Tragedy and Hope
The Third International Soy Symposium – Part I

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"Each year, research on the health effects of soy and soybean components seems to increase exponentially.... Furthermore, research is not just expanding in the primary areas under investigation, such as cancer, heart disease and osteoporosis; new findings suggest that soy has potential benefits that may be more extensive than previously thought." So writes Mark Messina, PhD, General Chairperson of the Third International Soy Symposium, held in Washington, DC in November of 1999.[1]

For four days, well-funded scientists who had gathered in Washington made presentations to an admiring press and to their sponsors – United Soybean Board, American Soybean Association, Monsanto, Protein Technologies International, Central Soya, Cargill Foods, Personal Products Company, SoyLife, Whitehall-Robins Healthcare and the soybean councils of Illinois, Indiana, Kentucky, Michigan, Minnesota, Nebraska, Ohio and South Dakota.

The symposium marked the apogee of a decade-long marketing campaign to gain consumer acceptance of tofu, soy milk, soy ice cream, soy cheese, soy sausage and soy derivatives, particularly soy isoflavones such as genistein and diadzen, the estrogen-like compounds found in soybeans. It coincided with an FDA decision, announced October 25, to allow a health claim for products "low in saturated fat and cholesterol" that contain 6.25 grams of soy protein per serving. Breakfast cereals, baked goods, convenience food, smoothie mixes and meat substitutes could now be sold with labels touting benefits to cardiovascular health as long as these products contained one heaping teaspoon of soy protein per 100-gram serving

Marketing the Perfect Food

"Just imagine you could grow the perfect food. This food not only would provide affordable nutrition, but also would be delicious and easy to prepare in a variety of ways. It would be a healthful food, with no saturated fat. In fact, you would be growing a virtual fountain of youth on your back forty." The author is Dean Houghton, writing for *The Furrow*,[2] a magazine published in 12 languages by the John Deere tractor company. "This ideal food would help prevent, and perhaps reverse, some of the world's most dreaded diseases. You could grow this miracle crop in a variety of soils and climates. Its cultivation would build up, not deplete, the land...this miracle food already exists.... It's called soy."

Just imagine. Farmers have been imagining...and planting more soy. What was once a minor crop, listed in the 1913 USDA handbook not as a food but as an industrial product, now covers 72 million acres of American farmland. Much of this harvest will be used to feed chickens, turkeys, pigs, cows and salmon. Another large fraction will be squeezed to produce oil for margarine, shortenings and salad dressings.

Advances in technology make it possible to produce isolated soy protein from what was once considered a waste product – the defatted, high-protein soy chips – and then transform something that looks and smells terrible into products that can be consumed by humans. Flavorings, preservatives, sweeteners, emulsifiers and synthetic nutrients have turned soy protein isolate, the food processors' ugly duckling, into a New Age Cinderella.

Lately, this new fairy-tale food has been marketed not so much for her beauty as for her virtues. Early on, products based on soy protein isolate were sold as extenders and meat substitutes, a strategy that failed to produce the requisite consumer demand. The industry changed its approach. "The quickest way to gain product acceptability in the less affluent society," said an industry spokesman, "...is to have the product consumed on its own merit in a more affluent society."[3] So soy is now sold to the upscale consumer, not as a cheap poverty food, but as a miracle substance that will prevent heart disease and cancer, whisk away hot flashes, build strong bones and keep us forever young. The competition – meat, milk, cheese, butter and eggs – has been duly demonized by the appropriate government agencies. Soy serves as meat and milk for a new generation of politically correct vegetarians.

Marketing costs money, especially when it needs to be bolstered with "research," but there's plenty of funds available. All soybean producers pay a mandatory assessment of one-half to one percent of the net market price of soybeans. The total – something like 80 million dollars annually[4] – supports United Soybean's program to "strengthen the position of soybeans in the market place and maintain and expand domestic and foreign markets for uses for soybeans and soybean products." State soybean councils from Maryland, Nebraska, Delaware, Arkansas, Virginia, North Dakota and Michigan provide another two and one-half million dollars for "research."[5] Private companies like Archer Daniels Midland also contribute their share. ADM spent $4.7 million for advertising on "Meet the Press" and $4.3 million on "Face the Nation" during the course of a year.[6] Public relations firms help convert research projects into newspaper articles and advertising copy; law firms lobby for favorable government regulations; IMF money funds soy processing plants in foreign countries; and free trade policies keep soybean abundance flowing to overseas destinations.

The push for more soy has been relentless and global in its reach. Soy protein is now found in most supermarket breads. It is being used to transform "the humble tortilla, Mexico's corn-based staple food, into a protein-fortified 'super-tortilla' that would give a nutritional boost to the nearly 20 million Mexicans who live in extreme poverty."[7] Advertising for a new soy-enriched loaf from Allied Bakeries in Britain targets menopausal women seeking relief from hot flashes. Sales are running at a quarter of a million loaves per week.[8]

The soy industry hired Norman Robert Associates, a public relations firm, to "get more soy products onto school menus."[9] The USDA responded with a proposal to scrap the 30% limit for soy in school lunches. The NuMenu

program would allow unlimited use of soy in student meals. With soy added to hamburgers, tacos and lasagna, dieticians can get the total fat content below 30% of calories, thereby conforming to government dictates. "With the soy-enhanced food items, students are receiving better servings of nutrients and less cholesterol and fat."

Soy milk has posted the biggest gains, soaring from $2 million in 1980 to $300 million in the US last year.[10] Recent advances in processing have transformed the gray, thin, bitter, beany-tasting Asian beverage into a product that western consumers will accept – one that tastes like a milk shake, but without the guilt.

Processing miracles, good packaging, massive advertising and a marketing strategy that stresses the products' possible health benefits account for increasing sales to all age groups. For example, reports that soy helps prevent prostate cancer have made soy milk acceptable to middle-aged men. "You don't have to twist the arm of a 55- to 60-year-old guy to get him to try soy milk," says Mark Messina. Michael Milken, former junk bond financier, has helped the industry shed its hippie image with well-publicized efforts to consume 40 grams of soy protein daily. Now it's OK for stockbrokers to eat soy.

America today, tomorrow the world. Soy milk sales are rising in Canada, even though soy milk there costs twice as much as cow's milk. Soybean milk processing plants are sprouting up in places like Kenya.[11] Even China, where soy really is a poverty food and whose people want more meat, not tofu, has opted to build western-style soy factories, rather than develop western grasslands for grazing animals.[12]

Cinderella's Dark Side

The propaganda that has created the soy sales miracle is all the more remarkable because only a few decades ago the soybean was considered unfit to eat – even in Asia. During the Chou Dynasty (1134 - 246 BC) the soybean was designated one of the five sacred grains, along with barley, wheat, millet and rice. However, the pictograph for the soybean, which dates from earlier times, indicates that it was not first used as a food; for whereas the pictographs for the other four grains show the seed and stem structure of the plant, the pictograph for the soybean emphasizes the root structure. Agricultural literature of the period speaks frequently of the soybean and its use in crop rotation. Apparently the soy plant was initially used as a method of fixing nitrogen.[13]

The soybean did not serve as a food until the discovery of fermentation techniques, sometime during the Chou Dynasty. The first soy foods were fermented products like tempeh, natto, miso and soy sauce. At a later date, possibly in the 2nd century BC, Chinese scientists discovered that a puree of cooked soybeans could be precipitated with calcium sulfate or magnesium sulfate (plaster of Paris or Epsom salts) to make a smooth pale curd – tofu or bean curd. The use of fermented and precipitated soy products soon spread to other parts of the Orient, notably Japan and Indonesia.

The Chinese did not eat unfermented soybeans as they did other legumes such as lentils because the soybean contains large quantities of natural toxins or "antinutrients." First among them are potent enzyme inhibitors that block the action of trypsin and other enzymes needed for protein digestion. These inhibitors are large, tightly-folded proteins that retain their configuration even when heated for long periods of time. They can produce serious gastric distress, reduced protein digestion and chronic deficiencies in amino acid uptake. In test animals, diets high in trypsin inhibitors cause enlargement and pathological conditions of the pancreas, including cancer.[14] Soybeans also contain hemagglutinin, a clot-promoting substance that causes red blood cells to clump together.

Trypsin inhibitors and hemagglutinin are growth inhibitors – weanling rats fed soy containing these antinutrients fail to grow normally. Growth depressant compounds are deactivated during the process of fermentation, so once the Chinese discovered how to ferment the soybean, they began to incorporate small amounts of soy foods into their diets. In precipitated products, enzyme inhibitors concentrate in the soaking liquid rather than in the curd. Thus in tofu and bean curd, growth depressants are reduced in quantity, but not completely eliminated.

Soy also contains goitrogens, substances that depress thyroid function, a fact that has been known for at least 50 years. Soybeans are high in phytic acid, present in the bran or hulls of all seeds, a substance that can block the uptake of essential minerals – calcium, magnesium, copper, iron and especially zinc – in the intestinal tract. Although not a household word, phytic acid has been extensively studied – there are literally hundreds of articles on the effects of phytic acid in the scientific literature. Researchers are in general agreement that grain- and legume-based diets high in phytates contribute to widespread mineral deficiencies in ➤

Third World countries.[16] Analysis shows that calcium, magnesium, iron and zinc are present in the plant foods eaten in these areas, but the high phytate content of soy- and grain-based diets prevents their absorption.

The soybean has one of the highest phytate levels of any grain or legume that has been studied[16] and the phytates in soy are highly resistant to normal phytate-reducing techniques, such as long, slow cooking.[17] Only a long period of fermentation will significantly reduce the phytate content of soybeans. When precipitated soy products like tofu are consumed with meat, the mineral blocking effects of the phytates are reduced.[18] The Japanese traditionally eat a small amount of tofu or miso as part of a mineral-rich fish broth, followed by a serving of meat or fish.

Vegetarians who consume tofu and bean curd as a substitute for meat and dairy products risk severe mineral deficiencies. The results of calcium, magnesium and iron deficiency are well known, those of zinc are less so. Zinc is called the intelligence mineral because it is needed for optimal development and functioning of the brain and nervous system. It plays a role in protein synthesis and collagen formation; it is involved in the blood sugar control mechanism and thus protects against diabetes; it is needed for a healthy reproductive system. Zinc is a key component in numerous vital enzymes and plays a role in the immune system. Phytates found in soy products interfere with zinc absorption more completely than with other minerals.[19] Zinc deficiency can cause a "spacy" feeling that some vegetarians may mistake for the "high" of spiritual enlightenment.

Milk-drinking is given as the reason second generation Japanese in America grow taller than their native ancestors. Some investigators postulate that the reduced phytate content of the American diet – whatever may be its other deficiencies – is the true explanation, pointing out that both Asian and Western children who do not get enough meat and fish products to counteract the effects of a high phytate diet frequently suffer rickets, stunting and other growth problems.[20]

Soy Protein Isolate

Soy processors have worked hard to get these antinutrients out of the finished product, particularly soy protein isolate (SPI), which is the key ingredient in most soy foods that imitate meat and dairy products, including baby formulas and some brands of soy milk. SPI is not something you can make in your own kitchen. Production takes place in industrial factories where a slurry of soy beans is first mixed with an alkaline solution to remove fiber, then precipitated and separated using an acid wash and finally neutralized in an alkaline solution. Acid washing in aluminum tanks leaches high levels of aluminum into the final product. The resultant curds are spray dried at high temperatures to produce a high protein powder. A final indignity to the original soy bean is high-temperature, high-pressure extrusion processing of soy protein isolate to produce textured vegetable protein (TVP).

Much of the trypsin inhibitor content can be removed through high-temperature processing, but not all. Trypsin inhibitor content of soy protein isolate can vary as much as fivefold.[21] (In rats, even low-level-trypsin-inhibitor SPI feeding results in reduced weight gain compared to controls.[22]) But high-temperature processing has the unfortunate side effect of so denaturing the other proteins in soy that they are rendered largely ineffective.[23] That's why animals on soy feed need lysine supplements for normal growth. Nitrites, which are potent carcinogens, are formed during spray drying, and a toxin called lysinoalanine is formed during alkaline processing.[24] Numerous artificial flavorings, particularly MSG, are added to soy protein isolate and textured vegetable protein products to mask their strong "beany" taste, and impart the flavor of meat.[25]

In feeding experiments, use of SPI increased requirements for vitamins E, K, D and B12 and created deficiency symptoms of calcium, magnesium, manganese, molybdenum, copper, iron and zinc.[26] Phytic acid remaining in these soy products greatly inhibits zinc and iron absorption; test animals fed SPI develop enlarged organs, particularly the pancreas and thyroid gland, and increased deposition of fatty acids in the liver.[27] Yet soy protein isolate and textured vegetable protein are used extensively in school lunch programs, commercial baked goods, diet beverages and fast food products. They are heavily promoted in Third World countries and form the basis of many food giveaway programs.

In spite of poor results in animal feeding trials, the soy industry has sponsored a number of studies designed to show that soy protein products can be used in human diets as a replacement for traditional foods. An example is "Nutritional Quality of Soy Bean Protein Isolates: Studies in Children of Preschool Age" sponsored by the Ralston Purina Company.[28] A group of Central American children suffering from malnutrition was first stabilized and brought into better health by feeding them native foods, including meat and dairy products. Then for a two-week period these traditional foods were replaced by a drink made of soy protein isolate and sugar. All nitrogen taken in and all nitrogen excreted were measured in truly Orwellian fashion – the children were weighed naked every morning and all excrement and vomit were gathered up for analysis. The researchers found that the children retained nitrogen and that their growth was "adequate," so the experiment was declared a success. Whether the children were actually healthy on such a diet, or could remain so over a long period, is another matter. The researchers noted that the children vomited "occasionally," usually after finishing a meal; over half suffered from periods of moderate diarrhea; some had upper respiratory infections; and others suffered from rash and fever. It should be noted that the researchers did not dare to use soy products to help children recover from malnutrition, and were obliged to supplement the soy-sugar mixture with nutrients largely absent in soy products, notably vitamins A, D, B12, iron, iodine and zinc.

The FDA Health Claim

The best marketing strategy for a product that is inherently unhealthy is, of course, a health claim. "The road to FDA approval was long and demanding," writes a soy apologist, "consisting of a detailed review of human clinical data collected from more than 40 scientific studies conducted over the last 20 years. Soy protein was found to be one of the rare foods that had sufficient scientific evidence not only to qualify for an FDA health claim proposal but to ultimately pass the rigorous approval process."[29] The "long and demanding" road to FDA approval

ually took a few unexpected turns. The original petition, submitted by Protein Technologies International (a division of Dupont), requested a health claim for isoflavones, the estrogen-like compounds found plentifully in soybeans, based on assertions that "only soy protein that has been processed in a manner in which isoflavones are retained will result in cholesterol-lowering." In 1998, the FDA made the unprecedented move of rewriting PTI's petition, removing any reference to the phytoestrogens and substituting a claim for soy protein, a move that was in direct contradiction to the agency's regulations. The FDA is authorized to make rulings only on substances presented by petition.

The abrupt change in direction was no doubt due to the fact that a number of researchers, including scientists employed by the US government, submitted documents indicating that isoflavones are toxic. The FDA had also received, early in 1998, the final British government report on phytoestrogens, which failed to find much evidence of benefit and warned against potential adverse effects.[30] Even with the change to soy protein isolate, FDA bureaucrats engaged in the "rigorous approval process" were forced to deal nimbly with concerns about mineral blocking effects, enzyme inhibitors, goitrogenicity, endocrine disruption, reproductive problems and increased allergic reactions from consumption of soy products.[31] One of the strongest letters of protest came from Dr. Dan Sheehan and Dr. Daniel Doerge, government researchers at the National Center for Toxicological Research.[32] Their pleas for warning labels were dismissed as unwarranted.

"Sufficient scientific evidence" of soy's cholesterol-lowering properties is drawn largely from a 1995 meta-analysis by Dr. James Anderson, sponsored by Protein Technologies International and published in the *New England Journal of Medicine*.[33] A meta-analysis is a review and summary of the results of many clinical studies on the same subject. Use of meta-analyses to draw general conclusions has come under sharp criticism by members of the scientific community. "Researchers substituting meta-analysis for more rigorous trials risk making faulty assumptions and indulging in creative accounting," says Sir John Scott, President of the Royal Society of New Zealand. "Like is not being lumped with like. Little lumps and big lumps of data are being gathered together by various groups."[34] There is the added temptation for researchers, particularly researchers funded by a company like Protein Technologies International, to leave out studies that would prevent the desired conclusions. Dr. Anderson discarded eight studies for various reasons, leaving a remainder of 29. The published report suggested that individuals with cholesterol levels over 250 mg/dl would experience a "significant" reduction of seven to 20% in levels of serum cholesterol if they substituted soy protein for animal protein. Cholesterol reduction was insignificant for individuals whose cholesterol was lower than 250 mg/dl. In other words, for most of us, giving up steak and eating vegeburgers instead will not bring blood cholesterol levels down. The health claim that the FDA approved "after detailed review of human clinical data" fails to inform the consumer about these important details. ➤

Research that ties soy to positive effects on cholesterol levels is "incredibly immature," said Ronald M. Krauss, MD, head of the Molecular Medical Research Program and Lawrence Berkeley National Laboratory.[36] He might have added that studies in which cholesterol levels were lowered either through diet or drugs have consistently resulted in a greater number of deaths in the treatment groups than in controls, deaths from stroke, cancer, intestinal disorders, accidents and suicide.[36] Cholesterol lowering measures in the US have fueled a sixty-billion-dollar-a-year cholesterol-lowering industry but have not saved us from the ravages of heart disease.

Soy and Cancer

The new FDA ruling does not allow any claims about cancer prevention on food packages, but that has not restrained the industry and its marketeers from making them in their promotional literature. "In addition to protecting the heart," says a vitamin company brochure, "soy has demonstrated powerful anticancer benefits...the Japanese, who eat 30 times as much soy as North Americans, have a lower incidence of cancers of the breast, uterus and prostate."[37]

Indeed they do. But the Japanese, and Asians in general, have much higher rates of other types of cancer, particularly cancer of the esophagus, stomach, pancreas and liver.[38] Asians throughout the world also have high rates of thyroid cancer.[39] The logic that links low rates of reproductive cancers to soy consumption requires attribution of high rates of thryoid and digestive cancers to the same foods, particularly as soy causes these types of cancers in laboratory rats.

Just how much soy do Asians eat? A 1998 survey found that the average daily amount of soy consumed in Japan was about 8 grams for men and 7 for women – less than two teaspoons.[40] The famous Cornell China Study, conducted by Colin T. Campbell, found that legume consumption in China varied from 0 to 58 grams per day, with a mean of about 12.[41] Assuming that two-thirds of legume consumption is soy, then the maximum consumption is about 40 grams or less than 3 tablespoons per day, with an average consumption of about 9 grams, less than two teaspoons. A survey conducted in the 1930s found that soy foods accounted for only 1.5% of calories in the Chinese diet, compared with 65% of calories for pork.[42] (Asians traditionally cooked in lard, not vegetable oil!)

Traditionally fermented soy products make a delicious, natural seasoning that may supply important nutritional factors in the Asian diet. But except in times of famine, Asians consume soy products only in small amounts as condiments, and not as a replacement for animal foods – with one exception. Celibate monks living in monasteries and leading a vegetarian lifestyle find soy foods quite helpful because they dampen libido.

It was a 1994 meta-analysis by Mark Messina, published in *Nutrition and Cancer*, that fueled speculation on soy's anticarcinogenic properties.[43] Messina noted that in 26 animal studies, 65% reported protective effects from soy. He conveniently neglected to include at least one study in which soy feeding caused pancreatic cancer, the 1985 study by Rackis.[44] In the human studies he listed, the results were mixed. A few showed some protective effect but most showed no correlation at all between soy consumption and cancer rates.

"...the data in this review cannot be used as a basis for claiming that soy intake decreases cancer risk," he concluded. Yet in his subsequent book, *The Simple Soybean and Your Health*, Messina makes just such a claim, recommending 1 cup or 230 grams of soy products per day in his "optimal" diet as a way to prevent cancer.

Thousands of women are now consuming soy in the belief that it protects them against breast cancer. Yet in 1996 researchers found that women consuming soy protein isolate had an increased incidence of epithelial hyperplasia, a condition that presages malignancies.[45] A year later, dietary genistein was found to stimulate breast cells to enter the cell cycle, a discovery that led the study authors to conclude that women should not consume soy products to prevent breast cancer.[46]

Next Month: Part II Phytoestrogens – Panacea or Poison?

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