don’t eat fish twice weekly, as experts recommend. In predisposing children to like fish, parents are doing their kids a big favor, Brewer said.

She knows her recommendations might meet with some resistance. “When we started working on salmon baby food, I thought, Ewww! But the American Heart Association and the American Academy of Pediatrics are solidly behind the idea, and fish-based baby foods, common in Asian markets, have been marketed successfully in the United Kingdom and Italy.”

Brewer experimented with both pink and red salmon, finding that red salmon survives the baby food production process better.

To boost nutrition, in separate experiments she added bone meal and pureed salmon roe (eggs) to her entrees. The first ingredient (made by grinding the bones in the salmon into a powder) provides calcium in a form that is readily available for bone building in children. The second provides high-
quality protein and contains significant quantities of vitamin D and omega-3 fatty acids, particularly docohexaenoic acid (DHA).

“A newborn infant’s brain is 50 percent DHA,” Brewer noted. “However, babies and toddlers have immature livers and can’t synthesize enough DHA to ensure an adequate supply to their developing nerve tissues. If small children are going to get DHA, they must ingest it in their food.”

According to Brewer, the results of her experiments have been encouraging. “Salmon is very mild, and the toddler dinners, which are 27 percent meat or fish, don’t taste or smell fishy at all.”

Besides, could 107 parents of preschoolers be wrong? In a recent sensory panel conducted in the scientist’s lab, parents found little difference in taste between formulations that contained roe or bone meal and those that didn’t. Eight in 10 of the parent panelists—even those who don’t eat salmon themselves—said they would offer the fish product to their children after tasting it.

“It’s not enough for mothers to know that toddlers need fish in their diets. They won’t buy a product unless it also appeals to the eye and the taste buds,” Brewer said.

The study was published in the Journal of Food Science.

ew parents have one more reason to pay attention to the oral health of their toothless babies. A study has confirmed the presence of bacteria associated with early childhood caries (ECC) in infant saliva.

ECC is a virulent form of caries, more commonly known as tooth decay, or a cavity. Cavities are the most prevalent infectious disease in U.S. children, according to the Centers for Disease Control and Prevention.

“By the time children reach kindergarten, 40 percent have dental cavities,” said Kelly Swanson, lead researcher and professor of animal science. “In addition, populations who are of low socioeconomic status, who consume a diet high in sugar, and whose mothers have low education levels have a much higher risk of disease.”

Swanson studied infants before teeth erupted, whereas most previous studies have focused on children in preschool or kindergarten—after many already have cavities.

“Can oral care for babies prevent future cavities?”

“We now recognize that the ‘window of infectivity’ occurs at a young age, long before all of the teeth are in the mouth,” he said. “Minimizing snacks and drinks with fermentable sugars and wiping the gums of babies without teeth, as suggested by the American Academy of Pediatric Dentistry, are important practices for new parents to follow to help prevent future cavities.”

Swanson’s team used high-throughput molecular techniques to characterize the entire community of oral microbiota, rather than focusing on identifying a few individual bacteria. Researchers learned that the oral bacterial community in infants without teeth was much more diverse than expected, and they identified hundreds of species.

“Improved DNA technologies allow us to examine the whole population of bacteria, which gives us a more holistic perspective,” Swanson said. “Like many other diseases, dental cavities are a result of many bacteria in a community, not just one pathogen.”

The study was published in PLoS ONE.
Scientists believe that carotenoids—the pigments that give the red, yellow, and orange colors to some fruits and vegetables—provide the cancer-preventive benefits in tomatoes. But how?

To find out, researchers used isotopic labeling on three tomato carotenoids with carbon atoms heavier than are commonly seen in nature, which will allow tracking of the tomato components’ absorption and metabolism in the body.

“We wanted to know, are the carotenoids themselves bioactive, or are their metabolic or oxidative products responsible for their benefits? And is lycopene alone responsible for the tomato’s benefits, or are other carotenoids also important?” said John W. Erdman, a professor of food science and human nutrition.

Previous animal studies from Erdman’s laboratory have shown that whole tomato powder, which contains all of the fruit’s nutritional components, is more effective against prostate cancer than lycopene alone.

“Lycopene, which gives the fruit its red color, has received a lot of attention—it’s even advertised as an ingredient in multivitamin supplements—but two little-known colorless carotenoids, phytoene and phytofluene, probably also have benefits,” said Nancy Engelmann Moran, a postdoctoral researcher in Erdman’s lab who helped develop the new method.

Engelmann Moran learned to optimize the amount of carotenoids in tomato cell cultures by treating already high-achieving tomato varieties with two plant enzyme blockers. The best performers were chosen for culturing and carbon-13 labeling, she said.

The scientists grew tomato cells with nonradioactive carbon-13 sugars, yielding carbon molecules that are heavier than the 12-carbon molecules that exist elsewhere, Erdman said.

“These heavy carbon molecules are then incorporated into the carotenoids in the tomato cell cultures. The result is that researchers will be able to track the activity of lycopene, phytoene, and phytofluene and their metabolites,” he said.

“It’s exciting that we now have the means to pull off this human study,” said Erdman. “It’s work that should move us forward in the fight against prostate cancer.”

The research was published in the Journal of Agricultural and Food Chemistry.
Sprouts? Supplements? Team up to boost broccoli’s cancer-fighting power

A recent study provides convincing evidence that the way you prepare and consume your broccoli matters. The results also suggest that teaming broccoli or broccoli supplements with broccoli sprouts may make the vegetable’s anticancer effect almost twice as powerful.

“Broccoli, prepared correctly, is an extremely potent cancer-fighting agent—three to five servings a week are enough to have an effect. To get broccoli’s benefits, though, the enzyme myrosinase has to be present; if it’s not there, sulforaphane, broccoli’s cancer-preventive and anti-inflammatory component, is not released,” said Elizabeth Jeffery, a professor of nutrition.

According to Jeffery, many people destroy myrosinase by overcooking their broccoli. And health-conscious consumers who use broccoli powder supplements in recipes to boost their nutrition are also missing out. These supplements often do not contain this necessary enzyme, she said.

Because broccoli sprouts contain myrosinase in abundance, Jeffery and researcher Jenna Cramer hypothesized that myrosinase from the sprouts would enhance sulforaphane formation and absorption from broccoli powder if the two were eaten together.

In a small pilot study, they recruited four healthy men who ate meals that contained broccoli sprouts alone, broccoli powder alone, or a combination of the two. After the men ate, the researchers measured the levels of sulforaphane metabolites in their blood and urine.

“We were looking at biomarkers—plasma and urine levels—that are associated with cancer prevention,” Cramer said.

Three hours after eating, a definite synergistic effect was noted between the powder and the sprouts.

“We saw almost a two-fold increase in sulforaphane absorption when sprouts and powder were eaten together. It changed the way the subjects metabolized the powder. We saw plasma and urine metabolites much earlier and at much higher levels than when either was eaten alone,” Jeffery said.

This finding indicates that myrosinase from the broccoli sprouts released sulforaphane not only from the sprouts but also from the precursor present in the broccoli powder, she said.

So don’t overcook your broccoli, Jeffery advises. “Steaming broccoli for two to four minutes is the perfect way to protect both the enzyme and the vegetable’s nutrients.” She added that teaming fresh broccoli with a spicy food that contains myrosinase significantly enhances each food’s individual cancer-fighting power and ensures that absorption takes place in the upper part of the digestive system, providing the maximum health benefit.

“To get this effect, spice up your broccoli with broccoli sprouts, mustard, horseradish, or wasabi. The spicier, the better; that means it’s being effective,” she said.

The sprouts research was published as two studies, one in *Nutrition and Cancer* and the other in the *British Journal of Nutrition*.

Growers can boost benefits of broccoli and tomatoes

Researchers John Erdman and Elizabeth Jeffery collaborated to demonstrate that agronomic practices can greatly increase the cancer-preventive phytochemicals in broccoli and tomatoes.

“We enriched preharvest broccoli with different bioactive components, then assessed the levels of cancer-fighting enzymes in rats that ate powders made from these crops,” said Jeffery.

The highest levels of detoxifying enzymes were found in rats that ate selenium-treated broccoli. The amount of one of broccoli’s cancer-fighting compounds was six times higher in selenium-enriched broccoli than in standard broccoli powder, she said.

Selenium-treated broccoli was also most active in the liver, reaching a level of bioactivity that exceeded the other foods used in the experiment.

“Our bodies need a certain amount of selenium, but many areas of the world, including parts of the United States and vast areas of China, have very little selenium in the soil,” said co-researcher Sonja Volker.

“Not only could selenium in broccoli deliver this necessary mineral, it also appears to rev up the vegetable’s cancer-fighting power,” she added.

Erdman and Jeffery along with Volker and Ann Liu are experimenting with ways to increase the bioactive components in broccoli and tomatoes in order to test the efficacy of enriched versions of the foods in a new prostate cancer study.

Rats were fed diets with food powders containing 10 percent of either standard broccoli; standard tomato; lycopene-enriched tomato; tomato enriched with lycopene and other carotenoids; broccoli sprouts (which contain very high levels of cancer-fighting compounds); or broccoli grown on soil treated with selenium.

The scientists found that greater amounts of bioactive components in the food powders translated into increased levels of the compounds in body tissue and increased bioactivity in the animals.

Carotenoid-enriched tomatoes produced more bioactivity in the liver than lycopene-enriched or standard tomatoes, yielding the most cancer-preventive benefits.
Several U of I scientists have teamed up to examine the factors that contribute to childhood obesity, because the problem is too complex for any of them to tackle alone.

“Our Strong Kids team members are looking at such diverse factors as genetic predisposition, the effect of breastfeeding, how much TV a child watches, and the neighborhood he or she lives in, among many others,” said Kristen Harrison of the Division of Nutritional Sciences. “It seems like the answer should be simple—just eat less and exercise more—but when you look at the reasons that kids overeat and burn fewer calories, it turns out there are a lot of them.”

The scientists have collected and analyzed two rounds of data on approximately 400 families, and they are beginning a third wave of data collection. The team’s “Six Cs” model will examine the problem of childhood obesity from the angles of cell, child, clan (or family), community, country, and culture. A paper detailing their approach appeared in Child Development Perspectives.

“From 30 to 40 percent of individuals have a variety of genetic markers that put them at greater risk for obesity,” said professor of nutrition Margarita Teran-Garcia. “We still need to know more about how this genetic predisposition interacts with the environment to place someone at higher or lower risk for developing obesity and obesity-related diseases.”

Teran-Garcia is approaching the problem at the cellular level. As a starting point,
she is taking saliva samples from preschool-ers in the study group to map their genetic susceptibility to obesity.

Child development professor Kelly Bost is looking at the quality of parent–child attachment. “There’s evidence that insecure attachment predicts more TV exposure, more consumption of unhealthful foods, and other factors leading to greater obesity,” she said.

Another kinesiology and community health professor, Diana Grigsby-Toussaint, is geomapping retail environments in the neighborhoods where the participating families live, looking in detail at what foods are available there. “She’s also mapping how much green space is available and how that relates to outdoor play and activity,” Harrison said.

Later work will add more puzzle pieces relating to the community and culture components. For example, what is the community’s average BMI (body mass index, a measure of body fat), and do participants believe that BMI is normal? What’s the usual portion size in this culture? Are children urged to take second and third helpings at mealtime?

“Southern U.S. culture, Latin American culture, and the Sam’s Club bulk-buying phenomenon are all elements of what we’re trying to capture when we talk about culture,” Harrison said.

“Childhood obesity is a puzzle, and at different stages, certain variables drop in or out of the picture,” she added. “Breastfeeding versus formula feeding is a predictor, but it drops out of the model entirely when you get past babyhood. Vending machines in schools are important later in a child’s life, but they weren’t important in earlier years.”

There has been very little transdisciplinary effort to map out how all these factors work together, Harrison noted, although research has shown that no single factor is the most important.

Why do some Mexican parents discourage teens’ physical activity?

Imagine this scene: A teen who is about to enter college goes for a run or heads off for a game of soccer. But Mom and Dad complain about it, and the more physically active the teen is, the more the parents push back.

“This scenario is a variation on an often-heard complaint among students in Mexico,” said Angela Wiley, co-author of a survey of Mexican college applicants that suggests these attitudes and experiences may be rooted in cultural beliefs and expectations.

“In Mexico, where there are very high rates of obesity and diabetes, we’d expect parents to encourage their teens to be active, but this study tells us the opposite is often true, at least for college-bound students,” she added.

Wiley and other faculty members formed a collaboration called Up Amigos (derived from the Universities of San Luis Potosí and Illinois: A Multidisciplinary Investigation on Genetics, Obesity, and Socio-Environmental Factors). The researchers were given access to data from college applicants’ physical exams and were asked to formulate questions for the surveys that aspiring students complete. Each year since 2008, Up Amigos has received new data, and Wiley took the lead in publishing some initial findings in the Journal of Adolescent Health.

In the study, almost 4,000 16- to 25-year-old applicants to the University of San Luis Potosí answered questions about themselves, their parents’ perceived physical activity, and their family’s influence on exercise and fitness. Because students in Mexico usually live at home while attending college, family influence may be a bigger factor than it would be in other countries.

Of the students in this pilot study, 61 percent reported being physically active, although only about 40 percent reported having physically active parents.

“If the teens believed their parents were active, they too were likely to enjoy and participate in various forms of exercise. The surprise was that we expected to find parents supporting their sons’ and daughters’ physical activity. Instead physically active applicants reported more conflict about exercise at home,” Wiley said.
If you’ve been trying to lose weight and suspect your body is working against you, you may be right.

“When obese persons reduce their food intake too drastically, their bodies appear to resist their weight loss efforts. They may have to work harder and go slower in order to out-smart their brain chemistry,” said Gregory G. Freund, a professor in the U of I College of Medicine and a member of the university’s Division of Nutritional Sciences.

He particularly cautions against beginning a diet with a fast or cleansing day, which appears to trigger significant alterations in the immune system that work against weight loss. “Take smaller steps to start your weight loss and keep it going,” he said.

The scientist compared the effects of a short-term fast on two groups of mice. For 12 weeks, one group consumed a low-fat diet (10 percent of calories from fat); the other group was fed a high-fat diet (60 percent of calories from fat) and became obese. After the 12 weeks, the mice were fasted for 24 hours. In that time, the leaner mice lost 18 percent of their body weight, compared with 5 percent for the obese mice.

Freund said that there is an immune component to weight loss that has not been recognized. “Our data show that fasting induces an anti-inflammatory effect on a lean animal’s neuroimmune system, and that effect is inhibited by a high-fat diet. Some of the brain-based chemical changes that occur in a lean animal simply don’t occur in an obese animal,” he said.

This breakdown occurs because obese animals resist downregulation of genes that activate the interleukin-1 system and associated anti-inflammatory cytokines, Freund said.

The scientist also studied differences in the behavior of the two groups of mice, mon-
itoring how much they moved, administering tests to discern the animals’ ability to learn and remember, and noting whether the mice exhibited signs of depression or anxiety.

He particularly cautions against beginning a diet with a fast or cleansing day, which appears to trigger significant alterations in the immune system that work against weight loss.

The results suggest that beginning a diet with a fast or near-fast may alter brain chemistry in a way that adversely affects mood and motivation, undermining the person’s weight-loss efforts.

“The obese mice simply didn’t move as much as the other mice. Not only was there reduced locomotion generally, they didn’t burrow in the way that mice normally do, and that’s associated with depression and anxiety,” he said.

Beginning a weight-loss program in a depressed frame of mind and with decreased motivation doesn’t bode well for the diet’s success, Freund noted.

The research was published in Obesity.

Study shows hunger hitting close to home

A study on hunger entitled “Map the Meal Gap” was the first to identify the county-level distribution of over 50 million food-insecure Americans. “Until now, we could only compare the data by state,” said Craig Gundersen, professor of agricultural and consumer economics and executive director of the National Soybean Research Laboratory, who led the data analysis on the project. “Having this data by county has the potential to redefine the way service providers and policy makers address areas of need.”

Gundersen explained that the term “meal gap” represents the additional number of meals a given food-insecure population requires annually to meet their food needs. Nationally the average cost of a meal is $2.54. The study shows that the shortfall in meals represents an estimated $21.3 billion annually.

“Per person this is only about $56 more each month on average to address the shortages in their food budget,” Gundersen said.

There are 44 counties in the United States that fall into the top 10 percent categories for both food insecurity and food prices. “These counties struggle with multiple stressors, including high food insecurity, high poverty, high unemployment, and above-average food costs,” Gundersen said.

A summary of the findings, an interactive map of the United States showing data for each county, and the full report are available at www.feedingamerica.org.

The executive summary of the report describes how Latinos and American Indians are disproportionately affected by high rates of hunger and high food prices.

“In order to address the problem of hunger in our communities, we have to understand it,” Gundersen said. “The results from Map the Meal Gap will help researchers to better identify the populations and develop strategies to reach those who are most in need of food assistance.”
Researcher Elvira de Mejia has found a promising new weapon for treating metastatic colon cancer, particularly in patients who have developed resistance to chemotherapy. The soy peptide lunasin binds to a specific receptor in highly metastatic colon cancer cells, preventing them from attaching to the liver.

“When lunasin was used in combination with the chemotherapy drug oxaliplatin, we saw a sixfold reduction in the number of new tumor sites,” said de Mejia, an associate professor of food chemistry and food toxicology.

According to de Mejia, almost all colon cancer deaths are caused when cancer metastasizes, or spreads, to the liver. Until now chemotherapy has targeted the primary tumor because the process of metastasis is not well understood.

De Mejia learned that lunasin can penetrate the cancer cell, cause cell death, and interact with at least one type of receptor in a cell that is ready to metastasize. When that receptor is blocked, new blood vessels can’t form and differentiate, and that prevents cancer from spreading. Binding such receptors has emerged as a promising target for developing cancer therapies.

In the study, which mimicked the spread of colon cancer in humans, mice were separated into four groups: a control group; a group that was injected daily with lunasin; a group injected with the chemo drug oxaliplatin; and a group that received both lunasin and oxaliplatin. After 28 days, the mice were examined to learn the extent of cancer’s involvement in the liver.

“The group that received lunasin alone had 50 percent fewer metastatic sites. But an even more exciting result was seen in the group that received both lunasin and the chemotherapy drug—only 5 new cancer sites, compared with 28 in the control group,” de Mejia noted.

This significant reduction in metastasis was achieved with the amount of lunasin in only 25 daily grams of soy protein, the amount recommended in the FDA health claim.

The study was published in Cancer Letters.
Personalized gene therapies may increase survival in brain cancer patients

Personalized prognostic tools and gene-based therapies may improve the survival and quality of life of patients suffering from glioblastoma, an aggressive and deadly form of brain cancer.

“We confirmed known biomarkers of glioblastoma survival and discovered new general and clinical-dependent gene profiles,” said Nicola Serao, a Ph.D. candidate in animal sciences. “We were able to compare biomarkers across three glioblastoma phases that helped us gain insight into the roles of genes associated with cancer survival.”

Using information from more than 22,000 genes, Serao began painstakingly slicing away at the collection, one gene at a time, until he ended up with a group of genes related to brain cancer. He studied different variables, including the lengths of time from birth to death, from diagnosis to death, and from diagnosis to progression of the cancer.

The study also took into consideration clinical factors such as age, race, and gender.

“Our research suggests you can’t treat all patients the same,” Serao said. “For example, we found gene expression patterns that have different, and sometimes opposite, relationships with survival in males and females and concluded that treatments affecting these genes will not be equally effective. Personalizing therapy according to gender, race, and age is something that is possible today with our advanced genomic tools.”

Sandra Rodriguez-Zas, co-researcher and professor of animal science and bioinformatics, said they also looked at commonalities between the genes linked to glioblastoma survival and progression.

“If a large number of genes linked to survival belong to a particular pathway, this pathway is considered enriched,” Rodriguez-Zas said. “Depending on whether the pathway and genes have tumor suppressor or oncogenic characteristics, we should be able to use that information to support or attack that pathway with targeted therapies.”

The study was published in *BMC Medical Genomics.*

Compounds in mate tea induce death in colon cancer cells

Could preventing colon cancer be as simple as developing a taste for yerba mate tea? Researcher Elvira de Mejia showed that human colon cancer cells die when they are exposed to bioactive compounds present in one cup of this brew, which has long been consumed in South America for its medicinal properties.

“The caffeine derivatives in mate tea not only induced death in human colon cancer cells, they also reduced important markers of inflammation,” de Mejia said. “That’s important because inflammation can trigger the steps of cancer progression.”

In the in vitro study, human colon cancer cells were treated with caffeoylquinic acid (CQA) derivatives isolated from mate tea. As the CQA concentration was increased, cancer cells died as a result of apoptosis.

“Put simply, the cancer cell self-destructs because its DNA has been damaged,” de Mejia said.

She noted that the ability to induce apoptosis, or cell death, is a promising tactic for therapeutic interventions in all types of cancer.

The results of the study strongly suggest that the caffeine derivatives in mate tea have potential as anticancer agents and could also be helpful in other diseases associated with inflammation, she said.

But, because the colon and its microflora play a major role in the absorption and metabolism of caffeine-related compounds, the anti-inflammatory and anticancer effects of mate tea may be most useful in the colon.

“We believe there’s ample evidence to support drinking mate tea for its bioactive benefits, especially if you have reason to be concerned about colon cancer. Mate tea bags are available in health food stores and are increasingly available in large supermarkets,” de Mejia added.

This in vitro study was published in *Molecular Nutrition and Food Research.*
College of ACES scientists have learned to mask the bitterness of ginseng, a common ingredient of energy drinks.

"Consumers like to see ginseng on a product’s ingredient list because studies show that it improves memory, boosts immunity, and alleviates diabetes. But the very compounds that make ginseng good for you also make it taste bitter," said Soo- Yeun Lee, an associate professor of food science and human nutrition.

In an earlier study, Lee and professor of food chemistry Shelly J. Schmidt found that ginseng contributes more to the perception of bitterness in energy drinks than does caffeine, an indispensable component of these beverages and the very compound that sensory scientists use as their reference for bitter perception.

"Ginseng has over 30 bitter compounds, and scientists still don’t know which compound or group of compounds is responsible for the bitter taste," Lee said.

While experimenting with five possible solutions to ginseng’s bitterness problem, the researchers discovered that cyclodextrins—hydrophobic compounds made of glucose molecules that occur in a ring form—were able to capture the bitter flavor compounds and reduce bitterness by more than half.

Lauren Tamamoto, a graduate student who worked on the study, assembled a group of 13 nonsmokers who also lacked allergies that would affect their perception of bitterness. Panelists had to be able to detect a chemical called 6-n-propyl-2-thiouracil (PROP) on a piece of filter paper (some people can, some people can’t) and pass basic taste tests for sweet, sour, bitter, and salty perceptions. They then participated in 12 training sessions and taste-tested 84 samples, rating each on a 16-point scale.

The researchers used the panelists to test these potentially effective bitterness-reducing treatments:

- adding a related complementary flavor (in this case, citrus) as a sensory distraction
- incorporating a bitterness blocking agent that neutralizes the taste buds
- using ingredient interaction (the scientists added large amounts of taurine because research indicated that it might be useful in blocking bitterness)
- utilizing an enzyme that would break down the peptide bonds of bitter components
- experimenting with complexation, or the use of cyclodextrins to form inclusion complexes with the bitter compounds, which masks the bitter taste

"Cyclodextrins were by far the most effective in reducing the bitterness of ginseng solutions. We also found that gamma-cyclodextrins were more successful than beta-cyclodextrins and were more cost-effective," Schmidt said.

These compounds have been used to mask bitterness before, but not at the level of ginseng used in a typical energy drink, she said.

Lee and Schmidt intend to continue studying ginseng’s bitterness compounds to learn which are most responsible for producing objectionable flavors and to gain insight into exactly how these compounds interact with cyclodextrins.

That knowledge would facilitate the use of ginseng as a functional ingredient in energy drinks and allow manufacturers to add health benefits to the beverages beyond general nutrition and the calories they provide, Lee said.

"The U.S. energy drink industry is expected to reach $19.7 billion in sales by 2013, even though these beverages often have a medicinal taste because of their functional ingredients. The creation of more palatable products will help manufacturers to expand this market even farther.

"But, beyond that, this new method for masking bitterness in ginseng gives food scientists an opportunity to improve the health of consumers," Lee said.

The study was published in the Journal of Food Science.
Children who have asthma are at high risk for separation anxiety, but there is a home remedy that parents can use—regular family mealtimes.

“It makes sense that children who have difficulty breathing might be anxious and prefer to keep their parents, who can help them in an emergency, close by,” said Barbara H. Fiese, a professor of human and community development and director of the university’s Family Resiliency Center.

Fiese and her colleagues had two guiding questions going into the study. First, is children's asthma severity, as measured by pulmonary testing and by reported asthma symptoms, related to the development of separation anxiety symptoms? Second, can family interaction patterns mediate this relationship? They found that the answer to both questions is yes.

“In this study, we identified one important practice that makes a difference. Supportive interaction during family mealtimes helps increase a child’s sense of security and eases separation anxiety symptoms. And when children are less anxious, their lung function improves,” Fiese said.

In the six-week study, 63 9- to 12-year-old children with persistent asthma completed questionnaires and were interviewed about their physical and mental health, including an assessment of separation anxiety. Within one week, a family meal was then recorded on video. The children’s medication use was monitored electronically throughout the study.

The researchers found a relatively strong relationship between compromised lung function and symptoms of separation anxiety.

“But, interestingly, we could also see that these intense feelings of concern were related to how the family interacted at mealtime. When children had separation anxiety, their mealtimes were characterized by withdrawal, a lack of engagement, and low levels of communication,” Fiese said.

Conversely, family mealtimes that were organized, featured assigned roles, and generated involvement among participants were a protective factor for children.

Why are shared family mealtimes so important? “Few other family activities are repeated with such regularity, allowing children to build up expectations about how their parents and siblings will react from day to day. As a result, kids develop a sense of security. They know someone is there for them. That’s important for a child who feels vulnerable,” Fiese said.

The repetitive nature of mealtimes allows parents of children with a chronic health condition to regularly check on their symptoms, quickly remind them to take medications, and plan ahead for the next day’s events, she said.

The study was published in the Journal of Child Psychology and Psychiatry.
Research has shown berries to be very nutritious, but do the people who eat them perceive these health benefits? This may seem like a question that would be easy to answer, but according to rural sociologist Courtney Flint, it’s actually complicated to study and to measure, particularly when the people eating the berries live in remote locations in Alaska—Seldovia, Akutan, and Point Hope.

“All the science in the world can talk about a particular food as having nutritious properties, but if it’s not perceived that way, people may not include it in their regular diet, particularly with the increasing prevalence of modern processed foods,” Flint said.

Flint was a researcher on a multifaceted project, along with professor emerita Mary Ann Lila, that examined how people in three Alaskan communities perceive the benefits of wild berries. A large part of Flint’s contribution was to develop methods that involved local people, and youth in particular, in the research.

The project highlighted the berries as important for community wellness—for traditional reasons including sharing, maintaining cultural values, and doing activities outdoors with family and friends—and for perceived health reasons such as vitamins, balanced diet, and freshness. Far less well known by local residents were the berries’ health benefits related to diabetes, obesity, and cardiovascular health.

“Given that remote Alaska Native communities are grappling with major socioeconomic and environmental changes and associated vulnerabilities, having such a nutritious and valued traditional resource right out their back door during the summertime is a great asset,” Flint said. Young people in the communities valued the knowledge of elders who promote locally available and healthy food as a part of everyday life.

Flint hopes that the methods she developed to engage community youth in collecting data for this project will be used in future studies with rural sociology components.

One testimony to the trust Flint was able to cultivate is that an elder in Point Hope gave her an Inupiaq name, which is a rare occurrence. Flint received the name “Aqpik,” or “salmonberry.”
here can you find chocolate goat cheese truffles, organic okra, and Ginger Gold apples all in the same place? The answer is www.foodmarketmaker.com, an online nationwide marketing resource developed at the University of Illinois in 2004 to assist livestock farmers with marketing strategies for value-added meat products. It has grown into a tool that can benefit everyone in the food supply chain, including processors, distributors, retailers, and consumers looking for unique food products.

Each state has its own unique site, but all sites access a common database, which allows users to conduct multistate searches. MarketMaker’s interactive mapping capabilities let users easily see the locations of all businesses.

MarketMaker has helped link producers and educational institutions, giving farmers access to new markets. This helps diversify the producers’ markets while students reap the benefits of healthy, flavorful, local foods. “MarketMaker continues to grow and is a work in progress,” said the site coordinator Dar Knipe. “We are adding new states every year and are looking to diversify into more sectors such as horticulture, the timber industry, and agritourism.”

The vision of MarketMaker’s organizers is to provide all food producers, processors, wholesalers, and retailers electronic access to geographically referenced data. The platform enhances the opportunity for food and agricultural entrepreneurs to identify and develop new and profitable markets and improve the efficiency and profitability of food systems in the United States and, eventually, globally.
New treatments for intestinal failure and other disorders of intestinal absorption are a step closer to the patients who need them after a discovery in Kelly Tappenden’s laboratory.

“There are so few therapies for persons with these illnesses, many of them premature babies. Surgery may save a patient’s life, but with so much intestine removed, they’re unable to digest and absorb nutrients. They have to rely totally on intravenous feeding, which really reduces their quality of life,” said Tappenden, a professor of nutrition and gastrointestinal physiology.

Years of research in her lab show that butyrate, a short-chain fatty acid, helps intestine grow and become more functional.

“To develop effective treatments, though, we needed to understand why butyrate has this effect. Now we understand the mechanism behind it.”

According to Tappenden, butyrate increases the creation of intestinal cells. But, beyond that, it fortifies these new cells, preparing them to be more functional by increasing the transcription of a protein called GLUT2 that plays an important role in intestinal function by transporting sugars into the body.

“It’s actually a double hit in terms of benefits. Not only does butyrate cause the intestine to grow in size, but it increases the number of functional proteins in the cells that are made. Those cells transport more nutrients, thereby reducing the amount of intravenous nutrients needed by these patients,” she said.

Knowing how all this works is really important for strategizing and fine-tuning therapies for intestinal absorption disorders, said Tappenden.

“Right now, butyrate is not available in the bags of nutrients used for intravenous feeding. But our research tells us that we should at least be encouraging patients to consume more carbohydrates and dietary fiber, because intestinal bacteria use these nutrients to make butyrate.”

To learn more about butyrate’s action at the cellular level, Tappenden isolated human colon cancer cells (Caco2-BBe cells), which behave very much like cells from the small intestine.

“We transfected the promoter portion of the GLUT2 gene in these small intestinallike cells and then exposed them to a variety of short-chain fatty acids—a cocktail of acetate, propionate, and butyrate—as well as to each of them individually. Then we watched to see which of them would start manufacturing GLUT2, expecting to see that butyrate alone was responsible,” she said.

Sure enough, butyrate alone turned on the promoter responsible for making the GLUT2 intestinal transporter.

“This gives us insight into the cellular mechanisms whereby butyrate could really help people with intestinal failure;” she said. “Why? Because it’s increasing this important protein that causes the intestine to absorb more nutrients.”

The study was published in the Journal of Parenteral and Enteral Nutrition.
Certain omega-3 fatty acid is necessary to construct the arch that turns a round, immature sperm cell into a pointy-headed super swimmer with an extra long tail, according to a study conducted by Manabu Nakamura, associate professor of biochemical and molecular nutrition.

“Normal sperm cells contain an arclike structure called the acrosome that is critical in fertilization because it houses, organizes, and concentrates a variety of enzymes that sperm use to fertilize an egg,” Nakamura said.

The study shows for the first time that docosahexaenoic acid (DHA) is essential in fusing the building blocks of the acrosome together.

“Without DHA, this vital structure doesn’t form, and sperm cells don’t work,” said doctoral student Timothy Abbott, who co-authored the study. The male mice that lacked DHA were basically infertile, he said.

But when DHA was introduced into the mice’s diet, fertility was completely restored. “It was very striking. When we fed the mice DHA, all these abnormalities were prevented,” Abbott said.

Men concerned about their fertility may wonder what foods contain DHA. Marine fish, such as salmon and tuna, are excellent sources of this omega-3 fatty acid.

Nakamura finds the role DHA plays in membrane fusion particularly exciting. Because DHA is abundant in specific tissues, including the brain and the retina as well as the testes, the scientists believe their research findings could also impact research relating to brain function and vision.

The study was published in Biology of Reproduction.
No-Fuss Cupcakes

1 2-layer boxed cake mix
6 ounces silken tofu
water according to cake mix directions
2 eggs*

1. Preheat the oven according to cake mix directions. Line muffin tins with 24 paper cupcake liners.

2. Put into a blender the silken tofu and half the water called for in the cake mix directions; blend until smooth.

3. In a large mixing bowl, use an electric mixer at low speed to beat together the cake mix, tofu mixture, eggs, and remaining water. When combined, increase speed to medium and beat 2 minutes more.

4. Pour the batter into the prepared muffin cups, filling each about two-thirds full. Bake according to the directions on the cake mix box.

5. When cupcakes are completely cool, frost with your favorite recipe for icing.

*Tofu replaces all of the oil and one of the eggs or egg whites normally called for to prepare a cake mix. If the mix directions call for three eggs, use two eggs; if they call for three egg whites, use two egg whites.

Makes 24 cupcakes. Per cupcake: 100 calories, 2 g protein, 17 g carbohydrate, 3 g fat (0.5 g saturated), 0 g dietary fiber.