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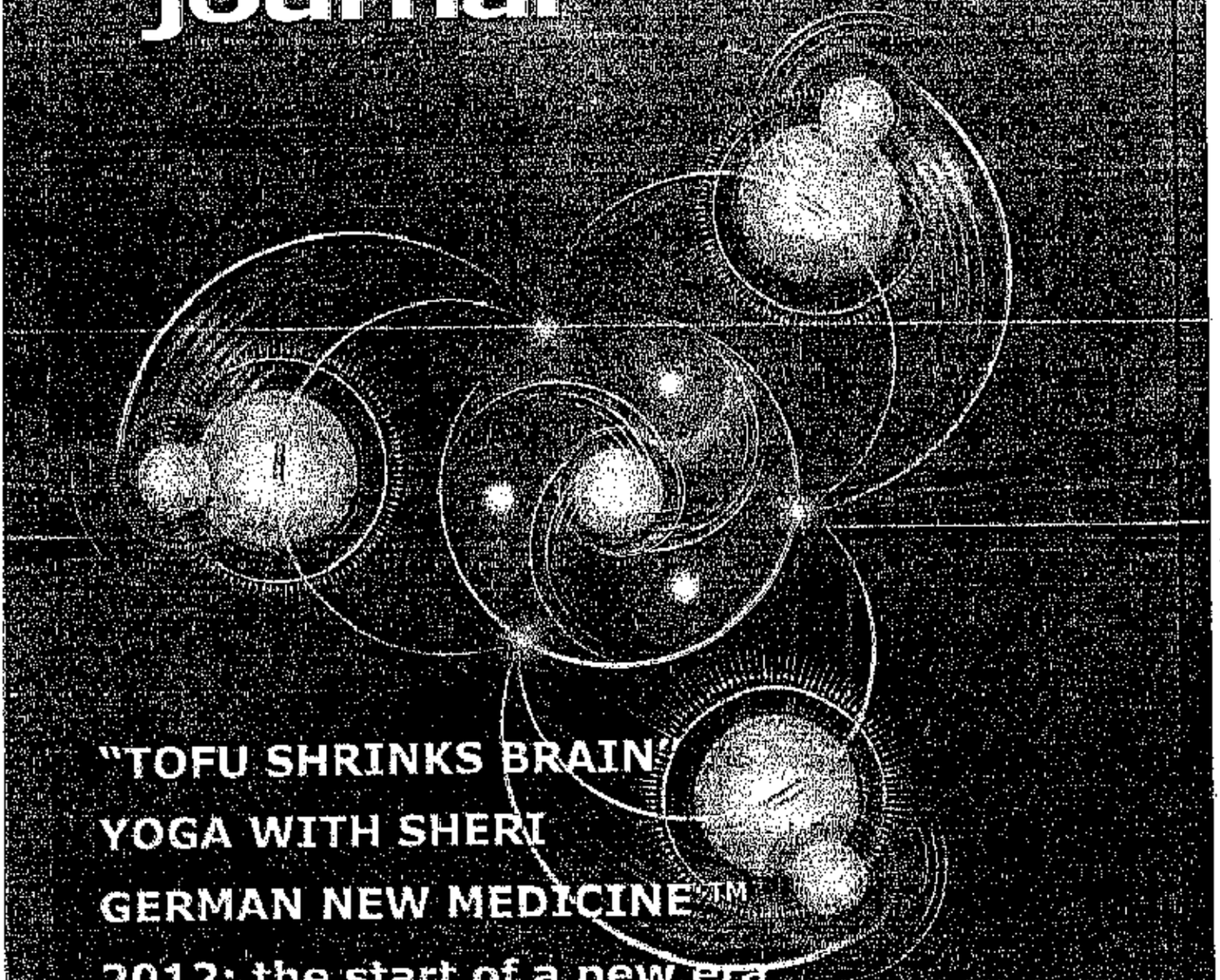

"TOFU SHRINKS BRAIN"

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"Tofu Shrinks Brain!"

by John MacArthur
through the Weston A. Price Foundation

No science fiction scenario, this sobering soybean revelation is for real. But how did the "poster bean" of the '90s go wrong? Apparently, in many ways - none of which bode well for the brain.

In a major ongoing study involving 3,734 elderly Japanese-American men, those who ate the most tofu during midlife had up to 2.4 times the risk of later developing Alzheimer's disease. As part of the three-decade long Honolulu-Asia Aging Study, 27 foods and drinks were correlated with participants' health. Men who consumed tofu at least twice weekly had more cognitive impairment than those who rarely or never ate the soybean curd.

"The test results were about equivalent to what they would have been if they were five years older," said lead researcher Dr. Lon R. White from the Hawaii Center for Health Research. For the guys who ate no tofu, however, they tested as though they were five years younger.

What's more, higher midlife tofu consumption was also associated with low brain weight. Brain atrophy was assessed in 574 men using MRI results and in 290 men using autopsy information. Shrinkage occurs naturally with age, but for the men who had consumed more tofu, White said "their brains seemed to be showing an exaggeration of the usual patterns we see in aging."

Toestrogens - Soy Self Defense

Tofu and other soybean foods contain isoflavones, three-ringed molecules bearing a structural resemblance to mammalian steroidal hormones. White and his fellow researchers speculate that soy's estrogen-like compounds (phytoestrogens) might compete with the body's natural estrogens for estrogen receptors in brain cells.

Plants have evolved many different strategies to protect themselves from predators. Some have thorns or spines, while others smell bad, taste bad, or poison animals that eat them. Some plants took a different route, using birth control as a way to counter the critters who were wont to munch.

Plants such as soy are making oral contraceptives to defend themselves, says Claude Hughes, PhD, a neuro-endocrinologist at Cedars-Sinai Medical Center. They evolved compounds that mimic natural estrogen. These phytoestrogens can interfere with the mammalian hormones involved in reproduction and growth--a strategy to reduce the number and size of predators.

Toxicologists Concerned About Soy's Health Risks

Soy experts at the National Center for Toxicological Research, Daniel Sheehan, Ph.D., and Daniel Doerge, Ph.D., consider the above mentioned tofu study very important. "It is one of the more robust, well-designed prospective epidemiological studies generally available. We rarely have such power in human studies, as well as a potential mechanism."

In a 1999 letter to the FDA (and on the ABC News program 20/20), the two toxicologists expressed their opposition to the agency's health claims for soy, saying the Honolulu study "provides evidence that soy (tofu) phytoestrogens cause vascular dementia. Given that estrogens are important for maintenance of brain function in women; that the male brain contains aromatase, the enzyme that converts testosterone to estradiol; and that isoflavones inhibit this enzymatic activity, there is a mechanistic basis for the human findings."

Although estrogen's role in the central nervous system is not

well understood, White notes that "a growing body of information suggests that estrogens may be needed for optimal repair and replacement of neural structures eroded with aging."

One link to the puzzle may involve calcium-binding proteins, which are associated with protection against neurodegenerative diseases. In recent animal studies at Brigham Young University's Neuroscience Center, researchers found that consumption of phytoestrogens via a soy diet for a relatively short interval can significantly elevate phytoestrogen levels in the brain and decrease brain calcium-binding proteins.

CONCERNS ABOUT GIVING SOY TO INFANTS

The most serious problem with soy may be its use in infant formulas. "The amount of phytoestrogens that are in a day's worth of soy infant formula can equal five birth control pills," says Mike Fitzpatrick, a New Zealand toxicologist. Fitzpatrick and other scientists believe that infant exposure to high amounts of phytoestrogens is associated with early puberty in girls and retarded physical maturation in boys.

A study reported in The Lancet found that the "daily exposure of infants to isoflavones in soy infant-formulas is 6 - 11 fold higher on a bodyweight basis than the dose that has hormonal effects in adults consuming soy foods." (This dose, equivalent to two glasses of soy milk per day, was enough to change menstrual patterns in women. In the blood of infants tested, concentrations of isoflavones were 13,000 - 22,000 times higher than natural estrogen concentrations in early life.)

SOY INTERFERES WITH ENZYMES

While soybeans are relatively high in protein compared to other legumes, they are a poor source of protein because other proteins found in soybeans act as potent enzyme inhibitors. These "anti-nutrients" block the action of trypsin and other enzymes needed for protein digestion. Trypsin inhibitors are large, tightly folded proteins that are not completely deactivated during ordinary cooking and can reduce protein digestion. Therefore, soy consumption may lead to chronic deficiencies in amino acid uptake.

Soy's ability to interfere with enzymes and amino acids may have direct consequence for the brain.

High amounts of protein tyrosine kinases are found in the hippocampus, a brain region involved with learning and memory. One of soy's primary isoflavones, genistein, has been shown to inhibit tyrosine kinase in the hippocampus, where it blocked "long-term potentiation," a mechanism of memory formation.

TYROSINE, DOPAMINE AND PARKINSON'S DISEASE

The brain uses the amino acids tyrosine or phenylalanine to synthesize the key neurotransmitters dopamine and norepinephrine, brain chemicals that promote alertness and activity. Dopamine is crucial to fine muscle coordination. People whose hands tremble from Parkinson's disease have a diminished ability to synthesize dopamine. An increased incidence of depression and other mood disorders are associated with low levels of dopamine and norepinephrine. Also, the current scientific consensus on attention-deficit disorder points to a dopamine imbalance.

Soy has been shown to affect tyrosine hydroxylase activity in animals, causing the utilization rate of dopamine to be "profoundly disturbed." When soy lecithin supplements were given throughout perinatal development, they reduced activity in the cerebral cortex and "altered synaptic characteristics in a manner consistent with disturbances in neural function."

Researchers at Sweden's Karolinska Institute and at the National Institutes of Health are finding a connection between tyrosine hydroxylase activity, thyroid hormone receptors and depleted dopamine levels in the brain - particularly in the substantia nigra, a region associated with the movement difficulties characteristic of Parkinson's disease.

SOY AFFECTS THE BRAIN VIA THE THYROID GLAND

Tyrosine is crucial to the brain in another way. It's needed for the body to make active thyroid hormones, which are a major physiological regulator of mammalian brain development. By affecting the rate of cell differentiation and gene expression, thyroid hormones regulate the growth and migration of neurons, including synaptic development and myelin formation in specific brain regions. Low blood levels of tyrosine are associated with an underactive thyroid gland.

It is well known that isoflavones in soy products can depress thyroid function, causing goiter (enlarged thyroid gland) and autoimmune thyroid disease. In the early 1960s, goiter and hypothyroidism were reported in infants fed soybean diets. Scientists at the National Center for Toxicological Research showed that the soy isoflavones genistein and daidzein "inhibit thyroid peroxidase-catalyzed reactions essential to thyroid hormone synthesis."

Japanese researchers studied effects on the thyroid from soybeans administered to healthy subjects. They reported that consumption of as little as 30 grams (two tablespoons) of soybeans per day for only one month resulted in a significant increase in thyroid stimulating hormone (TSH), which is produced by the brain's pituitary gland when thyroid hormones are too low. Their findings suggested that "excessive soybean ingestion for a certain duration might suppress thyroid function."

THYROID HORMONES & FETAL BRAIN DEVELOPMENT

Thyroid alterations are among the most frequently encountered autoimmune conditions in children. Research-

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ers at Cornell University Medical College showed that the "frequency of feedings with soy-based milk formulas in early life was significantly higher in children with autoimmune thyroid disease." In a previous study, they found that twice as many diabetic children had received soy formula in infancy as compared to non-diabetic children.

Recognizing the risk, Swiss health authorities recommend "very restrictive use" of soy for babies. In England and Australia, public health agencies tell parents to first seek advice from a doctor before giving their infants soy formula. The New Zealand Ministry of Health recommends that "Soy formula should only be used under the direction of a health professional for specific medical indications.... "Clinicians who are treating children with a soy-based infant formula for medical conditions should be aware of the potential interaction between soy infant formula and thyroid function."

Thyroid hormones exert their influence during discrete windows of time during development of the infant. Inappropriate hormone levels can have a devastating effect on the developing human brain, especially during the first 12 weeks of pregnancy when the fetus depends on the mother's thyroid hormones for brain development. After that, both maternal and fetal thyroid hormone levels affect the central nervous system.

A 1999 study published in the New England Journal of Medicine showed that pregnant women with underactive thyroids were four times more likely to have children with low IQs if the disorder were left untreated. The study found that 19 percent of the children born to mothers with thyroid deficiency had IQ scores of 85 or lower, compared with only five percent of those born to mothers without such problems.

THYROID, BRAIN AND ENVIRONMENTAL TOXINS

Children exposed prenatally and during infancy to common environmental toxins like dioxin and polychlorinated biphenyls (PCBs) can suffer behavioral, learning and memory problems because these chemicals may be disrupting the normal action of thyroid hormone.

Soybeans grown in the United States often contain residues of the pesticide dieldrin, an organochlorine similar to DDT. Although both chemicals were banned in the 1970s, dieldrin still persists in soils and is absorbed through the roots. Today it is the most toxic residue found on domestic soybeans. In "Silent Spring", Rachel Carson warned that dieldrin is nearly 50 times as poisonous as DDT. In addition to disrupting hormones, it can have long delayed neurological effects, ranging from loss of memory to mania. Chinese aphids were recently discovered in fields scattered across Wisconsin, so increased pesticide applications are likely.

SOY FORMULAS FOR INFANTS CAN CONTAIN OTHER NEUROTOXINS:

aluminum, cadmium and fluoride. Studies found that aluminum concentrations in soy-based formulas were a 100-fold greater compared to human breast milk, while cadmium content was 8 - 15 times higher than in milk-based formulas. In an Australian study, the fluoride content of soy-based formulas ranged from 1.08 to 2.86 parts per million. The authors concluded that "prolonged consumption (beyond 12 months of age) of infant formula reconstituted with optimally-fluoridated water could result in excessive amounts of fluoride being ingested." A study of Connecticut children revealed that mild to moderate fluorosis was strongly associated with soy-based infant formula use. ...

The damage to the developing brain results in individuals poorly equipped to fight disease, learn, work effectively, or reproduce satisfactorily." This crucial role of iodine is another reason why the thyroid gland is especially vulnerable today. Canadian researcher Andreas Schuld has documented more than 100 studies during the last 70 years that demonstrate adverse effects of fluoride on the thyroid gland.

SOY INHIBITS ZINC ABSORPTION

The high phytic-acid content in soy may also have adverse effects on brain function. Phytic acid is an organic acid present in the outer portion of all seeds which blocks the uptake of essential minerals in the intestinal tract: calcium, magnesium, iron and especially zinc. . . .

John D. MacArthur is a freelance writer who's research on neuroscience and other topics can be found at www.westonaprice.org. This article can also be found in it's entirety with all the footnotes at: www.thehealingjournal.com.

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