THE TOXICITY/SAFETY OF PROCESSED FREE GLUTAMIC ACID (MSG): A STUDY IN SUPPRESSION OF INFORMATION

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Every company interested in promoting its product should attempt to convince its clients that its product is worth buying. However, "selective" collection and reporting of research data would be inappropriate. "Selective" collection and reporting of research data, including suppression of information contrary to that which is espoused by the industry in question, is the subject of this paper. Using promotion of the flavor-enhancing ingredient called monosodium glutamate, and its active component (variously referred to as processed free glutamic acid or MSG) as a case study, this paper presents the case against the safety of MSG and looks at the work of the defenders of the safety of MSG. The structure of the industry organization; an overview of their research; suppression of information; dissemination of misinformation; dirty tricks; and the special role of agencies of the United States government will be considered.

Keywords: accountability, deception, glutamic acid, glutamate, monosodium glutamate, MSG, suppression of information

INTRODUCTION

Some scientists carry out well-designed and properly executed research; but when data do not come out as "needed," the numbers are changed. Others don't conduct studies at all; but submit fabricated details and results of their choosing to peers for publication. When exposed, they may be punished with fines and imprisonment, and may be noted by the press. In addition, those who use money of the United States government are subject to investigation by the U.S. Office of Research Integrity.

Researchers who deceive by falsifying data seem to be few, even if growing in number; (Slind-Flor, 1993) and if suspected of devious practices, can be fairly easily challenged. There seem to be others, however, who use more subtle methods to influence public opinion--with great success. Although more difficult to execute than simple fabrication of data, any question of propriety can be passed off as an error of judgement or an honest mistake; and penalties for getting caught are non-existent or less severe.

This paper will describe how easily truth can be hidden; and how seemingly isolated incidents actually can be badly flawed research, direct suppression of information, and dissemination of biased information orchestrated by one group or industry.

Using the safety/toxicity of MSG as the subject, I will demonstrate how the glutamate industry has selectively collected and reported research data in a way that presents glutamate in a favorable fashion. In the following, the case against the safety of processed free glutamic acid (MSG) will be presented first, with particular attention given to the nature of the chemical whose safety/toxicity is being disputed; the first evidence of its toxicity; confirmation of toxicity; and my personal involvement. The second section will focus on the defenders of the safety of MSG: 1) the structure of their organization -- the International Glutamate Technical Committee (IGTC); The Glutamate Association; researchers; agents; people and organizations influenced by

them; 2) an overview of their research -- animal research; umami; the epidemiologic study; and double-blind studies; 3) suppression of information; 4) dissemination of misinformation; 5) dirty tricks; and 6) the special role of agencies of the United States government.

THE CASE AGAINST THE SAFETY OF PROCESSED FREE GLUTAMIC ACID (MSG)

The Chinese have used certain seaweeds to enhance the flavor of food for some 2,000 years. In 1908, the flavor-enhancing agent was identified as glutamic acid (Kizer, Nemeroff, and Youngblood, 1978). Shortly thereafter, methods for extracting glutamic acid from seaweed were developed; the Ajinomoto Company was established in Japan; and their flavor-enhancing product, monosodium glutamate, became commercially available.

In 1968, the safety of MSG was challenged.

The chemical in question: processed free glutamic acid

The glutamic acid in the initial Ajinomoto product was produced by extraction. Today, the glutamic acid component of the food additive, monosodium glutamate, is generally made by a method referred to as microbial fermentation. In this method, bacteria are grown aerobically in a liquid nutrient medium. The bacteria have the ability to excrete glutamic acid they synthesize outside of their cell membrane into the liquid nutrient medium in which they are grown. The glutamic acid is then separated from the fermentation broth by filtration, concentration, acidification, and crystallization, and converted to its monosodium salt (Leung and Foster, 1996).

The food additive, monosodium glutamate, was first used in the United States in any quantity in the late 1940s. By the 1960s, however, Accent, the leading brand of monosodium glutamate, had become a household word. Simultaneously, other hydrolyzed protein products such as autolyzed yeast, sodium caseinate, and hydrolyzed vegetable protein gained in popularity. Every hydrolyzed protein product, regardless of the name given to it on a label, contains MSG.

Monosodium glutamate is the name of a particular flavor-enhancing ingredient. When used in this paper, the words "monosodium glutamate" refer to that flavor-enhancing ingredient. MSG is not the name of an ingredient. In fact, the FDA would consider use of the term MSG on a label, to represent an ingredient, as misbranding. While industry often uses the term MSG as a shorthand for the ingredient monosodium glutamate, consumers use MSG as shorthand for the processed free glutamic acid in ingredients that cause adverse reactions. According to the FDA (1995) "While technically MSG is only one of several forms of free glutamate used in foods, consumers frequently use the term MSG to mean all free glutamate."

Further discussion of processed free glutamic acid will be found in Appendix A.

The first evidence of toxicity

The first published report of a reaction to monosodium glutamate appeared in 1968 when Robert Ho Man Kwok, M.D., who had emigrated from China, reported that although he never had the problem in China, about 20 minutes into a meal at certain Chinese restaurants, he suffered numbness, tingling, and tightness of the chest that lasted for approximately 2 hours (Kwok, 1968).

The New England Journal of Medicine gave Kwok's letter the title, "Chinese-Restaurant Syndrome." Subsequently, readers responded, suggesting that the culprit was monosodium glutamate.

The following year, John W. Olney, M.D. reported that laboratory animals suffered brain lesions and neuroendocrine disorders after being exposed to monosodium glutamate (Olney, 1969). Scientists studying retinal degeneration in mice treated with free glutamic acid had noted that these mice became grotesquely obese. Olney, who speculated that the obesity might be a sign of damage to the hypothalamus (the area of the brain that regulates a number of endocrine functions, including weight control), found that infant laboratory animals given free glutamic acid suffered brain damage immediately, and assorted neuroendocrine disorders later in life. Pharmaceutical grade L-glutamic acid was often used to produce these disorders until neuroscientists observed that monosodium glutamate, an inexpensive food additive, could be substituted for laboratory-grade free glutamic acid in these studies and produce the same effects.

Confirmation of toxicity

In the years that followed, neuroscientists replicated the work of Olney, and Olney spoke out repeatedly about the toxic potential of glutamic acid freed from protein prior to ingestion. In 1972, for example, Olney testified before the Senate Select Committee on Nutrition and Human Needs that ingestion of MSG places humans at risk, with the greatest risk being for the very young; and that a National Academy of Science panel organized to determine whether MSG ought to be banned from baby food had produced an "industry arranged whitewash" by a group of scientists with almost no experience in neuropathology (Gillette, 1972). In the early 1970s, manufacturers of baby food voluntarily removed the monosodium glutamate from their products, but replaced the monosodium glutamate with MSG-containing ingredients such as autolyzed yeast and hydrolyzed vegetable protein. In the late 1970s, manufacturers voluntarily removed all obvious MSG-containing ingredients from baby food.

Today scientists know that MSG kills brain cells and causes neuroendocrine disorders in laboratory animals; and that it causes adverse reactions in humans. Scientists know that the blood brain barrier, once thought to prevent glutamate that comes from exogenous sources (eating included) from entering the brain, is not fully developed until puberty; is easily damaged by such conditions as high fever, a blow to the head, and the normal course of aging; and, in the area of the circumventricular organs, is leaky at best at any stage of life. Scientists know that a diverse number of disease conditions such as ALS, Alzheimer's disease, seizures, and stroke are associated with the glutamate cascade (Blaylock, 1994).

Scientists also understand that MSG is simply processed free glutamic acid, or processed free glutamic acid combined with sodium (depending on how it is defined), and that glutamic acid is a neurotransmitter that causes nerves to fire; and when present in excess quantities, causes nerves to fire until they die. Scientists understand that in addition to the L-glutamic acid found in unprocessed, unfermented, unadulterated free glutamic acid, processed free glutamic acid invariably contains D-glutamic acid and brings with it pyroglutamic acid and other contaminants--some of which, depending on procedures used for processing and the protein source, are carcinogenic.

Personal involvement

In 1988, George R. Schwartz, M.D., published a book entitled, In Bad Taste: The MSG Syndrome (Schwartz, 1988). Prior to its publication, few consumers realized that the adverse reactions they suffered following ingestion of monosodium glutamate were caused by its free

glutamic acid component; or that there was processed free glutamic acid in all hydrolyzed protein products. It was only after reading Schwartz' book that I realized that the Alzheimer's disease-like symptoms that were being experienced by Jack Samuels, my husband, disappeared when processed free glutamic acid was eliminated from his diet.

In 1989, the Food and Drug Administration (FDA) and the U.S. Department of Agriculture (USDA) heard public testimony relevant to the National Labeling and Education Act of 1990 (NLEA). In that year, J. Samuels, Schwartz, and others testified before the NLEA panel to the toxic potential of MSG and the need to identify MSG whenever present in processed food. Subsequently, J. Samuels and Schwartz flew to Washington for an in-depth conference with FDA officials.

Following review of Schwartz' book, I attempted to determine what foods I could prepare for my husband without ill-effect. Failing to find any unifying concept by which I could identify potentially toxic ingredients, I turned to the Medline literature where I found two sorts of studies: 1) those sponsored by the glutamate industry, which invariably concluded that MSG is safe, and 2) those done by independent neuroscientists and other researchers who found that MSG kills brain cells, causes neuroendocrine disorders, learning disabilities, and a variety of disorders such as tachycardia and seizures. Although an investment banker in 1989, I am an experimental psychologist by training, with expertise in learning, test construction, research design, methodology, and statistics, and a doctorate degree in Educational Psychology from the University of Wisconsin. Inspired by what had become my husband's life-threatening sensitivity to MSG, my husband and I reviewed the medical literature, read widely in the literature of food science and technology, researched the history of the continued FDA approval of MSG as generally recognized as safe (GRAS), testified before the FDA and its agents, and monitored the activities of the FDA. I have been a member of the consumer group NOMSG since 1989, and am a director of, and financial contributor to, the Truth in Labeling Campaign, both nonprofit corporations whose work benefits the public.

DEFENDERS OF THE SAFETY OF MSG

In 1968, faced with allegations that MSG has toxic potential, Ajinomoto U.S.A., Inc., established a nonprofit corporation, recruited scientists and others to defend the safety of its product, and unleashed a public relations campaign.

Structure of their organization

The International Glutamate Technical Committee (IGTC)

In 1969, the IGTC was organized to represent the interests of the glutamate industry. The IGTC was founded as an association of member companies engaged in the manufacture, sale, and commercial use of glutamates. According to the Encyclopedia of Associations (International Glutamate Technical Committee (IGTC), 1992), the IGTC, then an 8 member organization, sponsored, gathered, and disseminated research on the use and safety of monosodium glutamate; designed and implemented research protocols and provided financial assistance to researchers; promoted acceptance of monosodium glutamate as a food ingredient and "glutamate" as its generic term; and represented members' collective interests. Those collective interests were to sell monosodium glutamate. The National Trade and Professional Associations of the United States (International Glutamate Technical Committee, 1994) stated that the IGTC was an association of 25 individuals, 20 companies, and 3 staff, composed of physicians and/or

scientists employed by producers or users of glutamic acid and its salts or doing research on it in university laboratories. Membership was given as $2,000/year. The budget was $250,000.

The Glutamate Association

In 1977, the IGTC spun off The Glutamate Association, with both organizations accommodated under the umbrella of The Robert H. Kellen Company of Atlanta, Georgia and Washington, DC., a trade organization and association management firm, specializing in the food, pharmaceutical, and health care industries. The Encyclopedia of Associations (The Glutamate Association, 1990) listed Robert H. Kellen as president of The Glutamate Association. Richard Cristol, executive director of The Glutamate Association, was also Vice President of The Kellen Company. Cristol assumed management of the Washington, DC operations of The Kellen Company and its subsidiary, HQ Services, in 1993 (Food Technology, 1993). In 1992, and still in 1998, Andrew G. Ebert, Ph.D., Chairman of the IGTC, was also Senior Vice President of The Kellen Company.

Membership in The Glutamate Association is secret. However, a source from within the glutamate industry, who has asked to remain anonymous, told me that besides Ajinomoto, Archer Daniels Midland, Campbell, Corn Products Corporation, McCormick & Company, Pet Foods, Pfizer Laboratories, and Takeda are among its members.

Researchers

Once established, the IGTC assembled a cadre of scientists who conducted research for them and/or spoke publicly about the safety of MSG (Altman, 1994; Anantharaman, 1979; Auer, 1996; Bunyan, 1976; Ebert, 1970; Fernstrom, 1996; Filer, 1979; Garattini, 1979; Geha, 1998; Germano, 1991; Giacometti, 1979; Goldschmiedt, 1990; Heywood, 1977; Iwata, 1979; Kenney, 1979; Kerr, 1979; Matsuzawa, 1979; Morselli, 1970; Newman, 1973; Owen, 1978; Pulce, 1992; Reynolds, 1971; Reynolds, 1976; Schiffman, 1991; Stegink, 1975; Stevenson, 1997; Takasaki, 1979a; Takasaki, 1979b; Tarasoff, 1993; Yang, 1997). Those who identified their funding sources in their publications or in communications with the FDA are listed with their funding sources in Table 1.

Steve Taylor, Ph.D., a prominent representative of the glutamate industry, (Taylor, 1993) has done little or no basic research related to monosodium glutamate safety/toxicity but is respected for his knowledge about food allergy, having served, for example as an officer of the Toxicology and Safety Evaluation Division and a member of the Expert Panel on Food Safety and Nutrition of the Institute of Food Technologists. His name appears prominently on advisory boards such as the Food Allergy Network (Food Allergy News, 1994) and editorial boards such as the Encyclopedia of Food Science Food Technology and Nutrition (Macrae, 1993). He has acknowledged being a paid, glutamate industry spokesman. Yet, when he introduces himself, he typically refers to his University of Nebraska affiliation, but not to the fact that he is an agent of The Glutamate Association, the IGTC, or Ajinomoto (Taylor, 1991, 1997).

The focus of researchers who represent the glutamate industry has been to demonstrate that various food additives are "safe." Scrutiny of the literature will demonstrate that for some of these scientists, early research relevant to the safety/toxicity of glutamic acid suggested that glutamic acid might have toxic potential (Auer, 1991; Kenney, 1972); while subsequent studies and/or public statements made by those same scientists proclaimed that MSG is safe (Auer, 1996; Kenny, 1979). By and large, those who represent the glutamate industry have produced research relative to the safety/toxicity of MSG only in response to encouragement from the glutamate industry to do so; and the only research that they have published has been research from which they have concluded that MSG is safe. Only two of the glutamate-industry

researchers or speakers have been neuroscientists: Richard J. Wurtman, M.D. (Filer, 1979), and Roland Auer, M.D., Ph.D. (Auer, 1996).

A special role has been played by Ronald Simon, M.D. and Donald D. Stevenson, M.D. of Scripps Clinic and Research Foundation, LaJolla, California. In 1991, Simon, with Dean D. Metcalfe, M.D., and Hugh R. Sampson,M.D., had praised the work of David Allen, M.D., who had found that MSG is an asthma trigger; and they included his study in Food Allergy: Adverse Reactions to Foods and Food Additives (Metcalfe, Sampson, and Simon, 1991). In a letter to George R. Schwartz, M.D., which Schwartz forwarded to me, Allen wrote, "Last week my friend Ron Simon from the Scripps Clinic called me and asked me to participate in a symposium at the American Academy of Allergy meeting in San Francisco in March of next year. I will be speaking on sulphites and MSG and their potential to provoke asthma" (D. Allen, personal communication, August 20, 1990).

On August 31, 1995, the FDA released a report on the safety of MSG in food, done by the Federation of American Societies for Experimental Biology [FASEB] (1995). In that report, FASEB acknowledged that MSG was an asthma trigger, and that doses of MSG as low as .5 grams MSG had triggered MSG reactions. On the day before that allegedly secret report was released, Simon and Stevenson wrote to inform the FDA that they believed that the FASEB report to be released the next day had made a grave error in stating that MSG was known to be an asthma trigger, for they had found Allen's work to be lacking (Simon and Stevenson, 1995). In 1995, Simon and Stevenson were doing research for the IGTC (Stevenson et al. 1997).

Of obvious interest is the fact that Simon and Stevenson knew what was in the August 31,1995 FASEB report before it was released to the public. Not obvious, is the fact that although Simon and Stevenson spoke of having conducted MSG oral challenges on asthmatic patients who experienced asthma attacks in restaurants since 1980, their letter clearly states that as of that date, they had tested only 25 patients (Simon and Stevenson, 1995). Given that 25 per cent or more of the population is sensitive to MSG (Reif-Lehrer, 1977) and that approximately 2 per cent of the MSG reactions reported to the FDA Adverse Reactions Monitoring System are asthma reactions, on a straight probability basis, Simon and Stevenson had not tested enough patients to expect even one of them to express an asthma reaction to MSG. Moreover, according to their August 30, 1995 letter to the FDA, Simon and Stevenson did no systematic study, but only observed patients who came to Scripps Clinic for treatment; and they looked for no reactions other than asthma (Simon and Stevenson, 1995).

In 1996, the newsletter of the NOMSG consumer group reported that when an MSG-sensitive person responded to an advertisement in the Los Angeles Times for test subjects for a new asthma study at Scripps Clinic being conducted by Simon and Stevenson, she was told that "1) if she feared her asthma reactions to be serious that she should not apply for the study; 2) that the person who was screening the applicants didn't believe that MSG could cause asthma reactions; and 3) that this particular person was most likely responding to sulfites, and not to MSG" (Schwartz, 1996).

In a May 28, 1997 letter, Simon responded to an inquiry I had made, saying, "There is no study that we are ‘doing for Ajinomoto or one of their agents, on the general subjective sensitivity to MSG. The abstract presented at the February 1997 AAAAI meetings was a preliminary report of an ongoing study we designed concerning MSG sensitivity in asthmatics." Included in the program for that meeting, however, was an abstract for a poster session "The Role of Monosodium L-Glutamate (MSG) in Asthma: Does it Exist?" by Stevenson et al. (1997); funded by the IGTC.

As is always the case, the activities of Simon and Stevenson might appear to be isolated incidents. When placed within the context of activities designed to accommodate the sale of monosodium glutamate, however, they assume great significance. In 1992, FASEB undertook a study of the safety of MSG in food, responding to 18 questions outlined for it by the FDA. The September, 1995 draft final report of that study, submitted to the FDA by FASEB, was rejected by the FDA, "for clarification;" and the contract between FASEB and the FDA was rewritten, directing FASEB, through the wording in their new contract, to come up with the conclusion that MSG reactions were not triggered by less than 3 grams MSG. In the face of growing recognition that MSG was causing adverse reactions in substantial numbers of people; and that the glutamate cascade was implicated in such disease conditions as stroke, seizures, ALS, Alzheimer's disease, and addiction; the glutamate industry had changed its strategy for keeping MSG hidden in food from claiming that essentially no one was sensitive to MSG, to claiming that essentially no one was sensitive to less than 2.5 or 3 grams MSG. For the FDA to accept, as credible, research that had found subjects to respond to as little as .5 grams MSG, as Allen had, would not, therefore, be tolerable. It is not inconceivable that Simon and Stevenson had been asked to discredit Allen's research.

Agents

Depending on the roles they play, researchers might be considered agents of the glutamate industry. In addition, there are those who promote the products of those they work for, just as public relations firms do, but these organizations highlight the fact that they are nonprofit corporations, while minimizing the fact that they promote the products of those who employ them. The International Food Information Council (IFIC) and the International Life Sciences Institute (ILSI) are examples of such glutamate-industry agents.

In 1990, faced with the threat of a "60 Minutes" segment scheduled to appear on CBS television, that might expose the toxic potential of monosodium glutamate, IFIC became actively involved in representing the interests of the glutamate industry. The IFIC represents itself as an "independent" organization. It sends attractive brochures to dietitians, nutritionists, hospitals, schools, the media, and politicians, proclaiming the safety of monosodium glutamate. In 1990, an anonymous person sent us a copy of a "Communication Plan" dated July-December, 1991, that detailed methods for scuttling the "60 Minutes" segment on MSG, or, failing, that, provided for crisis management. (International Food Information Council [IFIC], MSG Committee, 1991). IFIC's paid relationship to the glutamate industry is documented in the Encyclopedia of Associations (International Food Information Council, 1996).

Support of the International Life Sciences Institute (ILSI), an association sponsored by companies within the food, pharmaceutical, chemical, toxicology, and related industries, has also been observed (International Life Sciences Institute Australia Inc., 1990; Metcalfe, 1990). The ILSI has provided funding for The Food Allergy Network (Food Allergy News, 1994). Dean D. Metcalfe, M.D., of the National Institutes of Health (NIH), who has spoken out publically on the safety of MSG, and Sheldon Cohen, M.D., who evaluated possibly MSG-sensitive subjects at NIH with Metcalfe (Germano et al., 1991), are, or were, ILSI Allergy and Immunology Institute Scientific Advisors (International Life Sciences Institute, personal communication, July 20, 1995). So were Taylor and Sampson. Sampson was recommended by The Glutamate Association as one who might be interviewed by "60 Minutes" about the safety of MSG (The Glutamate Association, 1993). ILSI has also funded the work of Johathan H. Pincus, M.D., who, at the request of IFIC, reviewed the book Excitotoxins: The Taste that Kills by Russell L. Blaylock, M.D. Blaylock sent me a copy of the letter he wrote to Pincus following publication of Pincus' review (R.L. Blaylock, personal communication, August 15, 1994). Blaylock wrote,

"I have just finished reading your review (To tax the meaning of the word) of my book, Excitotoxins: The taste That kills, for the International Food Information Council. From your 'review' I have come to several conclusions. First, you did not read the book carefully, if at all....And second...apparently, you are of the opinion that only you should be allowed to draw conclusions from research or to propose hypotheses based on basic scientific research. Your review is full of errors and unfair characterizations...For example, you open your salvo by saying that I was 'armed primarily with the research of Dr. John Olney, which was published more than 20 years ago, and his own interpretation of a few more recent studies.' Dr. Olney has not retired and he is not dead. He is still engaged in primary research in the area of excitotoxins and his work has been, and continues to be, published in highly respected scientific journals."

People and Organizations Influenced by the Glutamate Industry

Some individuals and some organizations with alleged interest in food safety have reviewed the safety of MSG favorably (American College of Allergy and Immunology, 1991a; American College of Allergy and Immunology, 1991b; American College of Allergy and Immunology, n.d.; Institute of Food Technologists, 1980; "Chinese restaurant syndrome," 1990; McNutt, 1991; Schmitz, 1990; Taliferro, 1995; Tufts University Diet and Nutrition Letter, 1992; University of California at Berkeley Wellness Letter, 1989; University of California at Berkeley Wellness Letter, 1996; Wood, 1991). Others have prepared brochures either stating that there is no evidence that ingestion of monosodium glutamate or other MSG-containing food additives should cause consumers concern; or listing food additives that might cause consumers concern while omitting mention of MSG-containing ingredients (American Academy of Allergy and Immunology, 1993; FDA in cooperation with IFIC, 1992; Scripps Clinic and Research Foundation, 1995). The American Academy of Family Physicians Foundation allowed IFIC to claim "Favorable Review by the American Academy of Family Physicians Foundation" on a 1991 brochure (International Food Information Council [IFIC], 1991). The American Medical Association refused to implement a Resolution passed by its membership at its 1991 annual meeting calling for the AMA to "...encourage all appropriate regulatory agencies, including the Food and Drug Administration, to mandate labeling of all foods containing even small amounts of additive L-glutamic acid so that individuals wanting to avoid this substance may do so" (American Medical Association, 1991).

Whether or not these people and/or organizations are literally agents of the glutamate industry or simply influenced by them is irrelevant. Either way, they publish material that is read by others who respect their opinions; and that material is uncritical of anything said or done by the glutamate industry. Characteristic of those referenced here is their unwillingness to print any addition, correction, or retraction after errors or omissions in published material are pointed out to them.

Influence of the IGTC can be felt at every level. International Glutamate Technical Committee chairman Ebert has served on the FDA Food Advisory Committee; the Grocery Manufacturers of America (Technical Committee on Food Protection, the Codex Subcommittee on Food Additives and the GRAS-FASEB Monograph Committee); the National Food Processors Association; the Institute of Food Technology (Technology Toxicology and Safety Evaluation Division, and Scientific Lecturer); the National Research Council of the National Academy of Sciences Assembly of Life Sciences (Food and Nutrition Board: the Committee on Food Protection, and the GRAS List Survey); the American Medical Association (Industry Liaison Panel); the FAO/WHO Codex Alimentarius Food Standards Program as an Industry Observer; and the International Food Additives Council as Executive Director.

As a food-industry pharmacologist and toxicologist, Ebert has provided scientific and technical expertise for programs of many associations managed by The Kellen Company. His nomination to the FDA Food Advisory Committee did not refer to his affiliation with the IGTC, but listed him only as Senior Vice President of The Kellen Company. With him on the FDA Food Advisory Committee, was Kristin McNutt, a paid spokeswoman for the glutamate industry (McNutt, 1991).

Ebert is also an active member of the Institute of Food Technologists (IFT). Daryl Altman, M.D., a spokesperson for the glutamate industry, worked for former IFT president Al Clausi, Vice Chairman of Allerx, Inc. and its medical affiliate, The Food Allergy Center. Altman speaks publicly about the safety of monosodium glutamate, often with Taylor. The IFIC promotes them as speakers without mention of the fact that they represent the glutamate industry. L.T. Chiaramonte, M.D., who has co-authored work for the IGTC with Altman, has served on the medical advisory board of The Food Allergy Center.

Glutamate industry representatives and friends sit on boards of "independent" organizations. Glutamate industry researcher and spokesman Simon has been a member of the Scientific Advisory Board of the Center for Science in the Public Interest (CSPI). Monsanto's Robert Shapiro sits on the board of the Tufts University School of Nutrition. Allergy support groups often include industry-friendly allergists on their medical advisory boards. Taylor has served on the Medical Advisory Board of The Food Allergy Network. "Independent organizations" whose medical advisory board members have ties to the glutamate industry have not provided information to their members about MSG-containing ingredients.

Glutamate industry influence is also seen in peer review journals that publish their badly flawed studies. An argument is made later in this paper that published glutamate-industry sponsored studies are badly flawed. If that is the case, then their publication in peer review journals is difficult to justify. Consider, however, that if the peers who review the work of glutamate-industry representatives are themselves glutamate-industry representatives, or very close friends, the work of glutamate industry representatives may very well be published. Consider, also, that journals such as the Journal of Allergy and Clinical Immunology take advertising, and journals such as The American Journal of Clinical Nutrition acknowledge the generous support of members of the food and/or drug industries. Both of those journals publish glutamate-industry sponsored studies.

The subject of glutamate industry influence in peer review journals is discussed in some detail in the section entitled "Suppression of Criticism of Badly Flawed Research."

The potential for glutamate industry influence over the media is obvious. Radio, TV, and newspapers all carry food, drug, and cosmetic advertisements; and members of boards of directors may also be directors of food and/or drug companies.

Mention of MSG by major media sources has been virtually nonexistent since "60 Minutes" aired a story about the toxic effects of MSG in 1991. Some time after the "60 Minutes" program aired, Nancy Millman, writing for the Chicago Tribune, did an article focusing on the activities of J. Samuels and his fight to have MSG labeled. According to Millman, prior to beginning her work, Millman had cleared the story with her editor; but the article was never published. Similarly, the Baltimore Sun accepted and then refused to print an article on MSG by Linda Bonvie; and an editor at the New York Times told Bonvie that she wouldn't take a story that even mentioned MSG. According to Bonvie, the editor had said she was unwilling to face the pressure that she knew she would face if she did. In 1991, Don Hewett of "60 Minutes" said, on television, that he had never had so much pressure applied to him by industry as he had prior

to the airing of the MSG segment. Although rated by TV guide as one of the two most watched segments of the 1991 year, "60 Minutes" won't now touch a story about MSG.

Since 1991, little if any coverage outside of CNN and CBN has said anything other than that MSG-containing food is safe. The only coverage of a law suit filed by consumers against the FDA for failure to require labeling where labeling was needed to protect the public from excitotoxic MSG hidden in food was carried by CNN, CBN, and the St. Louis Post Dispatch when the suit was filed, and by CBN and the Post Dispatch when the court's decision was handed down.

Glutamate-industry involvement is rarely obvious. That's what makes it so effective.
An InHealth article (Schmitz, 1990) ran next to an advertisement from McCormick, a member of The Glutamate Association. Had the McCormick ad not been placed so close to the article, the possibility that McCormick might have commissioned the article might not have been considered. (Magazines often do stories about, or on behalf of, companies that purchase advertising.)

Over the last two decades, the glutamate industry has distributed material designed to convince the public that MSG is safe. Their influence has been so great that as recently as 1989, when consumers raised questions about the safety of free glutamic acid, the FDA commonly referred consumers directly to The Glutamate Association or sent them material prepared by The Glutamate Association. Present FDA practice includes distributing unsolicited copies of an FDA Medical Bulletin that assures physicians that MSG is safe; and distributing similar material to food service people.

The scientific community has been given information by the IGTC and The Glutamate Association, and through intermediaries such as IFIC and ILSI; and members of the scientific community have been encouraged to pass that information on to the public. Allergists, dieticians, and nutritionists appear to have been particularly targeted. Further, the media appear to have been well supplied with glutamate industry materials and to be under tremendous pressure from food and drug advertisers to comment only positively about the value of monosodium glutamate, or not comment at all. IFIC claims that "some three out of four journalists [surveyed] said they use [the IFIC newsletter] Food Insight as background for news stories" (Food Insight, 1994).

It would appear from records of his correspondence and meetings with the FDA, that IGTC chairman Ebert has been designing, or has been instrumental in designing, glutamate-industry sponsored double-blind studies for years with the blessings of the FDA (Ebert, 1990; Ebert, 1991a; FDA, 1992a). In the section entitled "Research," I will make the point that glutamate-industry sponsored research is badly flawed. Industry involvement with the FDA is discussed more fully in the section entitled "The Food and Drug Administration (FDA)."

An overview of glutamate industry research

Animal research: 1970-1980

When Olney and others demonstrated that MSG causes brain lesions and causes neuroendocrine disorders in maturing animals fed MSG as neonates and infants, glutamate industry researchers produced studies that they claimed were failed attempted replications; but their procedures were different enough to guarantee that toxic doses had not been administered, or that all evidence that nerve cells had died would be obscured. Industry-sponsored researchers said they were replicating studies, but did not do so. Instead, discussion was phrased to suggest that studies were "replications," and the conclusions were based on what was said, not on what was done.

Examination of the methodology sections of representative studies (Newman, 1973; Reynolds, 1971; Stegink, 1975). will demonstrate that subjects, test materials, overall procedures, and/or methods of analysis differed from the studies being "replicated." For example, although it had been established that brain lesions could not be identified if examination was not done within 24 hours after insult, glutamate-industry researchers routinely examined the brains of test animals after 24 hours had elapsed. They also used inappropriate methods and materials for staining the material they were examining.

Of particular interest were a study by Stegink et al. (1975) and a study by Reynolds, Butler, and Lemkey-Johnston (1976), which are discussed in more detail in the section titled "Suppression of criticism of badly flawed research." Careful examination will show that researchers used a single slide of the brain of one animal as evidence that free glutamic acid failed to produce brain damage in two different monkeys.

Those studies were underwritten by Ajinomoto, Gerber, International Minerals and Chemical Company, Nestle, and others, in cooperation with the IGTC.

In the 1970s, 1980s, and early 1990s, cooperation between individual researchers, universities and/or medical schools, government, and industry was openly displayed. For example, studies from the University of Iowa College of Medicine and the University of Illinois Medical Center were financed and/or orchestrated by Ajinomoto, Gerber Products Company, G.D. Searle & Company, the IGTC, and Searle Laboratories. Funding also included grants from various institutes of the National Institutes of Health (NIH). Olney had demonstrated earlier that aspartic acid (a structural analog of glutamic acid) and glutamic acid had the same toxic effects, killing brain cells in certain areas of the hypothalamus, and causing endocrine disorders later in life in those animals that had been given either substance as infants.

Monosodium glutamate manufactured by Ajinomoto contained essentially pure glutamic acid and sodium; and Gerber used monosodium glutamate and other forms of glutamic acid in their baby food. In the 1970s, Searle was having difficulty getting aspartame, a new sugar substitute made of approximately 50 per cent phenylalanine, 40 per cent aspartic acid, and 10 per cent a methyl esther, approved by the FDA.

The University of Iowa College of Medicine has a long history of cooperation with food and drug industry interests. In 1967, the Mead-Johnson Professorship in the Department of Pediatrics was established by the Mead-Johnson and Company Foundation, Inc., and Lloyd J. Filer, Jr., M.D., Ph.D., moved from Mead-Johnson (a producer of infant formula) to the University of Iowa College of Medicine, where he served as Mead-Johnson Professor from 1967 through 1977.

In 1969-70, Filer chaired a special FDA "scientific" committee to evaluate the safety of glutamic acid (often referred to as "glutamate") for babies. Not withstanding the fact that Olney had demonstrated that glutamic acid caused brain lesions and neuroendocrine disorders in laboratory animals, with infant animals being most at risk, Filer's committee concluded that glutamate was safe.

Subsequently, the committee was investigated, and most of its members were found to have close financial ties to the food industry (Gillette, 1972). Chairman Filer, then Mead-Johnson Professor at the University of Iowa, was found to be receiving money from both the baby food industry and the glutamate industry. But the FDA never challenged the Filer committee's conclusion that glutamate fed to infants was safe.

In 1979, Filer, Garattini, Kare, Reynolds, and Wurtman, edited the book Glutamic Acid: Advances in Biochemistry and Physiology. Stegink contributed to six articles. The book was a compilation of the papers from a symposium held in Milan, Italy, in 1978. The symposium was organized in response to a less than satisfactory outcome of the Federation of American Societies for Experimental Biology (FASEB)'s 1978 "Evaluation of the Health Aspects of Certain Glutamates as Food Ingredients," and became the basis for FASEB's 1980 "Evaluation of the Health Aspects of Certain Glutamates as Food Ingredients Supplemental Review and Evaluation." (FASEB, 1980) Glutamate industry spokespersons claim the book demonstrates that MSG is "safe."

The Iowa/Illinois animal studies were done between 1971 and 1979. In 1991, Olney testified before a FASEB Expert Panel reviewing data on the safety/toxicity of MSG. An excerpt from the text of that presentation, which follows in Appendix B, describes some of his interaction with these researchers, and concludes:

In summary, the record shows that FDA for two decades has been assuring the public that glutamate is safe, based almost exclusively on certain industry-generated monkey data which appear upon close scrutiny to be seriously flawed, unreliable and spurious. However, even if these data were not flawed, unreliable and spurious, it is obvious from industry's own finding, shown in Fig. 1 above, that the pharmacokinetics of glutamate absorption and/or metabolism are so disparate between monkeys and man that monkeys, despite their phylogenetic closeness to humans, must be regarded as a singularly inappropriate animal model for evaluating oral glutamate safety. The same oral dose of glutamate that causes a dramatic increase in blood glutamate concentrations in humans, causes no increase at all in monkeys. Therefore, it is difficult to understand why so much money and effort was expended on oral glutamate monkey studies, unless the goal was to amass an unchallengeable mountain of negative evidence that could serve as basis for fostering the misleading impression, and fueling the spurious argument, that if monkeys are resistant to glutamate-induced brain damage, other primates, including humans, must be similarly resistant (Olney, 1993).

Lest there be any confusion, note that it is the study of sub-human primates, not the study of mice, that is largely irrelevant to an understanding of the effects of MSG on humans. Mice quite closely approximate the human condition.

The work that demonstrates that glutamic acid causes brain lesions and neuroendocrine disorders in experimental animals has been replicated hundreds of times by neuroscientists. In contrast, almost every published study sponsored by the glutamate industry has concluded that glutamic acid is "safe." Nemeroff (1981), reviewing studies of the safety/toxicity of MSG stated unequivocally that "...not one single [primate] study has truly replicated the methods utilized by Olney, making evaluation of the available [industry] data impossible."

Umami: the alleged fifth basic taste

Ajinomoto has attempted to establish that there is a unique taste, a fifth basic taste, associated with monosodium glutamate. To debate the veracity of such a claim is beyond the scope of this paper. However, considering the fact that such a claim has been made is germane to a discussion of the safety of monosodium glutamate. The scientific literature suggests that only those in the employ of Ajinomoto are interested in proving that Umami is a fifth taste sensation. Moreover, reports from MSG-sensitive consumers suggest that if monosodium glutamate (and other MSG-containing ingredients) had a unique taste, people who were sensitive to the substance, who claim to want to avoid it, would be highly motivated to identify that taste and thereby avoid ingesting MSG–which they claim they are not able to do. It is my personal opinion that the

concept of umami has been developed in an effort to legitimize the use of monosodium glutamate in food.

The Epidemiologic Studies

To defend themselves against epidemiologic studies indicating that 25-30 per cent of the population reacted to monosodium glutamate (Reif-Lehrer, 1977), and against individual reports of human adverse reactions that included migraine headache, seizures, asthma, and depression, the glutamate industry built the fiction that a few people might react to monosodium glutamate with the "Chinese restaurant syndrome:" "burning," "tightness," and "numbness," all occurring at the same time, within two hours following ingestion. Virtually unchallenged, they effectively suppressed the information that other reactions to monosodium glutamate occurred as well, and that some reactions are delayed by as much as 48 hours.

The industry produced a questionnaire study that listed "18 food-associated symptoms," and asked subjects "the time of onset of each symptom [if any] after the start of a meal." (No test meal was provided.). Finding that 1.8 per cent of their 3,222 respondents marked "burning," "tightness," and "numbness," all occurring at the same time, and commencing between 10 minutes and 2 hours after the start of a meal, the authors concluded that 1.8 per cent of the population suffered "Chinese restaurant syndrome" or sensitivity to monosodium glutamate (Kerr et al, 1979). The fact that an additional 41.2 per cent of the subjects reacted with chest pain, dizziness, headache, palpitation, weakness, nausea/vomiting, abdominal cramps, chills, diarrhea, heartburn, unusual thirst, unusual perspiration, flushing sensation in face or chest, and tingling was ignored. Migraine headache, seizures, tachycardia, hives, skin rash, and depression, which were not offered as options, were not considered. Soon the FDA began to disseminate the misinformation that approximately 2 per cent of the population might be sensitive to MSG, reacting with the mild and transitory reactions of "Chinese restaurant syndrome."

The Double-Blind Studies

In the 1980s, in the face of overwhelming evidence that monosodium glutamate kills brain cells in laboratory animals (Olney and Price, 1978, 1980), industry researchers changed their strategy. They began to claim that animal studies were not relevant to humans. They initiated a series of double-blind human studies that, they would claim, "proved" that monosodium glutamate was safe.

A number of industry-sponsored double-blind studies followed the epidemiologic study. Detailed analysis of those double-blind studies revealed that subjects, materials used, and protocols for administering test and placebo material, minimized the chance that subjects would react to the MSG test material; and that if subjects did react to the MSG test material, they would also react to the placebo. Industry researchers:

1. Use variables and methods known to minimize or be irrelevant to identification of the toxic effects of glutamic acid; then conclude that glutamic acid never produces adverse effects. Studies have focused on the relationship between "objective" parameters such as blood pressure and body temperature and ingestion of MSG.

   Unless MSG sensitive people are studied, one can not legitimately draw conclusions about the relationship of the variables being studied (no matter how objective they are) to people who are sensitive to MSG. Often, these studies are used to allegedly "prove" that people who are not sensitive to MSG are not sensitive to MSG.

2. Limit the recorded adverse effects to a few generally mild and transitory reactions occurring simultaneously, such as those first reported in 1968 by Kwok and dubbed

"Chinese- restaurant syndrome" (CRS): "...numbness at the back of the neck, gradually radiating to both arms and the back, general weakness and palpitation." Industry researchers do not consider migraine headache, asthma, tachycardia, arrhythmia, depression, anxiety attacks or other obviously debilitating and/or life-threatening reactions reported since 1968.

3. Make no attempt during a study to prevent subjects from ingesting food to which they might be allergic or sensitive.

4. Record reactions as reactions to monosodium glutamate or placebo material only if they occur 2 hours or less following ingestion of test or placebo material, even though many symptoms are commonly expressed much later, and reactions may persist for much longer periods.

5. Fail to report all data.

6. Draw conclusions that do not follow from the results of the study. The IGTC researchers have concluded, for example, that because approximately one third of their subjects reacted adversely to placebos containing MSG and/or aspartame, they have "proved" that reactions to MSG-containing test material are not reactions to MSG.

7. Use test material that will minimize the effect of any stated amount of glutamic acid test material in producing adverse reactions. One gram monosodium glutamate encased in capsules, and therefore guaranteeing slow release, will cause less effect than 1g monosodium glutamate sprinkled on food; and 1g monosodium glutamate modified with sucrose will cause less effect than otherwise because sucrose is known to slow monosodium glutamate uptake (Stegink, 1986).

8. Continue subjects on medications that might block the effects of MSG.

9. Using placebos to which MSG-sensitive people would react (placebos containing MSG, aspartame, carageenan or enzymes, for example), test potential subjects for sensitivity to those placebos, and eliminate any subjects who react to placebos. Researchers can be fairly certain that those who do not react to their reactive placebos will not react to monosodium glutamate test material.

10. Advertise for, and presumably use, "well subjects" – people who had never experienced any of the symptoms with which reactions to MSG are associated. (If 50 per cent of the population were sensitive to MSG, but research design precluded inclusion of that 50 per cent who were sensitive, a study claiming to assess the number of people sensitive to MSG would be invalid.)

11. Refer to studies as "randomized double-blind crossover design studies," which gives the casual reader the impression that subjects were drawn randomly from the general population. In fact, subjects are often carefully selected people who tell researchers that they have never experienced any of the adverse reactions associated with monosodium glutamate, and, under those conditions, are paid to participate in the studies. Other subjects are people, often students, paid for participating in industry-sponsored studies only if they say that they are sensitive to monosodium glutamate. In either case, the only thing in those studies that is "random" is whether subjects get their monosodium glutamate test trial first and their placebo second, or vice versa. Subjects recruited in 1993 for as yet unpublished IGTC-sponsored studies begun in 1992 by Harvard Medical

School, Northwestern University Medical School, and UCLA Medical School, were paid hundreds of dollars each--only if the applying subjects (many of them students) claimed that they were sensitive to monosodium glutamate. One of my children, a Northwestern student at the time, saw the study advertised, found out the details of participation, applied for the study, and was rejected when she told the researchers that she was not very sensitive to MSG.

12. Use placebos virtually guaranteed to produce as many reactions as might be produced following ingestion of the monosodium glutamate test material. Using toxic material in both test material and placebo, researchers argue that the reactions to MSG-containing test material are not reactions to MSG because subjects also react to placebos, which are assumed to be inert. However, the use of toxic material in placebos, particularly when it is identical or similar to the MSG in the test material, makes it virtually inevitable that there will be approximately as many reactions to placebos as there are reactions to MSG test material.

Sometimes glutamate-industry researchers use MSG in placebos, but use sources of MSG different than the ingredient called monosodium glutamate. Gelatin, which always contains free glutamic acid, has been a favorite. Beginning in 1978, before aspartame was approved by the FDA for use in food, glutamate-industry researchers used aspartame in placebos (Ebert, 1991b). Over and above the fact that use of aspartame in placebos is grossly inappropriate, the fact that aspartame-containing products are supposed to carry a warning on their labels did not deter industry from using the substance, or the FDA from allowing its use. Aspartame contains phenylalanine (which adversely affects one in 15,000 Americans); aspartic acid (an excitatory amino acid); and a methyl esther. Aspartic acid and glutamic acid load on the same receptors in the brain, cause the same brain damage and neuroendocrine disorders in experimental animals, and, with the exception of blindness related to aspartame ingestion, cause virtually the same adverse reactions in humans. There are over 7,000 unsolicited reports of adverse reactions to aspartame filed with the FDA. It should surprise no one, therefore, that glutamate industry researchers find as many reactions following ingestion of an aspartame-containing placebo as they find following ingestion of monosodium glutamate test material.

Placebo reactions have also been noted in industry-sponsored animal studies. It was noted by Nemeroff (1981) that Abraham, Doughtery, Goldberg, and Coulston (1971) and Abraham, Swart, Goldberg, and Coulston (1975) found in both control and glutamic acid treated monkeys a "very small proportion of necrotic or damaged neuronal cells and oligodendrocytes... in the arcuate nuclear region of the hypothalamus." This might happen if the placebo, as well as the test material, contained small amounts of an excitotoxin identical or similar to glutamic acid.

On February 4, 1991 at the FASEB open hearing on the safety of amino acids in dietary supplements, J. Samuels raised the question of the propriety of placebo material used by the glutamate industry. Ebert rebutted, leading to a request from Sue Anne Anderson, R.D., Ph.D., Senior Staff Scientist with the Life Sciences Research Office at FASEB for information about the vehicle for administration of monosodium glutamate in IGTC-sponsored double blind studies. In a March 22, 1991 letter to Anderson, IGTC chairman Ebert responded that "since the completion of the work described in [1978], the sample has been modified to replace the sucrose with the low calorie sweetener Aspartame in both the placebo and sample with MSG." Still, no one at the FDA raised any question about the propriety of the research being submitted to the FDA by the IGTC as evidence that MSG is safe.

In 1993, J. Samuels came across the March 22, 1991 letter to Anderson in the files of the FDA; and brought the information to the attention of both FASEB and the FDA. Still, no one at the

FDA raised any question about the propriety of the research being submitted to the FDA by the IGTC as evidence that MSG is safe. Not long afterward, IGTC chairman Ebert was named by FDA Commissioner David A. Kessler, M.D., to the FDA Food Advisory Committee.

The IGTC has amassed a number of double-blind studies concluding--but not demonstrating--that MSG is safe. The fact that these studies are often done at generally respected universities or medical schools, all of which required that the research be approved by medical research review committees, has public relations value. Subsequently, studies may be published in peer reviewed journals--accepted by editors who, themselves, may have ties to the food and/or drug industries.

Given the methodological flaws inherent in their work, and their unwillingness to change their protocols after flaws were pointed out to them, it would appear that IGTC researchers move from a predetermined conclusion (that their product is "safe") to design and implementation of research guaranteed to bring the reader back to that predetermined conclusion.

Suppression of Information

Interwoven with the assertion that research has demonstrated that monosodium glutamate is "safe," has been the suppression of any and all commentary or data that would say otherwise.

When there was no getting around the fact that MSG caused adverse reactions, as is the case in migraine headache, the glutamate industry and colleagues at the FDA simply did not discuss those reactions. The FASEB, in a report done for the FDA and published July, 1995, (FASEB, 1995) covered the subject of asthma in some detail, but virtually ignored the subject of migraine headache, despite the fact that 43 per cent of the reactions reported to the FDA's Adverse Reactions Monitoring System by MSG-sensitive people were reactions of migraine headache.

Suppression of information relative to the toxic potential of monosodium glutamate has included industry/FDA refusal to identify MSG when present in processed food (making confirmation or denial of MSG-sensitivity extremely difficult); industry/FDA suppression of evidence that demonstrates that ingestion of MSG places humans at risk; industry/FDA use of poor research, imprecise and contradictory terms, half-truths, and misrepresentation of fact; and FDA refusal to provide either consumers or the Court, when a defendant in a legal action, with all of the evidence that the FDA has in its files on the safety/toxicity of MSG.

As consumer pressure to expose the toxic potential of MSG continues; as the growing science on neurodegenerative disease continues to implicate glutamic acid; as a growing number of diverse disease conditions are being linked to the glutamate cascade; and as members of the United States Congress are admitting that they, personally, are sensitive to MSG, industry-inspired articles attesting to the safety of MSG are being published.

A recently published article in The Washington Post by Robert L. Wolke is a case in point (Wolke, 1998).

According to Wolke, "...a lack of scientific understanding hasn't stopped people from enjoying the benefits of MSG for more than 2,000 years." But MSG was only invented in 1908.

According to Wolke, "[FDA] remains convinced that MSG and related substances are safe food ingredients for most people when eaten at customary levels.'" But Wolke fails to mention that could leave 49 percent of the population reacting to MSG.

According to Wolke, there are only small amounts of MSG in typical servings of prepared foods. He suggests that we "contrast this with the FDA's best scientific information, which is that even hypersensitive people must eat between 500 and 2,000 milligrams of pure MSG to cause CRS symptoms." But Wolke refers to "CRS [Chinese restaurant syndrome] symptoms," and not to all of the known reactions to MSG; and Wolke ignores the fact that the FDA's "best scientific information" is not based on any scientific study; because no study even attempting to determine the least amount of processed free glutamate that might cause an adverse reaction in an MSG-sensitive person has ever been done.

The source of Wolke's information is not given.

I wrote to the Editor of the Washington Post, expounding on the bias in Wolke's article. Several days later, I found the following message from Fanny Zollicoffer of the Washington Post on my answering machine: about your "...letter to the editor about MSG, and the article we had in the food section. We'd like to publish your letter. It's being considered for the free fall page on Saturday. And I'm just calling to confirm that you wrote the letter and put your name on it and sent it to no other newspaper." When I called several days later to inquire why my letter had not appeared in the paper, I was told that the editors had decided not to print it.

Suppression of criticism of badly flawed research has been similarly effective. Questions in the form of Letters to the Editor have been refused publication by the Journal of Allergy and Clinical Immunology (Goldschmiedt et al., 1990) and Food Additives and Contaminants (Daniels, Joe, and Diachenko, 1995). (The Daniels et al. study was done at the FDA.)

When a critique of the work of Tarasoff and Kelley was sent to Food and Chemical Toxicology in the form of a Letter to the Editor, (Samuels, 1995) the Letter was accepted for publication; but approximately seven weeks later, I was informed that "after reconsideration we cannot accept your comments on the paper by Tarasoff and Kelly for publication....Our concern is that your critique could be wrongly exploited by different groups of people involved in the MSG issue, and we therefore believe it is preferable that our journal should be kept away from any possible complications" (T. Ho, personal communication, June 1, 1994).

I protested that having been accepted, I had informed others that the Letter was "in press," and that in rejecting the letter as it had, the journal was not only acting in an unprofessional manner, but would cost me a great deal of embarrassment.

After considerable correspondence with the Journal, with Bibra Toxicology International, and with Elsevier Science, I was informed that their battery of expensive solicitors had assured them that by publishing the letter the damage to reputation, if any, had been sufficiently allayed (P. Shepherd, personal communication, February 9, 1995).

According to correspondence from Christopher Lloyd, Editorial Director, Life Sciences/Earth Sciences, Elsevier Science, "...the editorial decisions both to initially accept, and then reject [the] letter were made by the Journal's Editor, Dr. J. Borzelleca." In September, 1994, Editor-in-Chief Borzelleca had told me that the delay of publication should not be of concern because he, Borzelleca, had seen a copy of the draft final report sent to the FDA by FASEB, and knew that it would be rejected by the FDA; causing there to be sufficient time for my letter to be published and considered by FASEB.

The fact that the FASEB draft final report seen by Borzelleca was allegedly confidential, will be discussed in the section entitled "The Food and Drug Administration (FDA)."

The Letter to the Editor of Food and Chemical Toxicology was published more than a year after publication of the original article. Borzelleca, who is on the faculty of the Medical College of Virginia, had blocked publication of criticism of the Tarasoff and Kelly study for almost a year. Donald F. Kirby, M.D., who has done double-blind studies for the IGTC (Ebert, 1990) is also on the faculty of The Medical College of Virginia.

Borzelleca served on the Select Committee on GRAS (Generally Regarded As Safe) Substances that published reviews of the safety of monosodium glutamate for the FDA in 1978 and 1980.

When professional peer review journals hesitate to take articles from glutamate industry researchers because their studies are badly flawed and those flaws have been pointed out to journal editors, researchers hold seminars and/or present their papers at professional meetings with abstracts printed in appropriate journals (Altman, 1994; Stevenson, 1997). Studies reported in abstract form are not peer reviewed, and letters to the editor criticizing abstracts are not generally published. The principal forum for such papers has been the American Academy of Asthma, Allergy, and Immunology (Altman, 1994; Stevenson, 1997). In addition, there are a few journals that, by policy, do not accept critical letters. Food Additives and Contaminants is one (R. Walker, personal communication, September 1, 1995).

By the end of the 1970s, industry-sponsored researchers had basically given up doing animal studies designed to convince people that MSG poses no risk to humans. They continued, however, to claim that their research had demonstrated that MSG poses no risk to humans. Through verbal argument, they attempted to suppress contradictory information.

The work of Filer, Reynolds, and Stegink has been discussed earlier (Reynolds, 1971; Reynolds, 1976; Stegink, 1975). Filer retired from academia, but continued to serve as a spokesman for The Glutamate Association and the IGTC until his death (Filer, 1993).

Reynolds moved into administration, spending time at the University of California before moving on to New York State. However, she continued to proclaim the safety of MSG. In a five page letter to FASEB, for example Reynolds, Filer, and Stegink (1991) explained that cross sections presented in their 1975 and 1976 reports, discussed briefly earlier, although labeled differently, were, indeed, identical, because the 7 day-old Macaca fascicularis monkey that ingested MSG (reported by Reynolds, et al.) was the same "...infant rhesus monkey which received 4 g/kg of MSG by stomach tube 6 h prior to brain perfusion" (reported by Stegink et al.). They assured FASEB that they could find no evidence to support the allegation that the micrograph being challenged by critics came from a previously unreported monkey (an allegation that had not been made), and explained how "the differences between [the] captions [in the Stegink et al. article and the Reynolds et al. article] may confuse the casual reader." No reader would have cause to question the contents of the Reynolds, Filer, Stegink letter unless he or she had both the 1975 and 1976 articles in hand; and then only close scrutiny will reveal that none of the animals given 4g/kg MSG in1971 referred to by Stegink et al. (one of which was allegedly the same animal pictured by Reynolds et al.) had been 7 day-old-animals. (Table 1 of the Stegink et al. study contains that information.) Reynolds et al. had claimed that the section pictured in their paper, and alleged to have been from one of the animals given 4g/kg MSG in 1971 referred to by Stegink et al., came from a 7-day-old animal.

Stegink appears to write on behalf of the safety of MSG whenever the safety of MSG is challenged (Stegink, 1993a, 1993b).

Dissemination of misinformation

The Glutamate Association has disseminated masses of misinformation designed to suppress reports of adverse or toxic reactions, and to convince consumers that monosodium glutamate is safe.

Some of their information is based on distortion of fact. For example, the statement that monosodium glutamate has been used in the orient for more than 2,000 years, or the statement that the glutamic acid in monosodium glutamate (a manufactured product that invariably contains D-glutamic acid and pyroglutamic acid as well as L-glutamic acid) is chemically identical to the glutamic acid found in unadulterated protein (which is composed of L-glutamic acid, only). One of their favorites over time has been the assertion that "other authoritative bodies" have found MSG to be safe. In general, those "other authoritative bodies" have read the FDA's summaries concluding that MSG is safe, or have received selected data provided to them by The Glutamate Association and have called that their data. When questioned, however, Hellen Keller International, one of the "authoritative bodies," was not at all pleased to hear that their name was being used in this way. They had never considered that MSG might have toxic potential. Hellen Keller International was supplementing monosodium glutamate, a widely used food additive, with vitamin A in Indonesia to counteract xerophthalmia, an eye disease caused by lack of vitamin A. (National Food Review, 1987) They did not consider that to be an endorsement of the safety of MSG (Hellen Keller International, personal telephone communication, n.d.).

Half-truths also constitute misinformation. When The Glutamate Association's Richard Cristol wrote to FASEB on April 9, 1993 that researchers had received no funding from The Glutamate Association, he didn't rule out receipt of funding from the IGTC, Ajinomoto, Campbells or other members of the glutamate industry. On page 5 of a brochure titled "Sweet, sour, salty, bitter and umami, the statement is made that "...researchers confirmed that glutamate had an L-configuration." (Umami Information Center, n.d.) It was not, however, made clear that when glutamate is generated through a manufacturing process, the glutamate will contain D-glutamate as well as L-glutamate; that pyroglutamic acid will invariably accompany manufacture; and that under certain circumstances. carcinogenic substances will also be generated.

The balance of the information disseminated by the glutamate industry has been based on conclusions drawn from their badly flawed studies.

Dirty tricks

In October, 1994, the Truth in Labeling Campaign (TLC) was formed to promote truth in labeling, with its first project being full and clear labeling of MSG. In August, 1995 TLC sued the FDA and announced plans for fund raising.

In October, 1995, the Washington Post ran a story about the Truth in Food Labeling Campaign--formed by Public Voice for Food and Health Policy and the National Consumers League for the purpose of raising funds to combat the use of mechanically separated poultry (MSP). It seemed like an innocent coincidence–until the sponsors refused to reveal the source of the grant money given to them to set up the Truth in Food Labeling Campaign, or to elaborate on projects that had been planned for the future.

In an effort to generate publicity, TLC contracted with Bacons Communications to send out press releases announcing the suit filed against the FDA. Bacons provides clipping services, mailing services, and media directories. They have offices in Chicago, Illinois. On the day following the day the releases were to go out, TLC began getting inquiries about incomplete information that had been received by fax--often a cover page, only. After receiving several such

inquiries, it was ascertained that Bacons had held the releases, sending them out the day after the suit was filed, making them non newsworthy. When I made inquiry into what had happened, it became clear that the error was not due to a misunderstanding of instructions or to equipment breakdown.

In 1994, I attended an IFT Short Course "Allergies and other Adverse Reactions to Foods, Additives and Ingredients" sponsored by the IFT, The Food Allergy Center, and the University of Nebraska Food Processing Center. Presenters were Altman; Betty P. Rauch, M.B.A., Allerx Inc.; Daniel J. Skrypec, Ph.D. Kraft General Foods; and Sean F. Altekruse, D.V.M., M.P.H., FDA. According to Altman, who said what little was said about MSG, presenters had been told that I would be in the audience. It was only after the presentation was over that I discovered that prior to the presentation, Altman had given the press a manuscript that was replete with misinformation about the safety of MSG; while in her limited oral presentation, Altman had said nothing that I might question in public.

Agencies of the United States Government

The Food and Drug Administration (FDA)

Reference to the FDA has been made throughout this paper; and rightly so. Because it is the FDA that makes and enforces food labeling laws; and it is the FDA that determines whether or not MSG, or any other chemical, will be approved for use in food. Thus, the FDA holds the keys to life and death for many American people, who would hope that it is the welfare of consumers, not the profits of the food and/or drug industries, that is of concern to the FDA.

Evidence of FDA/industry cooperation will be found in the files of the FDA.

A July 13, 1990 letter from IGTC chairman Ebert to Walter Glinsmann, M.D., Associate Director of Clinical Nutrition, Division of Nutrition, FDA reads, in part "...attached are three [double-blind] protocols for your use...IGTC would be interested in your views, especially on the proposed work by Drs. Kirby and Kjos."(Ebert, 1990).

A January 2, 1991 letter from IGTC chairman Ebert to Fred R. Shank, Ph.D., Director, Center for Food Safety and Applied Nutrition, FDA, requested a scientific review session on MSG with FDA scientists. "In the past, IGTC has requested meetings with FDA staff for purposes of informal reviews of MSG research. Scientists who have carried out studies on MSG, usually in university laboratories or clinics, have presented their data to agency scientists for review and discussion." After elaborating on what the IGTC wanted covered at the meetings, the chairman continued: "As FASEB plans a one day Hearing on Free Amino Acids on February 4, 1991, it seems advisable to complete an FDA meeting prior to that date....FDA scientists who have participated in MSG research discussion in the past included among others: Drs. Shank, Hattan and Scheuplein. Others who would be key attendants include Drs. Rulls, Lin and Bailey...Members of the IGTC/TGA Executive Committee also would plan to join the meeting" (Ebert, 1991a).

A December 9, 1991 FDA Memorandum of Conference (FDA, 1991) notes that "The IGTC requested the meeting to discuss a protocol that they are currently developing for a proposed food allergy study involving MSG. We informed the visitors that we will provide our comments only after they have submitted a written protocol to us with some detailed description of the proposed study."

A September 4, 1992 FDA Memorandum of Conference (FDA, 1992b) reads: "Dr. Kimura gave me a copy of the [IGTC] request (dated 8/20/92) for a meeting with the Commissioner and a

copy of the Bob MacLeod's brief response (dated 9/3/92) to the IGTC. We both agreed that once a description of their research plan (or protocols) is given to us, a meeting will be scheduled for their scientists to discuss with our review staff regarding their research plan aimed to resolve scientific issues surrounding adverse reactions allegedly caused by monosodium glutamate consumed in food."

On October 23, 1992, the FDA hosted a conference at the Center for Food Safety and Applied Nutrition, FDA. Present were Geha (Harvard Medical School), Saxon (UCLA Medical School), Patterson (Northwestern University Medical School), Ebert, (Chairman IGTC), Yoshihisa Sugita (IGTC), Takeshi Kimura (IGTC); and Hattan, Tollefson, Glinsman, Bailey, and Lin of the FDA (FDA, 1992a). Protocols for these studies called for use of aspartame in placebos.

In May, 1992, the Journal of Dental Hygiene (1992) cited Hattan as saying "The FDA's findings were based on the scientific studies provided by the Glutamate Association. The work has been supported by people with an interest in glutamate: consortiums and manufacturers." Earlier, (August, 1990) Hattan had told a toxicology forum in Aspen Colorado that glutamic acid was implicated in a number of disease conditions. According to Hattan, "'developing data on exogenous and endogenous excitogens or excitotoxins has been the primary spur to the Food and Drug Administration's review of monosodium glutamate" (Food Chemical News, 1990). Hattan is central to the debate on the safety/toxicity of MSG, being Deputy Director for the Division of Toxicological Review and Evaluation, at the FDA, and the FDA liaison to FASEB relative to the 1995 FASEB analysis of adverse reactions to monosodium glutamate (MSG). Yet there is no evidence that Hattan raised any question about the propriety of the research being submitted to the FDA by the IGTC as evidence that MSG is safe.

The IGTC has brought badly flawed studies to the FDA for approval, and the FDA has accepted them as demonstrating that the glutamate industry's product is "safe." The FDA has refused to share with either the public, the Congress, or the Court all that it knows about the toxic potential of monosodium glutamate. The FDA has done original research for the benefit of the glutamate industry (Daniels et al, 1995). Thus, the FDA has been actively engaged in the suppression of information pertaining to the toxic potential of monosodium glutamate.

The FDA appears to have cooperated with the glutamate industry at every turn, and has ignored its mandate to protect the public from potentially toxic material. In turn, much of our government has cooperated with the FDA. The flawed nature of the IGTC's research was exposed in 1993 when evidence from the files of the FDA that the IGTC used aspartame in their placebos was brought to the attention of the FDA. In that year, J. Samuels and I asked FDA Commissioner Kessler to investigate the FDA's use of badly flawed studies in their determination that monosodium glutamate is safe. The request was ignored. Even the FDA/HHS Office of the Inspector General, when called upon to investigate charges that the behavior of the FDA was inappropriate, guaranteed that the investigation would be killed by turning the investigation over to the Office of Research Integrity, which, under no circumstances, would have jurisdiction in this matter (C.C. Maddox, Office of the Inspector General, personal communication, March 13,1995). When legislators receive inquiries or calls for help from constituents, they are forwarded to the FDA which, in turn, assures both legislator and constituent that there is no cause for concern.

The FDA is considered an expert in the areas of food, drug, and cosmetic safety by all branches of government; so in any argument over matters of science, the word of the FDA will, with rare exception, be the final word. In addition, the files of the FDA are privileged. Under the provisions of the Administrative Procedures Act, the FDA need disclose to the public, or the Courts, only that information which is part of the Administrative Record for the matter in

question; and it is the FDA that determines what the Administrative record for any question shall be.

When challenged in a suit over full and clear labeling of MSG (August 29, 1995), the Court considered nothing but the Administrative Record presented by the FDA. Studies that demonstrated the MSG had toxic potential were not allowed as evidence because they were not submitted to the Court by the FDA as part of its Administrative Record. The Administrative record was made up of material that the FDA needed in order to win its case, plus a smattering of material from the opposition that had no bite to it, but to which the FDA could point and say, "we looked at that." I was a plaintiff in that law suit.

In 1992, the FDA commissioned FASEB to do an independent review of research on the safety (never toxicity) of monosodium glutamate in food. The FDA has admitted, in reports of adverse reactions on file at the FDA, that headache (they don't call it migraine headache) has been reported as an adverse reaction by over 43 per cent of the people reporting reactions to monosodium glutamate. With possible rare exception, monosodium glutamate is acknowledged as a migraine headache trigger by every headache clinic in this country. In 1991, Alfred Scopp published a study entitled "Monosodium glutamate and hydrolyzed vegetable protein induced headache: review and case studies" (Scopp, 1991). But neither Scopp's study nor the subject of migraine headache are discussed in the August 31, 1995 FASEB report (FASEB, 1995).

J. Samuels and I have criticized the 1995 "independent" FASEB study for responding to just those questions posed by the FDA, and ignoring all others; for conflicts of interests of Expert Panel members; for failing to consider all data relevant to the safety/toxicity of monosodium glutamate; for dismissing, or attempting to dismiss, data that did not fit well with a conclusion that monosodium glutamate is safe; for rejecting the FDA's September, 1994 final draft report of FASEB's allegedly independent investigation; for sharing the contents of that September, 1994 final draft report with agents of the glutamate industry--but no one else; and for making the final FASEB report available to glutamate industry agents--but to no one else--prior to distribution.

The FDA claims that the FASEB September, 1994 draft final report was seen by no one outside of the FDA and FASEB. My requests to FASEB, to Hattan, and to Freedom of Information for copies of the report have been ignored, i.e., not even a written statement denying my request has been forthcoming. But when I spoke to Borzelleca in September, 1994 about the inappropriateness of keeping my letter to the editor of Food and Chemical Toxicology from being published, he told me that he had seen a copy of the September, 1994 FASEB draft final report. (This was discussed more fully under "Suppression of Information.")

For years, the FDA has had clear evidence that monosodium glutamate causes brain lesions and neuroendocrine disorders in laboratory animals, and adverse reactions in humans. Moreover, FASEB, in its 1995 report to the FDA, acknowledged that it was inappropriate to use aspartame in placebos used in double-blind studies of the safety of MSG (FASEB, 1995) and the FDA did not dispute FASEB's conclusion. However, the FDA still allows the unregulated use of MSG in processed food, basing its approval on the flawed aspartame-in-the-placebo studies; and refuses even to require that when present in food, its presence be disclosed.

The FDA allows a meaningless distinction to be made between the processed free glutamic acid in the ingredient called "monosodium glutamate" and the processed free glutamic acid in "other hydrolyzed proteins" (Federal Register, 1977). They allowed the words "No added MSG" or "No MSG added" to be used on labels of food that contain MSG (a practice, they say, is no longer sanctioned). They allow the term "natural" to be used in reference to excitatory amino acids.

(The FDA definition of "natural" is any product that has its original source in nature.) The FDA allows the glutamate industry to create and use sources of MSG that contain carcinogens (mono and dichloro propanols or heterocyclic amines). The FDA tells people that the free glutamic acid in processed food is identical to the free glutamic acid found in unprocessed food and in higher organisms. In all this, the FDA parrots the words of The Glutamate Association and the IGTC.

The FDA sends out, unsolicited, copies of their bulletins informing physicians and food service providers that MSG is not a potential health hazard; but they won't tell consumers in which ingredients MSG is hidden.

The National Institutes of Health (NIH)

Ties between the NIH and the glutamate industry are not immediately obvious. Review of the literature, however, will demonstrate that the NIH has funded some of the industry-sponsored studies designed to demonstrate that MSG is safe for use in food (Fernstrom, 1996; Goldschmiedt, 1990), and has done limited MSG research of its own (Germano et al., 1991). Review of statements made to the media in support of the safety of MSG will further demonstrate that Metcalfe, of the National Institute of Allergy and Infectious Diseases, has spoken out on the safety of MSG (Neergaard, 1994).

On May 4-5, 1998, the NIH hosted a conference designed to explore the evidence that the glutamate cascade appears to be associated with several seemingly diverse disease processes of the central nervous system. According to the conference brochure "...the ‘glutamate cascade' appears to be associated with...addiction, stroke, epilepsy, degenerative disorders, brain trauma, neuropathic pain, schizophrenia, anxiety, and depression." The only reference to the role that exogenous free glutamic acid might play came from a member of the audience.

The U.S. Environmental Protection Agency (EPA)

The EPA has only recently become involved with the issue of the safety/toxicity of MSG.

In July of 1998, with time on my hands, I determined to teach myself how to do a keyword search of the Federal Register. The details of my labors are irrelevant, except to say that when I plugged in the key word "glutamate," I discovered that on January 7, 1998, the EPA had approved spraying processed free glutamic acid, used in plant "growth enhancers," on all agricultural products (Federal Register, 1998).

Application to register AuxiGro, the first MSG-containing product to seek registration, had been published in the August 8, 1997 Federal Register (Federal Register, 1997a). Knowing that the product was being offered for sale, I called the EPA pesticide registration department to ask if and when that registration had been granted; and was informed that there was no such product on their computer. Having in hand the EPA registration number being used by the manufacturer, I insisted that the product had been registered. It was finally determined that AuxiGro had been registered on January 14, 1998. But people still call to inform me that they have called the EPA and been told that no such thing as AuxiGro has been registered; and I have not yet seen notice of the registration published in the Federal Register.

On July 14, 1998, J. Samuels wrote to the EPA Freedom of Information office (FOI) to request background material on the approval of glutamic acid spray on agricultural products. The FOI responded in a timely fashion that they could provide no information at this time, because the product had not yet been registered. When I supplied FOI with the product registration number, I was told that as soon as the file had been purged for proprietary information, it would be sent to J. Samuels. But first it had to be retrieved from the office of Edward Allen, who had borrowed it. I was told there was no other copy than that which had been taken by Mr. Allen. On August 26,

1998 I called FOI to determine the status of J. Samuels' FOI request. On August 28, 1998, I called and left a message for Frances Mann and later called, again; at which time Ms. Mann of the FOI office told me she was putting the Request for Registration into the mail. When I pointed out that I had requested the Administrative File, not the Request for Registration, she said she would look into it and get back to me.

On July 13, 1998, J. Samuels wrote to the EPA, alerting the EPA to the fact that a grievous error had been made in approving the use of a neurotoxic amino acid in a spray for use on food. Initial correspondence with the EPA was directed to Lynn Goldman, M.D., Assistant Administrator for Prevention, Pesticides, and Toxic Substances, with a follow-up conversation with her assistant, Douglas Parsons.

Subsequently, a phone call was received from Edward Allen (Regulatory Action Leader, Biopesticides and Pollution Prevention Division (BPPD), Office of Pesticide Programs, EPA; Roy Sjoblad, Ph.D., Branch Chief, Biochemical Branch; and Freshteh Tothrol, Ph.D., (the scientist who reviewed the Auxein applications); who called to assure J. Samuels that the research relating to Auxein's submission had been thoroughly reviewed, and that the product posed no risk to humans. In response to J. Samuels' protestations that the literature clearly indicated that ingestion or other use of free glutamic acid placed both humans and wildlife at risk, Dr. Sjoblad, told J. Samuels that

"We're simply asking you to support the claims you made that. You can do that. You have these claims. We're not aware of it. It's your responsibility..."
By e-mail, J. Samuels immediately submitted 75 references sufficient to demonstrate that ingestion of free glutamic acid places consumers at risk; and followed that, on July 29, with approximately 500 additional citations and abstracts. A more recent letter contained additional information.

Subsequently, J. Samuels received an e-mail from Janet Andersen, Ph.D., Division Director, BPPD, addressed, evidently, to all those who had written to the EPA by that time (J. Andersen (personal communication, July 27, 1998). The short letter contained basic misinformation and misquoted J. Samuels. That letter read, in part,

"The glutamic acid EPA has approved is 99.3% pure (pharmaceutical grade) L-glutamic acid and is NOT MSG (monosodium glutamate). The Auxein Corporation product contains L-glutamic acid and gamma aminobutyric acid. The product does not contain MSG; EPA is aware of the potential for allergic reactions to MSG."

As this is written, I have questions, but no answers, about the activities of the EPA. From the Auxein Corporation's request for glutamic acid: pesticide tolerance exemption, and publication of the Final Rule granting that exemption, I know that either Auxein Corporation did not comply with the requirements of the Federal Food, Drug and Cosmetic Act (FFDCA) when making its application, or the EPA failed to publish all of Auxein Corporation's submission when it published the request for exemption and the Final Rule. That fact has been pointed out to the EPA.

I also know, and the EPA has received material, including citations and abstracts of studies that contain the information that: 1) pharmaceutical grade L-glutamic acid was used to destroy retinas, kill brain cells, and cause neuroendocrine disorders before neuroscientists realized that they could accomplish the same effect using an inexpensive food additive called monosodium glutamate; 2) food additive monosodium glutamate, by FDA definition, must contain 78 percent free L-glutamic acid and 21 per cent sodium; and 3) it is the free glutamic acid that occurs as a

consequence of manufacture that causes adverse reactions, regardless of the name of the ingredient or product that contains it.

But I do not know why the EPA has ignored the fact that Auxein Corporation violated the FFDCA, has ignored the hard science that says that the free glutamic acid in the Auxein Corporation product has toxic potential, and has said that J. Samuels said "In an email message to EPA on July 23rd, Mr. Samuels has indicated he is not concerned about L-glutamic acid," when J. Samuels never did, and never would, make such a statement. Neither do I know why Andersen responded to a letter from J. Samuels with the answer to one of his many question while ignoring all of the others.

In a letter to J. Samuels dated August 21, 1998, Andersen made the following statements:

1) "There is no scientific evidence that oral consumption of L-glutamic acid normally found in plants and animal proteins causes adverse effects."

The statement is true. It is not the L-glutamic acid normally found in plants and animal proteins that causes brain lesions, neuroendocrine disorders, learning disabilities, and adverse reactions; it is processed free glutamic acid (which consumers refer to as MSG)–the type of glutamic acid found in AuxiGro–that causes those disease conditions.

2) "We have reviewed the scientific studies you sent us showing adverse effects of L-glutamic acid resulting from either direct injection or high-volume force feeding to rodents. None of this data is relevant to the effects of oral ingestion by humans."

Andersen did not respond to the fact that J. Samuels also sent the EPA feeding studies that demonstrated that free glutamic acid caused adverse reactions both in laboratory animals and in humans.

3) "Prior to registering ‘AuxiGro,' the Biopesticides and Pollution Prevention Division (BPPD) in OPP performed a risk characterization on L-glutamic acid as mandated by the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), and Federal Food, Drug, and Cosmetic Act (FFDCA) as amended by the Food Quality protection Act (FQPA)."

Both the references provided to me by the EPA and the statements made in publication of the Final Rule, demonstrate that the EPA has violated Sections 408 (b)(2)(D), 408(c)(2)(A)(i), and 408(c)(2)(B) of the Federal Food, Drug and Cosmetic Act, and ignored Executive Order 13045 entitled Protection of Children from Environmental Health Risks and Safety Risks (62FR 19885, April 23, 1997). Andersen did not address that issue.

According to Section 408 (b)(2)(D) of the Federal Food, Drug and Cosmetic Act, it is the responsibility of the EPA to review the scientific data and other relevant information in support of any action to be taken, and consider its validity, completeness, reliability, and relationship to human risk

According to Section 408 (c)(2)(A)(i) of the Federal Food, Drug and Cosmetic Act, the EPA is allowed to establish an exemption from the requirement of a tolerance (the legal limit for a pesticide chemical residue in or on food) only if there is a reasonable certainty that no harm will result from aggregate exposure to the pesticide chemical residue, including all anticipated dietary exposures and all other exposures for which there is reliable information. This includes exposure through drinking water.

According to Section 408 (c) (2) (B) of the Federal Food, Drug and Cosmetic Act, in considering an exemption from the requirement of a tolerance, EPA is required to give special consideration to exposure of infants and children.

According to Executive Order 13045 entitled Protection of Children from Environmental Health Risks and Safety Risks, "...each Federal agency: (a) shall make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children."

Approval of the use of free glutamic acid in a spray to be used on agricultural products was based, in part, on 14 toxicological studies published in 1979 or before, either found or referenced in one book published in 1979 on behalf of The Glutamate Association, (Filer, 1997) with no reference to the fact that those studies have long since been refuted, and no consideration of the fact that glutamic acid is a neurotransmitter and a neurotoxin known to cause endocrine disorders later in life when ingested by the young. There were no other toxicological studies from the literature considered.

4) "The amount of L-glutamic acid in the pesticide product ‘AuxiGro,' when used according to the label instructions, results in a final application rate of 0.125 to .75 pounds of product or 0.04 to 0.25 pounds (0.64 to 4 oz) per acre. In addition, the L-glutamic acid is applied three to four weeks prior to harvest. Virtually no residues of L-glutamic acid will remain on the crops at the time of harvest."

Andersen uses the word "virtually." I wonder how she knows. The EPA Final Rule establishing a temporary exemption from the requirement of a tolerance for residues of glutamic acid (Federal Register, 1997b), reads, in part, "...because this amino acid is found naturally in plants, the Agency has determined that residue analysis would not yield meaningful results, i.e., the analysis would not discern whether the glutamic acid source was the plant or the product treatment." No claim is made that there will be no residue. The Final Rule goes on to say, "Residues remaining in or on the raw agricultural commodity after this expiration date will not be considered actionable..." Andersen seems to know something that those who wrote the Final Rule didn't know. Those who wrote the Final Rule establishing a temporary exemption from the requirement of a tolerance for residues of glutamic acid spoke of "residues remaining."

SUMMARY AND CONCLUSIONS

This paper has described how one giant industry has selectively collected and reported research data in a way that presents its product, monosodium glutamate, in a favorable fashion.

The technique has three basic components. First, there is research that claims to have demonstrated that their product is safe. Procedures used to develop the research, and/or the statistics used to evaluate its results, produce data that will allow researchers to conclude that their product is safe. Few will notice if between abstract and conclusion, in that wasteland of ponderous detail and scientific terminology read only by the most concerned and conscientious scientists, a program of deception has been executed.

Second, there is suppression of information. When contradictory or embarrassing information has been published, those in positions of power block dissemination of that published information. When critiques of deceptive and misleading research reports are offered for publication, those in positions of power refuse to publish the critiques. When, prior to publication, critiques of deceptive and misleading research reports are anticipated, researchers publish their questionable research in journals that do not accept comment following publication; present their findings orally at industry-sponsored or professional meetings; or publish their

findings in abstract form, only. Neither oral presentations nor published abstracts are subject to peer review or to published criticism. In no case is it immediately obvious that either data or criticism of data have been suppressed.

Other subtle ways to suppress information involve drawing attention away from the truth, and focusing, instead, on the trivial or untrue. Critics are disparaged or made the subject of jokes. (Critics don't report adverse reactions, they "complain.") Irrelevant information is given in response to serious questions about the safety of a product. ("If you eat too much of anything you'll get sick.") Falsehoods are recited by alleged authorities. ("A blood-brain barrier prevents amino acids that you eat from entering the brain.")

Existing data may be distorted or trivialized. Every report of human suffering is labeled an anecdote and dismissed. Research misconduct, if detected, is excused as error of judgement or sloppy research. Suppression of information, in all of its many forms, is ignored. And those in positions of power to do otherwise, ignore the fact that quantities of badly flawed research and repeated instances of direct suppression of information have contributed to the acceptance of this product. That which has been portrayed here is a system wherein data and other information can be suppressed without accountability.

The third component is the industry's success in convincing those elected or appointed to attend to the welfare of the nation to follow the industry's lead in finding this product to be safe. The FDA, the NIH, and the EPA are the agencies that have been singled out for attention here. But the Department of Agriculture is equally culpable, approving labels of products that say "No MSG," or "No Added MSG," for example, when those products contain MSG in any ingredient except the one called monosodium glutamate. Even the FDA states that such practice is illegal.

This paper has described how Ajinomoto, its corporate friends, and its many agents have convinced others to purchase their product; and have made false representations of matters of fact, by words and by conduct, and by concealment of that which should have been disclosed.

The information presented in this paper is factual. The interpretation is my own. But anyone who takes the time to review the facts with detachment and without the bias of special interests will come to the same conclusions I do. The key to having the system work for those who use it to deceive others is the fact that few, if any, will take the time to review the facts with detachment and without prejudice; and whistle-blowers are punished.

APPENDICES

APPENDIX A

Processed free glutamic acid

Monosodium glutamate is the common or usual name assigned by the FDA to the ingredient that contains approximately 78 percent free glutamic acid, 22 percent sodium, and a maximum of 1 per cent contaminant.

Glutamic acid-containing ingredients with lesser amounts of free glutamic acid are assigned other common or usual names such as autolyzed yeast, hydrolyzed lecithin, sodium caseinate, and yeast food, for example.

The FDA makes a meaningless distinction between the ingredient called monosodium glutamate and all of the other hydrolyzed protein products. All, by FDA definition, are "natural" or "naturally occurring." All contain processed free glutamic acid that has been freed from protein, or excreted by bacteria, through a manufacturing process. But the industry refers to the processed free glutamic acid in the former as "added," and to the processed free glutamic acid in the latter as "naturally occurring."

Much of the argument for the safety of MSG is based on this meaningless distinction between food additive monosodium glutamate and other hydrolyzed protein products. The distinction is meaningless in a discussion of adverse reactions to processed free glutamic acid because glutamic acid that has been freed from protein or excreted by bacteria through a manufacturing process causes brain lesions, neuroendocrine disorders, and adverse reactions regardless of the method of processing, regardless of the source of the protein, and regardless of the name of the ingredient that contains it.

There is, however, a meaningful distinction to be made between processed free glutamic acid products and truly natural glutamic acid found in or accompanying truly natural, unfermented, unadulterated, unprocessed protein. The processed product contains L-glutamic acid, D-glutamic acid, pyroglutamic acid, and may contain other chemicals/contaminants. The truly natural glutamic acid found in higher organisms contains L-glutamic acid, only. Defenders of the safety of MSG state that processed free glutamic acid is both structurally and functionally identical to truly natural free glutamic acid. That statement simply is not true.

APPENDIX B

Excerpt from the prepared statement of John W. Olney, M.D. pertaining to adverse reactions to monosodium glutamate presented before the Federation of American Societies for Experimental Biology April, 1993

...When I reported in 1969-70 that glutamate destroys neurons in the hypothalamus when administered either subcutaneously or orally to immature mice (9-12), a U.S. Senate Nutrition Committee was investigating infant nutrition and asked me to comment on the fact that glutamate was being added to baby foods....Under pressure from the Senate committee, FDA arranged for a special ‘scientific' committee to evaluate the safety of glutamate for babies. The committee investigated the matter and concluded that glutamate was safe, but the committee was then investigated and most of its members were found to have close financial ties with the food industry....Of particular note, the committee Chairman, Lloyd J. Filer, was found to be receiving moneys from both the baby food industry and the glutamate industry while he chaired this committee.

When the Filer committee met in 1969-70, I was asked to present my findings to them. Inter alia, I advised the committee that I had demonstrated glutamate-induced brain damage in infant monkeys as well as rodents; the monkey findings were not yet published, but I presented them to the Filer committee. Carefully thereafter, over a period of two years, I completed my monkey study and published the data in the world's leading neuropathology journal (3). Hastily, on behalf of the glutamate and food industries, Filer assembled a group of non-neuroscientists (Reynolds, Filer et al) to study the issue. They hurriedly reported in Science in 1971 that infant monkeys are not susceptible to glutamate neurotoxicity (33) and recommended that my findings be dismissed as fixation artifact. At this time, the glutamate and food industries had also hired several other

non-neuroscience groups to study this brain damage issue. At first, they claimed that my findings could not be confirmed in any species, not even rodents (e.g., se 17), but later the industry consortium changed their story with respect to rodents and other subprimate species when numerous legitimate neuroscientists began reporting confirmation of my findings in the inexpensive species. However, the accuracy and authenticity of the industry findings in monkeys were never challenged, except by me, for a simple reason: no one outside of the food/glutamate industry circle had either the motivation or funding to study monkeys.

In the 1970 era, I was alarmed at some apparent flaws in the Reynolds et al. report in Science and began to challenge these authors. For example, they tube-fed very large doses of glutamate to infant monkeys, which led me to suspect that their infant monkeys probably vomited (large doses of glutamate are known to induce vomiting in monkeys). This raised a crucial issue; if their infant monkeys vomited, they obviously lost dose control and this would render their data unreliable for establishing the safety of glutamate. I questioned Dr. Reynolds on this in public at a scientific meeting a few months before their Science paper appeared in print. In front of a large audience, she admitted that their monkeys vomited. When their Science paper appeared in print (33), I was surprised to read the following description: 'Each infant was maintained in an incubator with handling and cuddling at intervals for a 6 hour period. No unusual behavior was exhibited by the infants.' No mention was made at all of vomiting. Therefore, I wrote a letter to Science pointing out that by the author's own acknowledgment at a public meeting, these infants had vomited. The letter was accepted for publication in Science and was sent to Dr. Reynolds for her response. To my astonishment, in a letter signed by Reynolds, she responded with a denial that they had encountered problems with vomiting or with dose control. Therefore, I withdrew my letter and this exchange was never published.

....In the following year, I invited Reynolds et al. to send a member of their group to my laboratory to learn how to find glutamate damage in monkey brain. In May 1972, a member of their group (Dr. N. Lemkey-Johnston) did visit my laboratory and reviewed microscopic slides with me and she told me she was convinced that glutamate neuropathology was present in the hypothalamus of my monkeys. She also thanked me for pointing out specifically where to look in the hypothalamus to find these lesions. Two years later, when Reynolds et al. published their second paper (34), they stated that they had treated a few additional monkeys with glutamate and had serially sectioned the hypothalamus to provide definitive evidence of no damage. To my amazement, the illustration they showed was once again from the wrong region of the brain....

....In summary, the record shows that FDA for two decades has been assuring the public that glutamate is safe, based almost exclusively on certain industry-generated monkey data which appear upon close scrutiny to be seriously flawed, unreliable and spurious. However, even if these data were not flawed, unreliable and spurious, it is obvious from industry's own finding, shown in Fig. 1 above, that the pharmacokinetics of glutamate absorption and/or metabolism are so disparate between monkeys and man that monkeys, despite their phylogenetic closeness to humans, must be regarded as a singularly inappropriate animal model for evaluating oral glutamate safety. The same oral dose of glutamate that causes a dramatic increase in blood glutamate concentrations in humans, causes no increase at all in monkeys. Therefore, it is difficult to understand why so much money and effort was expended on oral glutamate monkey studies, unless the goal was to amass an unchallengeable mountain of negative evidence that could serve as basis for fostering the misleading impression, and fueling the spurious argument, that if monkeys are resistant to glutamate-induced brain damage, other primates, including humans, must be similarly resistant.

TABLE 1

SPONSORSHIP OF SELECTED SCIENTISTS WHO HAVE CONDUCTED RESEARCH AND/OR SPOKEN PUBLICLY ABOUT THE SAFETY OF MSG

Researchers	Sponsors
Altman, D.R., Fitzgerald, T. & Chiaramonte, L.T (1994)	IGTC
Anantharaman, K. (1979).	Nestle
Bunyan, J., Murrell, E.A., and Shah, P.P. (1976)	Huntingdon Research Centre
Ebert, A.G. (1970)	IGTC
Fernstrom, J.D., Cameron, J.L., Fernstrom, M.H., McConaha, C., Weltzin, T.E., and Kaye, W.H. (1996)	IGTC; NIH
Geha, R. Saxon, A. and Patterson, R. (1998)	IGTC
Germano, P., Cohen, S.G., Hahn, B., and Metcalfe, D.D. (1991)	NIH
Giacometti, T. (1979)	Nestle; IGTC
Goldschmiedt, M., Redfern, J.S., and Feldman, M. (1990)	Ajinomoto; NIH; International Life Science Institute-Nutrition Foundation (ILSI)
Heywood, R., James, R.W., and Worden, A.N. (1977)	Huntingdon Research Centre
Iwata, S., Ichimura, M., Matsuzawa, Y., Takasaki, Y., and Sasaoka, M. (1979)	Ajinomoto
Kenney, R.A. (1979)	IGTC
Kerr, G.R., Wu-Lee, M., El-Lozy, M., McGandy, R., and Stare, F.J. (1979) Ajinomoto U.S.A.	Ajinomoto U.S.A.
Kirby, D. (unpublished)	IGTC
Matsuzawa, Y., Yonetani, S., Takasaki, Y., Iwata, S., and Sekine, S. (1979)	Ajinomoto
Morselli, P., and Garattini, S. (1970)	COFAG (IGTC Europe)
Newman, A.J., Heywood, R., Palmer, A.K., Barry, D.H., Edwards, F.P., and Worden, A.N. (1973)	Huntingdon Research Centre

Edwards, F.P., and Worden, A.N. (1973)	Huntingdon Research Centre
Owen, G., Cherry, C.P., Prentice, D.E., and Worden, A.N. (1978)	Huntingdon Research Centre
Reynolds, W.A., Lemkey-Johnston, N., Filer, L.J. Jr., and Pitkin, R.M. (1971)	Gerber; International Minerals and Chemical Corp. (IMC)
Schiffman, S.S. (1991)	International Food Information Council (IFIC)
Stegink, L.D., Reynolds, W.A., Filer, L.J. Jr., Pitkin, R.M., Boaz, D.P., and Brummel, M.C. (1975)	Gerber; IMC
Stevenson, D.D., Simon, R.A., and Woessner, K.M. (1997)	IGTC
Takasaki, Y., Matsuzawa, Y., Iwata, S., O'Hara, Y., Yonetani, S., and Ichimura, M. (1979)	Ajinomoto
Takasaki, Y, Sekine, S., Matsuzawa, Y., Iwata, S., and Sasaoka, M. (1979)	Ajinomoto
Tarasoff, L and Kelly, M.F. (1993)	IGTC
Yang, W.H., Drouin, M.A., Herbert, M., and Mao, Y. (1997)	IGTC

REFERENCES

Abraham, R., Doughtery, W., Goldberg, L., and Coulston, F. (1971). The response of the hypothalamus to high doses of monosodium glutamate in mice and monkeys: cytochemistry and ultrastructural study of lysosomal changes. Exp Mol Pathol 15: 43-60.

Abraham, R., Swart, J., Goldberg, L., and Coulston, F. (1975). Electron microscopic observations of hypothalami in neonatal rhesus monkeys (Macaca mulatta) after administration of monosodium L-glutamate. Exp Mol Pathol 23: 203-213.

Altman, D.R., Fitzgerald, T. & Chiaramonte, L.T. (1994). Double-blind placebo-controlled challenge (DBPCC) of persons reporting adverse reactions to monosodium glutamate (MSG). J. Allergy and Clinical Immunology Abstracts 93:303 (Abstract 844).

American Academy of Allergy and Immunology in cooperation with the International Food Information Council Foundation (1993). Understanding Food Allergy [Brochure].

American College of Allergy & Immunology (1991a). (News release).

American College of Allergy & Immunology (1991b). (Position statement).

American College of Allergy & Immunology (n.d.). (Answers to anticipated questions that may be asked by patients or reporters).

American Medical Association (AMA) Council on Scientific Affairs (1991). (Resolution 187).

Anantharaman, K. (1979). In utero and dietary administration of monosodium L-glutamate to mice: reproductive performance and development in a multigeneration study. In L.J. Filer, Jr., S.

Garattini, M.R. Kare, W.A. Reynolds, and R.J. Wurtman, (Eds), Glutamic acid: advances in biochemistry and physiology. New York: Raven.

Auer, R.N. (1991). Excitotoxic mechanisms, and age-related susceptibility to brain damage in ischemia, hypoglycemia and toxic mussel poisoning. NeuroToxicology 12:541-546.

Auer, R.N. (1996) Expert Report of Roland N. Auer, M.D., Ph.D., F.R.C.P.C. Statement made on behalf of the U.S. Department of Health and Human Services, Office of the General Counsel, Food and Drug Division, Rockville, MD 20857, September 30, 1996.

Blaylock, R.L. (1994). Excitotoxins: the taste that kills. Santa Fe: Health Press.

Bunyan, J., Murrell, E.A., and Shah, P.P. (1976). The induction of obesity in rodents by means of monosodium glutamate. Br J Nutr 35: 25-29.

Chinese restaurant syndrome. (1990, January). Mayo Clinic Nutrition Letter.

Daniels, D.H., Joe, F.L. and Diachenko, G.W. (1995). Determination of free glutamic acid in a variety of foods by high-performance liquid chromatography. Food Additives and Contaminants 12:21-29.

Ebert, A.G. (1970). Chronic toxicity and teratology studies of monosodium L-glutamate and related compounds. Toxicol Appl Pharmacol 17: 274.

Ebert, A.G. (1990). Letter to Walter H. Glinsmann, M.D. Associate Director of Clinical Nutrition, Division of Nutrition, FDA. Subject: the research of Donald Kirby, M.D., Medical College of Virginia. July 13, 1990.

Ebert, A.G. (1991a). Letter to Fred R. Shank, Ph.D. Director, CFSAN, FDA. Subject: the research of Donald Kirby, M.D., Medical College of Virginia. January 2, 1991.

Ebert, A.G. (1991b). Letter to Sue Ann Anderson, R.D., Ph.D., Senior Staff Scientist, FASEB. March 22, 1991.

FDA (1991, December 9). Memorandum of Conference. Center for Food Safety and Applied Nutrition, FDA. Visitors from the IGTC. FDA Hattan and Lin.

FDA (1992a, October 23). Memorandum of Conference. Center for Food Safety and Applied Nutrition, FDA. Subject: the research of R.S. Geha (Harvard Medical School), A. Saxon (UCLA Medical School), R. Patterson (Northwestern University Medical School), and the IGTC.

FDA (1992b, September 4). Memorandum of Conference. Center for Food Safety and Applied Nutrition, FDA. Visitors: Takeshi Kimura, Ajinomoto Co., Inc. FDA: Lawrence Lin.

FDA (1995, August 31). Backgrounder.

FDA in cooperation with the IFIC Food Education Foundation (1992). Food Additives [Brochure].

Federal Register (1977). March 15, 1977 (Vol 42, Number 50, Pages 14318-14319). CFR 21, Paragraph 101.35. Notice to manufacturers and users of monosodium glutamate and other hydrolyzed vegetable protein products.

Federal Register (1997a). August 8, 1997 (Volume 62, Number 153, Pages 42782-42783).

Federal Register (1997b). September 5, 1997 (Volume 62, Number 172, Pages 46882-46885).

Federal Register (1998). January 7, 1998 (Volume 63, Number 4, Pages 679-682).

Federation of American Societies for Experimental Biology (FASEB) (1980). Safety of amino acids used as dietary supplements. Bethesda, MD: Life Sciences Research Office, FASEB.

Federation of American Societies for Experimental Biology (FASEB) (1995). Analysis of adverse reactions to monosodium glutamate (MSG). Bethesda, MD: Life Sciences Research Office, FASEB.

Fernstrom, J.D., Cameron, J.L., Fernstrom, M.H., McConaha, C., Weltzin, T.E., and Kaye, W.H. (1996). Short-term neuroendocrine effects of a large, oral dose of monosodium glutamate in fasting male subjects. J Clin Endocrinol Metab 81: 184-191.

Filer, L.J. Jr., Garattini, S., Kare, M.R., Reynolds, W.A., and Wurtman, R.J. (Eds.). (1979). Glutamic acid: advances in biochemistry and physiology. New York: Raven Press.

Filer, L. J. (1993). Public Forum: analysis of adverse reactions to monosodium glutamate. Paper presented at open meeting of the Federation of American Societies for Experimental Biology, April 1993.

Food Allergy News (1994, December-January). Fairfax, VA: Food Allergy Network.

Food Chemical News (1990, August 6). Washington, DC: CRC Press. p.10.

Food Insight (1994, May/June). Washington, DC: International Food Information Council (IFIC) Foundation.

Food Technology (1993, September). Chicago: Institute of Food Technologists. p.34.

Garattini, S. (1979). Evaluation of the neurotoxic effects of glutamic acid. In R.J. Wurtman, & J.J. Wurtman (Eds.), Nutrition and the brain. New York: Raven Press.

Geha, R., Beiser, A., Ren, C., Patterson, R., Greenberger, P., Grammer, L.C., Ditto, A.M., Harris, K.E., Shaughnessy, M.A., Yarnold, P., Corren, J., Saxon, A. (1998). Multicenter multiphase double blind placebo controlled study to evaluate alleged reactions to monosodium glutamate (MSG). J. Allergy Clin Immunol Abstracts 101:S243 (Abstract 106).

Germano, P., Cohen, S.G., Hahn, B., and Metcalfe, D.D. (1991). An evaluation of clinical reactions to monosodium glutamate (MSG) in asthmatics using a blinded, placebo-controlled challenge. J Allergy Clin Immunol Abstracts 87:177 (Abstract 155).

Giacometti, T. (1979). Free and bound glutamate in natural products. In L.J. Filer, Jr., S. Garattini, M.R. Kare, W.A. Reynolds, and R.J. Wurtman, (Eds), Glutamic acid: advances in biochemistry and physiology. New York: Raven.

Gillette, R.(1972). Academy food committees: new criticism of industry ties. Science 177:1172-1175.

Glutamate Association. (1993). Letter to FASEB. April 9, 1993.

Glutamate Association - U.S. (1990). In The Encyclopedia of Associations, 24th Edition.

Goldschmiedt, M., Redfern, J.S., and Feldman, M. (1990). Food coloring and monosodium glutamate: effects on the cephalic phase of gastric acid secretion and gastrin release in humans. Am J Clin Nutr 51: 794-797.

Heywood, R., James, R.W., and Worden, A.N. (1977). The ad libitum feeding of monosodium glutamate to weanling mice. Toxicol Lett 1: 151-155.

Institute of Food Technologists' Expert Panel on Food Safety and Nutrition (1980). Monosodium glutamate, a scientific status summary. Chicago: Institute of Food Technologists.

International Food Information Council (1991) What you should know about Monosodium glutamate [Brochure].

International Food Information Council. MSG Committee/MSG Coalition. (1991). Communications Plan, July-December 1991 (As revised at 7/22/91 meeting).

International Food Information Council (1996). In The Encyclopedia of Associations, 31st Edition.

International Glutamate Technical Committee (IGTC) (1992). In The Encyclopedia of Associations, 26th Edition.

International Glutamate Technical Committee (IGTC) (1994). In National Trade and Professional Associations of the United States, 1994 Edition.

International Life Sciences Institute Australia Inc. (1990, July 31). The Scientific Facts about MSG. Symposium held at the Sydney Hilton Hotel, Sidney, Australia.

Iwata, S., Ichimura, M., Matsuzawa, Y., Takasaki, Y., and Sasaoka, M. (1979). Behavioral studies in rats treated with monosodium L-glutamate during the early states of life. Toxicol Lett 4: 345-357.

Journal of Dental Hygiene (1992). 66:(4) 158.

Kenney, R.A. (1979). Placebo-controlled studies of human reaction to oral monosodium L-glutamate. In L.J. Filer, Jr., S. Garattini, M.R. Kare, W.A. Reynolds, and R.J. Wurtman, (Eds), Glutamic acid: advances in biochemistry and physiology. New York: Raven.

Kenney, R.A., and Tidball, C.S. (1972). Human susceptibility to oral monosodium L-glutamate. A J Clin Nutr 25:140-146.

Kerr, G.R., Wu-Lee, M., El-Lozy, M., McGandy, R., and Stare, F.J. (1979). Prevalence of the "Chinese restaurant syndrome." J Am Diet Assoc 75: 29-33.

Kizer, J.S., Nemeroff, C.B., and Youngblood, W.W. (1978). Neurotoxic amino acids and structurally related analogs. Pharmacological Reviews 29: (4) 301-318.

Kwok, R.H.M. (1968). Chinese-restaurant syndrome. Letter to the editor. N Engl J Med 278: 796.

Leung, A. and Foster, S.(1996). Encyclopedia of common natural ingredients used in food, drugs, and cosmetics. New York: Wiley.

Lucas, D.R., and Newhouse, J.P. (1957) The toxic effect of sodium L-glutamate on the inner layers of the retina. AMA Arch Ophthal 58: 193-201.

Macrae, R., Robinson, R.K., and Sadler, M.J. (Eds.). (1993). Encyclopedia of Food Science Food Technology and Nutrition (1993 ed.). London: Academic Press.

Matsuzawa, Y., Yonetani, S., Takasaki, Y., Iwata, S., and Sekine, S. (1979). Studies on reproductive endocrine function in rats treated with monosodium L-glutamate early in life. Toxicol Lett 4: 359-371.

McNutt, K. (1991, May 22). Nutrition, Communications and the Information Explosion. Presentation before the Society for Nutrition Education Metro-DC Affiliate.

Metcalfe, D.D., and Sampson, H.A., (Eds.). (1990). Workshop on Experimental Methodology for Clinical Studies of Adverse Reactions to Foods and Food Additives. J. Allergy Clin Immunol Supplement 86:(3, part 2)421-442.

Metcalfe, D.D., Sampson, H.A., and Simon, R.A. (Eds.). (1991). Food Allergy: Adverse Reactions to Foods and Food Additives. Oxford: Blackwell.

Morselli, P., and Garattini, S. (1970). Monosodium-glutamate and the Chinese restaurant syndrome. Nature (London) 227: 611-612.

National Food Review (1987, Fall). p 22.

Neergaard, L. (1994, March 23). Eating MSG Associated Press wire.

Nemeroff, C.B. (1981). Monosodium glutamate-induced neurotoxicity: review of the literature and call for further research. In S.A. Miller (Ed.), Nutrition & behavior. Philadelphia: Franklin Institute Press.

Newman, A.J., Heywood, R., Palmer, A.K., Barry, D.H., Edwards, F.P., and Worden, A.N. (1973). The administration of monosodium L-glutamate to neonatal and pregnant rhesus monkeys. Toxicology 1: 197-204.

Olney, J.W. (1969). Brain lesions, obesity, and other disturbances in mice treated with monosodium glutamate. Science 164: 719-721.

Olney, J.W. (1993, April). Prepared statement for the public meeting (April 1993) pertaining to adverse reactions to monosodium glutamate (MSG). Presented at a public meeting conducted by the Federation of American Societies for Experimental Biology (FASEB), Bethesda, MD.

Olney, J.W. and Price M.T. (1978). Excitotoxic amino acids as neuroendocrine probes. In E.G. McGeer, J.W. Olney, and P.L. McGeer (Eds.), Kainic Acid as a Tool in Neurobiology. New York: Raven.

Olney, J.W. and Price, M.T. (1980). Neuroendocrine interactions of excitatory and inhibitory amino acids. Brain Research Bulletin 5: Suppl 2, 361-368.

Owen, G., Cherry, C.P., Prentice, D.E., and Worden, A.N. (1978). The feeding of diets containing up to 4% monosodium glutamate to rats for 2 years. Toxicol Lett 1: 221-226.

Pulce, C., Vial, T., Verdier, F., et al. (1992). The Chinese restaurant syndrome: a reappraisal of monosodium glutamate's causative role. Adverse Drug Reaction Toxicology Review pp.19-39.

Reif-Lehrer, L. (1977). A questionnaire study of the prevalence of Chinese restaurant syndrome. Fed Proc 36:1617-1623.

Reynolds, W.A., Butler, V., Lemkey-Johnston, N. (1976). Hypothalamic morphology following ingestion of aspartame or MSG in the neonatal rodent and primate: a preliminary report. J Toxicol environmental Health 2: 471-480.

Reynolds, W.A., Filer, L. J., and Stegink, L.D. (1991). Letter to Dr. Kenneth G. Fisher, LSRO, FASEB. May 31, 1991.

Reynolds, W.A., Lemkey-Johnston, N., Filer, L.J. Jr., and Pitkin, R.M. (1971). Monosodium glutamate: absence of hypothalamic lesions after ingestion by newborn primates. Science 172: 1342-1344.

Samuels, A. (1995). Monosodium L-glutamate: a double-blind study and review. Letter to the editor. Food and Chemical Toxicology. 33: 69-78.

Schaumburg, H.H., Byck, R., Gerstl, R. and Mashman, J.H. (1969) Monosodium L-glutamate: its pharmacology and role in the Chinese restaurant syndrome. Science 163: 826-828.

Schiffman, S.S. (1991). Taste and smell perception in elderly persons. In J.E. Fielding and H.I. Frier (Eds.), Nutritional needs of the elderly. New York: Raven Press.

Schmitz, A.(1990, November/December). MSG: A cause for alarmists. InHealth pp 20-23.

Schwartz, G.R.(1988). In bad taste: the MSG syndrome. Santa Fe: Health Press.

Schwartz, K. (1996, Summer). NoMSG Messenger (Newsletter of the National Organization Mobilized to Stop Glutamate)

Scopp, A.L.(1991). MSG and hydrolyzed vegetable protein induced headache: review and case studies. Headache 31:107-110.

Scripps Clinic and Research Foundation Division of Allergy, Asthma, and Immunology Developed in conjunction with the International Food Information Council Foundation (1995). What You Should Know About Asthma and Food [Brochure].

Simon, R.A. and Stevenson, D.D. (1995, August 30). Letter to FDA Commissioner David A. Kessler.

Slind-Flor, V. (1993, October 25). Scientific Fraud and the Law. The National Law Journal 16(8): 1.

Stegink, L.D. (1993a, October 15). Letter to Dr. Kenneth D. Fisher, FASEB (Submission #707).

Stegink, L.D. (1993b, October 22). Letter to Dr. Kenneth D. Fisher, FASEB (Submission #709)

Stegink, L.D., Filer, L.J. Jr., Baker, G.L. and Bell, E.F.(1986). Effect of sucrose ingestion on plasma glutamate concentrations in humans administered monosodium L-glutamate. A J Clin Nutr 43:510-515.

Stegink, L.D., Reynolds, W.A., Filer, L.J. Jr., Pitkin, R.M., Boaz, D.P., and Brummel, M.C. (1975). Monosodium glutamate metabolism in the neonatal monkey. Am J Physiol 229: 246-250.

Stevenson, D.D., Simon, R.A., and Woessner, K.M. (1997, February 25). The role of monosodium L-glutamate (MSG) in asthma: does it exist? Poster presentation #1670. AAAAI/AAI/CIS joint meeting. American Academy of Allergy Asthma & Immonology. San Francisco, CA.

Takasaki, Y., Matsuzawa, Y., Iwata, S., O'Hara, Y., Yonetani, S., and Ichimura, M. (1979a). Toxicological studies of monosodium L-glutamate in rodents: relationship between routes of administration and neurotoxicity. In L.J. Filer, Jr., S. Garattini, M.R. Kare, W.A. Reynolds, and R.J. Wurtman, (Eds), Glutamic acid: advances in biochemistry and physiology. New York: Raven.

Takasaki, Y., Sekine, S., Matsuzawa, Y., Iwata, S., and Sasaoka, M. (1979b). Effects of parenteral and oral administration of monosodium L-glutamate (MSG) on somatic growth in rats. Toxicol Lett 4: 327-343.

Taliferro, P.J. (1995). Monosodium glutamate and the Chinese restaurant syndrome: a review of food additive safety. J. Environmental Health 57: 8-12.

Tarasoff, L and Kelly, M.F. (1993). Monosodium L-glutamate: a double-blind study and review. Food Chem Toxic 31:1019-1035.

Taylor, S.L. (1991, July 26). Letter to FDA Dockets Management Branch.

Taylor, S.L. (1993, April). Possible adverse reactions to hydrolyzed vegetable protein. Paper submitted to the Federation of American Societies for Experimental Biology review panel.

Taylor, S.L. and Hefle, S.L. (1997, March 7). Letter to FDA Dockets Management Branch Re: Food Labeling Declaration of Free Glutamate in Food (Docket 96N-0244).

Tufts University Diet & Nutrition Letter (1992, February). pp 4-6.

Umami Information Center (n.d.). Sweet, Sour, Salty, Bitter and UMAMI: It's simply a matter of taste [Brochure]. 1-5-8 Kyobashi, Chuo-ku, Tokyo 104, Japan.

University of California at Berkeley Wellness Letter: (1989, October). University of California at Berkeley School of Public Health.

University of California at Berkeley Wellness Letter (1996, June). University of California at Berkeley School of Public Health. p. 2.

Wolke, R.L. (1998, June 17). Food 101: The mystery of MSG. Washington Post. E1-E2.

Wood, J. (1991, August-September). Are you sensitive to ‘harmless' MSG? Modern Maturity 34:74.

Yang, W.H., Drouin, M.A., Herbert, M., and Mao, Y. (1997). The monosodium glutamate symptom complex: Assessment in a double-blind, placebo-controlled, randomized study. J Allergy Clin Immunol 99: 757-762.