



Chemo sense

EDITORIAL

Clarity or Confusion: Umami, AACSS and SARS

By Graham Bell

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Scientific research is meant to reduce uncertainty, yet often it reveals only the existence of more uncharted territory. On occasions, research sows the seeds of confusion and even falsehood. This has been the case with the subject of "umami" and monosodium glutamate (MSG), of which it has been said, on the flimsiest of research evidence and anecdote, that it exacerbates asthma, and leaves one feeling hungrier after food (the "Chinese restaurant syndrome"). Our leading review helps set the record straight on these and other issues.

In addition, over sixty abstracts of the AACSS's Heron Island meeting, published herein, contribute clarity to the broad canvass of chemosensory science: from corals to man.

A tale of confusion, wrought by SARS (Severe Acute Respiratory Syndrome), is told in our exclusive eyewitness e-mail from Beijing. The SARS outbreak has, thankfully, been contained, at great cost and suffering, mostly in China. So what have we learned? ■

Umami: An Oriental or a Universal Taste?

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Although there is no English word for it, *umami* is a savory taste imparted by glutamate and 5'-nucleotides, such as inosinate and guanylate, which occur naturally in many foods including meat, fish, vegetables, and dairy products. The taste of umami itself is subtle. It blends well with others to expand and round out flavors.

Most people don't recognize umami when they encounter it, but all of them taste it when they eat tomatoes, Parmesan cheese, cured ham, mushrooms, sun-dried tomatoes, meat and fish, etc. Almost no one can identify umami in the taste of tomatoes, but it is one of the important taste elements that are in harmony with sweet, sour and the little earthy flavor of tomato. When Australians eat Vegemite sandwiches, they enjoy harmonious blends of umami and salty tastes.

Who first identified the taste of glutamate?

Almost 100 years ago, a Japanese scientist, Prof. Kikunae Ikeda, thought that there was something common in the complicated taste of asparagus, tomatoes, cheese and meat, which was quite peculiar and could not be classified under any of the well defined four taste qualities, sweet, sour, salty and bitter. He started investigating the constituents of dried seaweed (called *konbu*), because he detected this taste most clearly in soup stock prepared with *konbu*. The soup stock, or "*dash*" in Japanese, has been traditionally used in Japanese cuisine for more than 1000 years. He discovered the taste to be contributed by glutamate contained in dried *konbu*, and named this taste "*umami*" (Ikeda 1908). It should be noted that Prof. Ikeda's 1909 scientific paper on the discovery of umami, was re-introduced in the recent volume of *Chemical Senses* along with short communications by Drs. Halpern, Lindeman, et al. (Halpern, 2002; Lindeman et al., 2002; Ikeda, 2002).

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Wine Sense

Umami

AACSS 2003 at Rutherglen

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Umami: An Oriental or a Universal Taste? continued

After the discovery of umami, Ikeda tried to develop a new flavoring substance based on glutamate compatible with the natural taste of foods. To formulate his ideal flavoring, he tried to make crystals of sodium glutamate, potassium glutamate, calcium glutamate, ammonium glutamate, etc. Finally he found that monosodium glutamate (MSG) was the best flavoring because it was readily soluble in water, had strong umami taste, high stability, and absorbed no humidity. Thus MSG was first marketed in Japan in 1909. His discovery of umami, and introduction of the new seasoning, MSG, made a great contribution to the food industry. His idea of using glutamate, one of the amino acids that are building blocks of protein, in seasoning was the world's first product based on a single amino acid. Prof. Ikeda is listed as one of the ten greatest Japanese inventors by the Japanese government Patent Office (<http://www.jpo.go.jp/indexj.htm>).

In 1913, Kodama, a student of Prof. Ikeda, examined the constituents of katsuobushi (flakes of dried bonito), and reported that inosinate also had umami taste characteristics (Kodama 1913). Many years later, during a study of ribonucleotide production through biochemical degradation of yeast RNA, Kuninaka identified guanylate to be another important umami substance (Kuninaka 1960 and 1964, Sakaguchi et al. 1958). Subsequently, guanylate was found to occur naturally in dried shiitake mushrooms, which are used widely in Japanese and Chinese cooking (Nakajima et al. 1961). Kuninaka also described the taste synergism between glutamate and nucleotides (Kuninaka 1960 and 1964, Sakaguchi et al. 1958), i.e., when glutamate and 5'-ribonucleotides, such as inosinate or guanylate, are mixed together, the intensity of the umami taste is markedly enhanced. It is interesting to note that the long tradition of using combinations of food ingredients in soups and stocks might

conceivably have achieved a combination of glutamate and 5'-ribonucleotides, which would have greatly enhanced the umami taste. For example, common knowledge of using seaweed and bonito in Japan, or meat (or fish) and vegetables in western countries uses the synergistic effect of glutamate and nucleotides to make flavorful stocks.

Discovery of rapidly-cooking soups in Europe

Bouillon has traditionally been used in western countries in a similar way to Japanese broth prepared by Konbu and dried bonito, which simply adds the taste of umami to various Japanese dishes. Bouillon cubes were first commercially made by Swiss flour manufacturer Julius Maggi in 1882 (Heer 1991). He developed and produced bouillon cubes so that people who could not afford meat would have an inexpensive method for making nutritious soup. Rapid-cooking dehydrated soups evolved into an important business segment in western

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ChemoSensory Scientific Meeting

at Rutherglen, Victoria

2 - 4 October, 2003

The Sixth Annual Scientific Meeting of the Australasian Association for ChemoSensory Science Inc. (AACSS) will be held from 2 - 4 October at The Tuileries, Rutherglen, Victoria, Australia

Final Call for Papers: Submission of oral and poster papers are now invited.

For information on abstract format please e-mail the Program Chair.

Abstracts should be emailed to the **Program Chair: Caroline Owen: cowedn@swin.edu.au**. All abstracts will be refereed by peer review prior to acceptance.
Closing date for abstracts is 31st July 2003.

Registration: Contact the Conference Organiser, Jennifer Weller: jenniferweller@goodmanfielder.com.au

Attendance Fees:

Full fee: \$140, Students (Full time only) \$70.
Early bird discount (before 31 August): Full: \$130, Students (Full time only): \$60.
Students: Proof of enrolment is required at registration to obtain fee reduction.
Conference Dinner (3 October): Additional cost of \$60 (3 course dinner, with wine + music)

Three cash prizes for student papers/posters will be awarded.

Program:

Thursday 2 Oct: Welcoming function and plenary lecture
Friday 3 Oct: Morning and afternoon sessions and conference dinner
Saturday 4 Oct: Morning session. Close (optional winery tours).

About the Venue:

The Tuileries, Rutherglen, Victoria, Australia
<http://www.tuileriesrutherglen.com.au>

The conference will be held in this modern conference centre built into an old winery of the early 1800s. The venue offers AACSS a relatively inexpensive conference with all the enjoyment of an interesting country location.

About the Region:

The Rutherglen is one of Australia's oldest wine regions and is famous for superb reds, ports, muskets and tokays. Its many gourmet restaurants draw on the high quality produce, including meat, wine, olives, bread, and cheese for which the region is famous. The mountain resorts of Victoria (Buller, Falls Creek, Mount Buffalo) can be accessed in an hour or so by car, for anyone wishing to see unique snow gum trees and Australian alpine flowers in spring snow. Tour the wineries by horse-drawn carriage or explore the beautiful Murray River. Winery tours will be arranged for Saturday and Sunday to meet demand.

Transport

Rutherglen is accessible by car or bus in about 3h from Melbourne and 7h from Sydney, or by train or air into Albury.

Accommodation

There is a good range of accommodation to suit every budget and an impressive number of fine restaurants. **Book your own accommodation directly.** For information, see <http://www.visitrutherglen.com.au>

Who should attend?

Researchers and applied scientists in the chemical senses from research institutions and academia, as well as *industrial delegates* are welcome and encouraged to attend. A contingent of Australian and international representatives of the *food, wine, beverage, perfume, pharmaceutical, flavour, air & water quality industries* are expected.

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Umami: An Oriental or a

countries. A meaty flavor from hydrolyzed plant protein was an indispensable factor used to satisfy these Europeans. At that time, it was not known that a major taste part of these hydrolysates was a taste imparted by glutamate, which is most abundant in protein hydrolysates. Two discoveries, the bouillon cube and MSG, reflect the traditional dietary culture in Europe and Japan. Taste of bouillon is made up of various components that are brought out from meat and vegetables. Taste of "dashi" is mainly made up by glutamate from dried konbu. The major and important taste element in both bouillon and dashi is umami, imparted by glutamate or nucleotides. Although the traditional way of enriching taste in various dishes in Europe and Japan differed, the key component in the bouillon cube and MSG, was the same: glutamate.

Natural occurrence

Even before the formal identification of umami as a separate taste, it is interesting to note that glutamate-rich foods and ingredients were used in many civilizations. The use of fermented fish sauce in ancient Greece and Rome, which is called garum, is well documented (Curtis 1991). Method of production process for garum is thought to be similar to fish sauces currently produced in Southeast Asia, which have high glutamate

Table 1. Free glutamic acid in fish and soy sauces (mg/100g)

Fish sauce	
China	828
Japan	1383
Indonesia	727
Malaysia	621
Myanmar	948
Philippine	988
Thailand	950
Vietnam	1370
Soy sauce	
China	926
Japan	782
Korea	1264
Philippine	412

concentration (Table 1) (Yoshida 1998). Soy sauce is also rich in glutamate. Further, several concentrated extracts (paste), Vegemite in Oceania, Bovril and Marmite in the UK, Glace de viands in France, Oyster sauce in China, etc. have high concentration of glutamate (Yoshida 1998).

Free glutamate is present naturally in most foods such as meat, poultry, seafood and vegetables (Table 2) (Ninomiya 1998). Two 5'-ribonucleotides that contribute much to the umami taste, inosinate

Table 2. Free glutamate in foods (mg/100g)	
Meat and poultry	
Beef	10
Pork	9
Chicken	22
Seafood	
Scallop	140
Snow crab	19
Blue crab	43
Alaska king crab	72
White shrimp	20
Seaweed	
Dried lever	1378
Konbu (Dried seaweed)	1608
Wakame (<i>Undaria pinnatifida</i>)	9
Vegetable	
Cabbage	50
Spinach	48
Tomato	246
Green asparagus	49
Corn	106
Green peas	106
Onion	51
Potato	10
Shampignon	42
Shiitake mushroom (fresh)	71
Fruits	
Avogado	18
Apple	4
Grape (<i>V.labrusca</i>)	5
Kiwi	5
Cheese	
Emmental	308
Parmigiano reggiano	1680
Cheddar cheese	182
Milk	
Cow	1
Goat	4
Human breast milk	19
Concentrated extract s (Paste)	
Vetemite	1431
Marmite	1960
Bovril	498
Oyster sauce	900

and guanylate, are also present in many foods. Inosinate is found mainly in meat, whereas guanylate is abundant in various fungi (Table 3).

The ripening of vegetables generally makes them more flavorful. For example, ripening of tomatoes has been related to the increase in their natural contents of glutamate, sugars and organic acids

Table 3. 5'-Ribonucleotides in foods (mg/100g)		
	IMP	GMP
Beef	70	4
Pork	200	2
Chicken	201	5
Squid	-	-
Tuna	286	-
Snow crab	5	4
Scallop	-	-
Tomato	-	-
Green peas	-	-
Shiitake mushroom (fresh)	-	-
Shiitake mushroom (dried)	-	150
Fungi portini (dried)	-	10
Oyster mushroom (dried)	-	10
Morel (dried)	-	40
-: not detected, blank: not analyzed		

(Inaba et al. 1980, Kader et al. 1977, Stevens et al. 1977a and 1977b). Synthetic extracts of tomato containing citric acid, glucose, potassium hydrogen phosphate, magnesium sulfate, calcium chloride, glutamate and aspartate, reproduce convincingly, the taste of tomato (Okumura et al. 1968). The ratio and the coexistence of both amino acids, glutamate and aspartate, are the most important factors in reproducing tomato taste. When no glutamate was added to the extract, the taste was similar to green tomato or citrus.

During the ripening of cheese, proteins are broken down progressively into smaller polypeptides and individual amino acids. In particular, significant increases in leucine, glutamate, valine, lysine, phenylalanine and valine are noted (Weaver and Kroger 1978). Increase in these amino acids are generally recognized to be a reliable indicator of cheese ripening (Puchades et al. 1989, Weaver and Kroger 1978), and contribute to the taste and texture of the cheese (Ramos et al. 1987). Large increases in free amino acid content also occur during the curing of ham. Among 20 kinds of amino acids found in cured ham, glutamate is the most abundant amino acid found in the final product (Cordaba et al. 1994).

It is interesting to note that glutamate is abundant in human breast milk (Rassin et al. 1978). More than 50% of free amino acids in human breast milk is glutamate (Fig. 1). Glutamate presence may influence the taste acceptability to nursing infants. A series of studies on facial expressions of infants responding to different tastes, showed that glutamate-seasoned vegetable broth triggered facial expressions very similar to those induced by sweet taste. Sour taste always triggered nose-wrinkling, lip pursing and some gaping. Bitter tasting solutions induced head-shaking, frowning, tight closure of the eyes, depressed mouth- corners, wide mouth opening and tongue protrusion (Steiner 1987 and 1993). These results suggest that umami is a palatable taste for humans infants, it might conceivably contribute to the taste acceptability of plain vegetable soups.

Glutamate in MSG and Natural Foods

Glutamate is one of 20 kinds of amino acids: the building blocks of protein. Thus our body contains glutamate in various tissues, such as muscles, brain kidneys, liver, and blood plasma (Giacometti, 1979). Although some people may be concerned about dietary intake of glutamate from MSG, it is only one of the forms of glutamate. Our body cannot distinguish glutamate from MSG and natural foods, and metabolizes both in the same way. Analyses of amino acids in tomato, soy sauce, parmesan cheese and MSG shows that glutamate

Universal Taste? continued

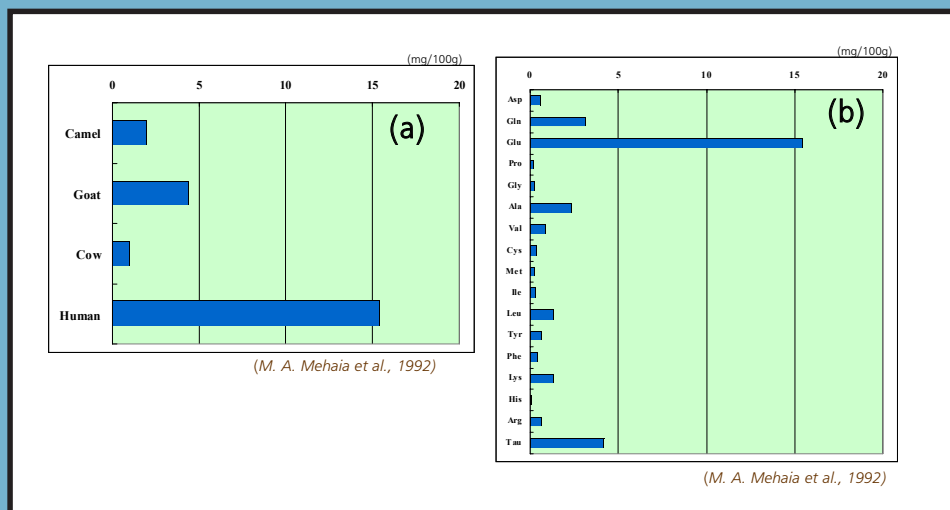


Fig. 1 Glutamate content in breast milk (a) and free amino acids in human breast milk (b).

in many items are the same (Fig. 2). A recent study suggested the occurrence of glutamate sensors distributed in the digestive system (Nijijima 2000). Neurophysiological studies showed the possible ability of glutamate to stimulate sensory afferents of the vagus nerve to induce a reflex activation of efferent fibers from the brain to the pancreas and elsewhere, which conceivably might function to facilitate digestion, and nutrient absorption and distribution. It is also suggested that food-derived glutamate was the main energy

source for the intestine (Reeds 2000). Further, food-derived glutamate, in conjunction with cysteine and glycine, is a component of glutathione, an antioxidant that plays an important role in the biodefense mechanism in our body.

MSG is now produced through a fermentation process (Yamaguchi and Ninomiya, 1998). Before the development of the fermentation process, MSG was produced by hydrolysis of natural proteins, such as wheat gluten and defatted

soybean flakes. After the discovery of natural microbes that produce large quantities of glutamate, fermentation processes using the microbe was immediately applied to the industrial production of MSG. The substances for the industrial production of MSG include molasses from sugar cane or beets, and starch hydrolysates from tapioca, corn and rice.

Ribonucleotides, such as IMP and GMP, are also produced through fermentation. All these products that convey umami taste are produced by a fermentation process that is similar to that used in making beer, yogurt or vinegar from natural materials.

International Recognition of Umami

Almost seventy years after discovery of umami by Prof. Ikeda, several leading Japanese scientists in biochemistry, food science, physiology, and nutrition, established a Society for Research on Umami Taste (SRUT) in 1982. SRUT actively organized workshops, seminar and symposia to expand research network on umami taste. In the first international symposium on umami, which was held in Hawaii in 1985, umami received international recognition as a scientific term as well as a basic taste, along with the traditional four basic tastes, sweet, sour, salty and bitter (Kawamura et al., 1987). SRUT activities triggered various researches on umami worldwide. After the second international symposium on umami organized by SRUT, in Italy in 1998, the concept and classification of umami as a basic taste were accepted (Kawamura et al, 1991). Further, progress of researches on umami taste receptor in these several years strongly support umami as a basic taste separate from other four tastes: sweet, sour, salty and bitter (Lindeman, 1996 and 2001). A recent textbook on neural science describes umami as a basic taste (Kandel et al. 1998). Besides symposia organized by SRUT, there have been many opportunities to discuss umami in scientific congresses. These include the International Symposium on Olfaction and Taste in 1993, 1997 and 2000 (Kurihara et al. 1994, Murphy et al. 1998, Yamamoto, 2001), and the International Congress of Nutrition in 2001 (Elmadfa et al. 2001).

How MSG is Used in Cooking

Some people believe that MSG is only used for Chinese, Japanese or oriental cooking, but it can be used for wide variety of dishes in the world. Because it does not have any special odour such as chicken, beef or fish, nor strong taste, that masks the original flavour of foods.

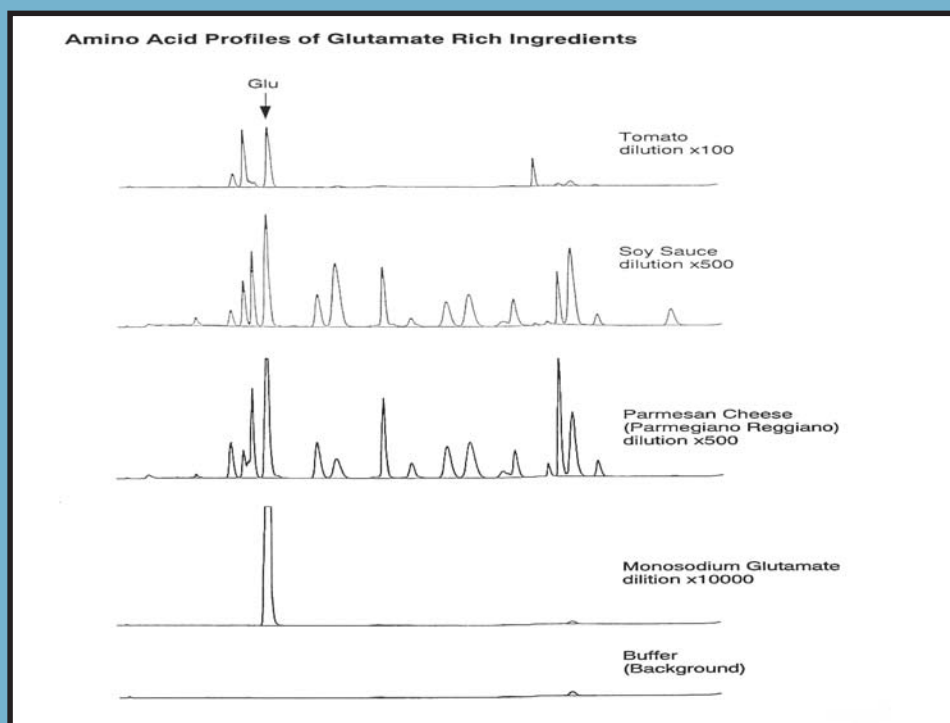


Fig. 2 Free amino acids in tomato, soy sauce, parmesan cheese and MSG (Original Data from Ajinomoto Co., Inc.)

Umami: An Oriental or a

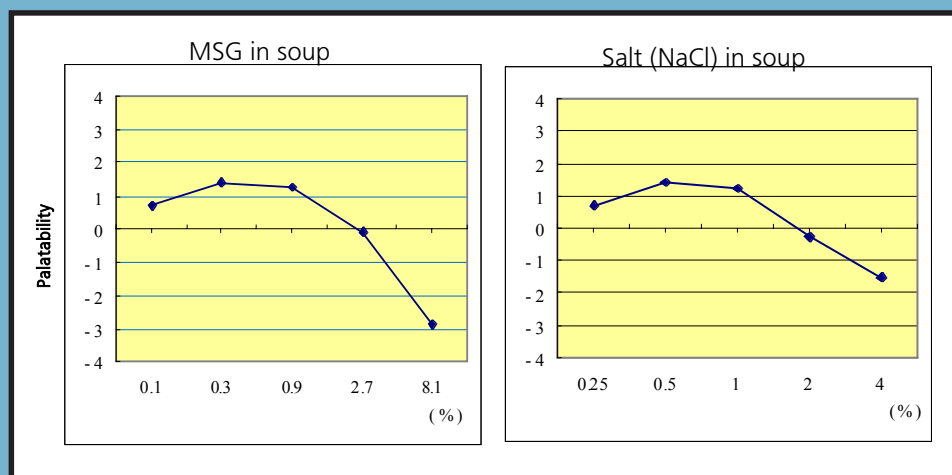


Fig. 3 MSG and salt concentration and palatability (S. Yamaguchi, 1987)

Dr. Bellisle reported the first demonstration of MSG in spinach mousses and beef and vegetable jelly used in long-term food intake by young French (Bellisle, 1989). She confirmed that addition of MSG exerted a positive effect on palatability and suggested that MSG could facilitate acquisition of taste liking for new foods.

Dr. Prescott investigated the effect of MSG on the acceptability, richness, saltiness and natural taste of three different foods: salmon cakes, chicken soup and spring rolls in Australian subjects (Prescott, 2001a). He suggested that MSG did not adversely affect the natural taste of foods. He also showed that MSG added to a novel flavour can condition liking for that flavour, when it is consumed. This suggests that the human body finds MSG rewarding (Prescott, 2001b). In the study of American subjects using chicken soup, adding a pinch of MSG (0.2%) increased palatability of the soup (Okiyama and Beauchamp, 1998). The subjects described the taste of soup with MSG with the following expressions; more flavor, richer, more savory, more taste, more brothy, more chicken flavor more chicken taste or better flavoring. These studies suggest that MSG brings out and enhances the original taste of foods.

Although MSG contains sodium (Na^+), it is not a salt substitute. The effect of MSG on the taste of foods is produced by glutamate, not by sodium.

It has been shown by many studies that umami has the characteristic of increasing palatable taste of various foods (Yamaguchi 1998). In the first and second symposia on MSG, held in 1948 and 1955 in Chicago, many researchers introduced taste characteristics of MSG (Dove, 1948; Foster, 1955). At the time, neither the concept of umami nor the synergistic effect had been established. Experts in food taste and flavor described the characteristic taste of MSG (Sjöström, 1964, Cairncross, 1948). It was suggested that an additional effect of MSG was in enhancing "mouth fullness" and satisfaction in what were otherwise too sweet sugar solutions or of too salty solutions. During the early stage of

research on umami taste, its taste quality was variously described in such terms as "amplitude" (Cairncross and Sjöström 1950, Caul 1957), "mouth fullness" and "bloom". MSG was generally regarded as a flavor enhancing agent. Sjöström et al. said that all the taste buds were stimulated pleasantly and the stimulation persisted for a long time. When Japanese subjects familiar with the umami taste were asked to express the changes in the flavor profile of foods, after addition of MSG, without using the word "umami," they reported that the overall taste intensity of the foods was increased by the addition of MSG. The most notable descriptions of the changes were major increases of the flavor characteristics, continuity, mouth fullness, impact, mildness and thickness. The most effective usage levels of MSG, based on the previous numerous studies, are between 0.1 to 0.8 % as consumed (Yamaguchi 1987). Too much use of MSG causes a decrease of palatability of food as salt does (Fig. 3).

Safety Aspects of Glutamate

In 1968, Dr. Kwok suggested a relationship between MSG and symptoms experienced after eating Chinese food. He called these symptoms the "Chinese Restaurant Syndrome" (Kwok, 1968). Though numerous studies have evaluated MSG's possible causative role in food hypersensitivity, a majority of scientific challenges failed to reproduce the adverse reactions that many individuals believed to be associated with ingestion of MSG (Tarasoff and Kelly, 1993; Geha et al. 2000a). The largest clinical study to date was done on MSG sensitivity concluded that "Neither persistent nor serious effects from MSG are observed, and the responses were not consistent on retesting" (Geha et al. 2000b).

Since Allen and Baker first reported two cases of MSG-induced asthma in Australia in 1981, MSG-induced asthma had been discussed by researchers until the validity of previous studies was questioned (Allen and Baker, 1987; Stevenson et al., 2000). The latest studies conducted in

Australia and US showed that existence of MSG-induced asthma, even in history-positive patients, has not been established conclusively (Woods 1997, 1998 and 2001; Stevenson et al. 2000).

Generally, safety of food additives is evaluated at the international level. Among numerous food additives, MSG is the most extensively researched food additive in the past 30 years (Walker and Lupien, 2000). The Joint FAO/WHO Expert Committee on Food Additives (JECFA) was established in the mid-1950s by the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO) to assess the safety of food additives on an international basis. Members of JECFA are independent scientists from government or academic research institutes, who serve in their individual expert capacity, not as representatives of their government or research institutes. JECFA's goals are to establish safe levels of intake and to develop specifications for identity and purity.

The latest and comprehensive safety evaluation on MSG by JECFA was in 1987 (JECFA, 1988). The JECFA reviewed the available data on metabolism and pharmacokinetics of MSG, toxicological data including carcinogenicity and mutagenicity in multigeneration studies as well as human studies. After examining latest available data on glutamate, JECFA concluded that the total dietary intake of glutamate arising from their use at levels necessary to achieve the desired technological effect and from their acceptable background in food, *do not represent a hazard to health*. And an "ADI (Acceptable Daily Intake) not specified" was allocated to MSG and potassium, calcium and ammonium salts of glutamates. The JECFA also noted that it was *not* necessary to have special treatment for pregnant women and infants. JECFA has a general rule that food additives should not be used in infant foods to be consumed before 12 weeks of ages. Glutamate is not an exception like most of the additives (JECFA 1974).

The Scientific Committee for Food of the Commission of the European Communities reached the similar conclusion to the JECFA (SCF 1991). United States Food & Drug Administration (US FDA) classified glutamate in a list of Generally Recognized as Safe substances with pepper, vinegar, baking powder, etc. (US FDA 1959). The latest comprehensive safety evaluation was conducted in Federation of American Societies for Experimental Biology (FASEB), which is an independent group of scientists, under the contract with FDA. The FASEB report published in 1995 reaffirmed the safety of MSG when the general population consumes it at usual levels with *no* evidence of connection between MSG and *any* serious long-term reactions (FASEB 1995).

In Australia and New Zealand, MSG (food additive no. 621) as well as potassium, calcium and

Universal Taste? continued

ammonium glutamates are included among substances permitted to be added to processed foods according to good manufacturing practice (GMP) (ANZFA 2001). This is the same conclusion arrived at by JECFA, EC SCF, US FDA and many other governments in the world. As an increasing concern about allergy caused by food ingredients such as peanut, gluten, etc., ANZFA examined if it was necessary to label MSG as a possible allergen, and it was concluded that there was *no need to claim MSG in a list of allergens* (ANZFA 2002).

Even though world authorities concluded that it is not necessary to set a numerical limitation for using MSG in food, we should remember that there is an optimal usage level of MSG. That is, in the range of 0.1 - 0.8% of the food consumed, by adding to food to improve its flavour, as shown in Fig 2.

IMP and GMP have also received the same classification "ADI not specified" both from the JECFA in 1975 and 1990, and EC SCF in 1990 (JECFA 1975 and 1990; EC SCF, 1991).

Umami in the Future

Healthy eating is essential to maintaining a good quality of life, especially in an aging population. Among anticipated physical changes in elderly people, chemosensory decline will have a marked impact on eating behavior, appetite and health. A study conducted in elderly persons in a nursing home suggested that MSG added to certain dishes, vegetable soups, cooked rice or mashed potatoes, increase spontaneous lunch intake. As a consequence, MSG improved the nutrient intake of elderly people (Bellisle 1991 and 1998). Food specialists, nutritionists and dietitians recommend use of ingredients that enhance flavor and sensory enjoyment. For example, use of extracted flavors like meat, mushroom or vegetables, concentrated fruits sauces or jams, herbs and spices, dry rubs as well as use of flavor-enhancers such as MSG, IMP or GMP may enhance the enjoyment and nutrient intake of the elderly. In addition to increased enjoyment of eating in elderly people, MSG can also help people to reduce the total amount of

sodium intake from the diet. MSG contains only one-third the sodium of salt (sodium chloride). Furthermore, the usage level of MSG is only one tenth of that for salt. By using a pinch of MSG together with a low level of salt, a pleasing flavour can be maintained whilst the total quantity of salt in the food is reduced overall (Yamaguchi and Takahashi, 1984; Chi and Chen, 1992). A study conducted in Japan evaluated the acceptability of low sodium egg soup. Acceptability of standard soup with added no MSG (total sodium content was 0.272%) is almost the same as the low salt soup with added MSG (total sodium content was 0.194%), whilst acceptability of low sodium soup without added MSG (total sodium content was 0.189%) was very low (Fig. 4). The study showed that almost 30% of salt intake was reduced by adding only 0.04% of MSG, without changing acceptability of the soup (Sakamoto, 1997). Standard usage of MSG for cooking is one-half of a teaspoon per 500g of meat or 4-6 servings of mixed vegetables, casseroles or soup. Once the proper amount is used, adding more contributes little to food flavor.

Numerous articles on nutrition and healthy eating appear in magazines, newspapers, TV, radio, etc all around the world. Advice on "healthy eating", i.e., low sodium or fat, high dietary fibre, vitamins and minerals or other beneficial ingredients sometimes satisfy people, even though many of these "healthy" foods are not palatable. However, enjoyment of eating is only achieved from food. The process of eating, including licking and chewing foods in our mouths cannot be replaced by taking tablets or capsules of nutrients. Eating food stimulates the nerves of our tongue, oral and nasal cavities and sends flavour information to the brain, triggering digestion and metabolism (see review by Mattes, *ChemoSense*, 5(2) 2003). Using all the senses in eating is good for activating our digestive organs as well as our brain.

Schiffman suggested that flavor-enhanced food could improve palatability and/or intake, increase salivary flow and reduce chemosensory complaints in both healthy and sick elderly, and lessen the need for table salt. Hence, flavor enhancement also improves overall quality of life (Schiffman 2000). In the next decades, a better understanding of MSG and other umami taste perception should be forthcoming. Further knowledge on the importance of umami could provide insight into fundamental motivations in our eating behavior.

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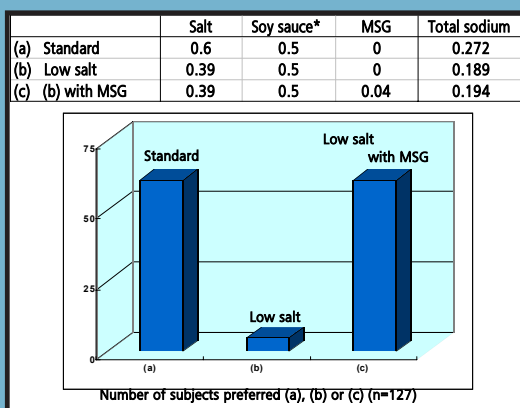


Fig. 4 Effect of MSG on the palatability of low salt diet. (* Low salt soy sauce was used in the study.) (Sakamoto, 1997).

Umami: An Oriental or a Universal Taste?

continued

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WineSense

WineSense

By Graham Bell

What Value are Wine Medals?

How often have you bought a wine because it had one or more of those little stick-on metallic disks - the "medals" around the label, proclaiming that the wine has won a wine show award, usually in some indecipherable class? I'd be lying if I said I hadn't. And if you are a buyer and consumer of table wine, I'll bet you have too. Then, later, at the appropriate time, when you've sampled the wine, have you noticed how much better it was? My bet is that you haven't noticed anything unusually good or bad about it.

I'm curious as to what purpose wine shows and medals really serve.

They certainly influence my impulses at the "point of sale". Do they tell me anything about the quality of the wine? Generally, in my personal experience, not a thing. The wine is as good or indifferent as any other, without medals, in the same price range. Perhaps the owners of the label would have been less inclined to price it in this category? I doubt it: they're not naive when it comes to pricing.

Nevertheless, wine medals are undoubtedly valued as a promotional tool, as you can tell from looking at the sales and advertising material on any day, in any medium. In short, the retail consumer is a sucker for stickers. These medallions are the "bush" of old, as in the saying: "good wine needs no bush". In days gone by, sprigs of foliage were used to declare that the wine was "good". Thus began in the dim distant past, the argument of what these packaging adornments actually signify and what purpose they serve.

So, in short, they serve a function in the promotion of wine sales.

But how are they assigned? Well, not at random, of course. There is quite an industry involved in judging the wine. We'll leave who owns it and what it takes to crack the big ones to another time. Here, let's just consider the sensory procedures in wine judging and how they might be improved to make the medal really worth something and to represent truly better wine.

How judging at wine shows is conducted

Once the entries have been registered into their various classes, colours and styles, they are coded and poured into coded glasses. These are arranged in "flights" of six. It is common for a judge to assess 10 flights in a session. The possibility of sensory fatigue here is enormous, despite the spit-don't-swallow rule. The latter just serves to slow the rate of alcohol intake, and keep the judge's pencil steady, which after 60 or 120 samples must be non-trivial, even with spitting. There is a panel of 4 to 6 judges all doing the same thing.

First, the chief judge calls the panel to a meeting and explains "what they should be looking for". This is not in itself a no-no, as an expert panel has to be briefed on what they are being required to do. But in wine judging, the panel is told "what chardonnays should taste like this year". This biases the definition of the brief to be anything the chief judge deems it to be. This year buttery notes are out, last year they were in. The question is begged: what makes the chief judge decide that buttery notes are in or out? Well, he's the style fashion setter, you see.

The wine judges then set their minds on the chief judge's brief and start to work on the flights. Attributes are assessed and comments made in their notes. I am told that the order of presentation is the same for all judges. This totally wrecks the validity of the judgements because as a second year food science student knows, every sensory experience in judgement carries forward the influence of the previous one, and the only way to eliminate the order effect, is to randomise the presentation sequence to the judges. So the outcome of judging done this way has to be directly determined by the order in which the flights are constructed. This must be corrected, or the shows might find themselves deemed to be "fixed".

Conferring between judges generally does not take place during the sampling of the "flights", mainly because there is not enough time, with all those wine samples to inspect, swirl, sniff, sip, slurp, chew and spit. Finally the judges



WineSense continued

confer, discuss their notes and reach a consensus decision on what takes first, second and third places. Generally, there is no time for scores and statistics. The chief judge gets the casting vote. The die is cast and the medals are awarded. The best "show ponies" take home the garlands. But are they the best? I don't think so.

The sensory procedure in wine judging is left so wanting as to be ludicrous and possibly even scandalous. Could the shows do it differently? Most certainly. It can be made to serve the industry, to provide a clear set of useful information and pay tribute to the winemakers who are doing a good job. All that is needed is for the process to be based on good principles of sensory science. This is what it will take:

A ten-point plan for making wine shows really useful for the industry and for consumers

1. A fairer system of deciding what are this year's characteristics of a particular style is essential. This should be openly debated within the industry and with outside inputs to keep them honest. Transparency is the only defence against corruption here.
2. The judging panel should follow the same brief arrived at as above. There should be no single fashion guru or chief wine judge, briefing the panel. That person's role must be abolished. The chief judge/ president of the awarding body, must see that all these steps are carried out with exactness.
3. The judges should have normal sensory acuity and preferably have been trained in sensory evaluation of wine (most judges work hard to attain judge status but have little or no training).
4. There should be as many judges as possible. I would recommend 20 or more. This will be good for the statistics but also will limit the degree to which a panel might become corrupted - it is harder to influence 20 people than three or four.
5. The order of presentation must be blind coded and presented in randomised order.
6. There must be a rest interval and a rinse to refresh the palate between every sample. This must be enforced, if necessary by a system of controlling access by the judges to the wine, until the inter-trial procedure has been followed. More time to do the judging must be allowed, than is presently the case. There must be no "rushing through the flights." The word and practice of "flights" will become history.
7. The attributes (agreed in advance at step 1) must be given a numerical score or a score on a graphic rating scale. The order in which they are scored can follow the natural way the experience unfolds for the wine drinker: nose variables, taste variables, mouthfeel variables. The extent to which the wine meets the overall description of the style (overall impression of goodness of fit) should be the final attribute scored. The score sheets must be collected and the data processed by a reputable statistician. Such technical people will have to be recruited: after all, this is a multi-billion dollar industry.
8. The statistics must be presented and interpreted in a transparent manner. The decisions should be based on statistical inference and be fully defensible and available for scrutiny. The winning wine should be the product with the attribute scores that best fit the exemplar agreed to in step 1, and which has the highest overall style-fit score. The data, in its entirety, must be made available to the participants, for further analysis. They can work out, for instance, where their own product's strengths and weaknesses are, and what attributes were really driving those overall style scores. If the participants agree, the detailed results for specific entries can be open to all participants, or if not agreed, the data can still be analysed as suggested, but direct comparisons across samples will be precluded. These are "rules of engagement" that can be worked out well in advance.
9. The outcome of this decision process on the day must be taken as final. Later analysis must be for the industry's benefit and not part of the competition.
10. The divisions into which the entries are initially categorised may survive scrutiny, but a shake out of these definitions might also be needed. Divisions must have names that consumers

understand. It is not good enough to show a medal for "Class 22". Less esoteric names can be found. Here are some suggestions: "New Entrants"; "Region X wines" or "Vintage of 2002"; "Open Class Whites - all comers"; "Best of Style X"; "Best Red on Show" "Shiraz-style aged 4+yrs"; etc. What we have now are class codes that sound mysterious but are designed to leave the consumer in ignorance.

The wine industry has been slow to take up what is to be learned from sensory science. This is improving slowly, and will continue to do so, especially once the communication between the sensory scientists and the industry improves. The industry desperately needs to shake off the bad practices of the bad old bygone days for its own sake. The applied sensory science outlined above is a sound technology. What we have at present is what Ben Canaider (The Age, Epicure, 17 June 2003, p 20) called: "a façade of objectivity", behind which "lies a rambling old house of subjectivity".

The pay-off to the industry of adopting the ten-point plan

Wine show entrants will know that they are not entering a roulette game. Their esteem for the awards will grow and they will try harder to win. The quality of the wine in the region, state or country served by the awarding body, will steadily improve. Entrants from outside the region will strive to participate. The wines showing the awards of the show will be the best representatives of the style (for age, etc) and consumers will notice the difference immediately. The awards will empower the wine to command a better price and deservedly, on the quality of the product in the bottle. The same promotional purposes will be served, so the retailers will not lose anything. The participating winemakers can use the information as real feedback on what needs to be improved, how good they're getting, etc. If the rules allow it, they can also compare their scores with others' and so they will understand where they lie relative to competitors.

Look for further opinion and information on wine by leaders in the field, in *WineSense*, in future issues of *ChemoSense*.

ABSTRACTS: oral presentations

Plenary Lecture

HOW CORALS BUILD REEFS: ROLE OF PHOTOBIOLOGY AND KEY PROTEINS

Sophie Dove

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Coral reefs have formed in nutrient poor tropical waters primarily due to the solar powering of Scleractinian corals by their symbiotic dinoflagellates. Corals live and photosynthesise in a broad range of habitats ranging from exposed reef-flats to dark caves. For some time, it has been speculated that the animal, as opposed to dinoflagellate pigments may play key role in explaining how they manage to exist in such diverse light environments. Our isolation of these animal pigments is a first step towards the testing of these hypotheses. Do they deflect light from the photosystems? Do they channel light into the photosystems? By quantifying specific pigment concentrations, distance from photosystems and the energization of the photosystems with specific wavelength radiation, amongst a range of other experiments, we plan to provide answers to these questions. By studying differential expression in plus/ minus experimental designs, we will be able to identify a number of proteins that are associated with the biochemical responses of corals and their zooxanthellae to a range of environmental stresses, specifically to light and heat. Coral bleaching results from loss of heat damaged zooxanthellae in high light environments, whilst this mechanism is well-documented, the biochemical details are not similarly documented. Differential expression can provide information on proteins that fail to express in the stress environment, as well as information on the protective capabilities of the association.

1

GREAT ADVANTAGES IN FISH OLFACTORY SYSTEMS

Zippel, H.P. Dolle, H. Foitzik, M. Hamadeh, A. Möller-de Beer, A.M. & Köhnke, R.

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The goldfish olfactory system has the advantage that the respective structures are easily accessible for experimental preparations. The olfactory epithelium lies peripherally and is covered only by a skin fold, and the pedunculated olfactory bulb can easily be prepared without lesioning telencephalic structures. A great number of naturally relevant stimuli is structurally known (see below) and can be applied in defined molarities. The present study investigated whether application of many types of biologically relevant chemical sensory stimuli results in different response characteristics in *in vivo* recordings from the dendritic endings of single olfactory sensory neurons (surface neural recordings). Extracellular recordings were made with platinum-black electrodes. Pheromones and amino acids, amino acids, stereoisomers of amino acids, L-arginine and structural analogues, and structurally similar and dissimilar non-familiar stimuli were investigated in successive series of experiments. In general, no response was recorded from 50-70% of sensory neurons during application of an olfactory stimulus. Excitatory responses were more frequently (15-25%) found than inhibitions (10-20%). Differences in responses of the same neuron to different classes stimuli were apparent in "generalists", and to a few (or only one) in "specialists". Even structurally very similar stimuli like α - and β -ionone or pairs of stereoisomers of amino acids were discriminated by approximately 60% of responding sensory neurons. From dose-response experiments it is evident that a majority of neurons responded similar during application of 2 log units different concentrations of amino acids, and 20% of sensory neurons application of the lower concentration had a weaker effect. Whether recordings were made from ciliated or from microvillous sensors is unknown.

Supported by DFG Zi 112/7-3



2

OLFACTORY SPECIFIC GENES MARK SPECIFIC CELL TYPES IN MATURE AND PROLIFERATION ZONES OF THE LOBSTER OLFACTORY ORGAN.

McClintock, T.S., Hollins, B., Hardin, D., Cobb, M., Stoss, T. & Derby, C.D.

Department of Physiology, University of Kentucky, and Department of Biology, Georgia State University, USA.

We have used a high-throughput PCR method to identify transcripts specific not only to the olfactory organ, but also specific to single cell types within the prominent type of olfactory sensillum, the aesthetasc. These transcripts include an α -tubulin and a putative ionotropic glutamate receptor expressed only by the olfactory sensory neurons (OSNs), a putative dopamine β -monooxygenase expressed only by outer auxiliary cells that ensheath the OSN dendrites, and a serine protease expressed only by the collar cells that also surround the OSN dendrites. Other transcripts specific to the olfactory organ include an α 2 macroglobulin and a calcyphosin (a calcium binding protein). The calcyphosin is strongly expressed in OSNs and auxiliary cells of aesthetascs and also in cells of other chemosensilla. Overall, these clones provide the first cell specific markers in the lobster olfactory organ. In a more focused experiment, we took advantage of the physical separation of mature OSNs and their progenitors to identify transcripts enriched in the proliferation zone of the lobster olfactory organ. These 13 clones include novel

Upcoming Events

- 27 July - 1st August 2003** **Summer School on Human Olfaction**
University of Dresden Medical School
Dresden, Germany
www.tu-dresden.de/medkhno/riechenschmecken/summerschool.htm
- 10 - 15 August 2003** **39th IUPAC Congress and 86th Conference of the Canadian Society for Chemistry**
Ottawa, Canada
www.iupac2003.org
- 24 - 27 August 2003** **"2003 Foods For Life", 36th AIFST Convention and 2nd World Symposium of Dairy Products in Human Health and Nutrition plus DIAA Dairy Science World Series Conference**
Melbourne, Australia
www.2003foodsforlife.com
- 28 August 2003** **Sense-ation 2003**
Sensory Analysis & Consumer Research Seminar
Food Science Australia, Werribee, Victoria
Contact: Alison.Johnson@foodscience.afisc.csiro.au
Ph.+61 3 9731 3417
- 2-4 October, 2003** **Australasian Association for ChemoSensory Science Inc (AACSS)**
6th Annual Scientific Meeting
Rutherglen, Victoria, Australia
Jennifer.Weller@goodmanfielder.com.au
Abstract deadline 31 July 2003: cowen@swin.edu.au
Accommodation: www.visitrutherglen.com.au
- 21-25 April 2004** **ACheMS, Sarasota Florida USA**
<http://www.achems.org>
- 5 - 9 July, 2004** **XIII International Symposium on Olfaction and Taste (ISOT) / JASTS**
Kyoto, Japan
Jasts@hus.osaka-u.ac.jp
- 28-30 July 2004** **7th Sensometrics Meeting**
Davis, California USA
Info: <http://www.statistik.uni-dortmund.de/sensometrics/>■

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ABSTRACTS: oral

sequences expressed only in epithelial cells, and others expressed in both the epithelial cells and in OSNs. PET15, an epithelial specific transcript related to a family of antibacterial proteins, was strongly up-regulated by stimuli that increase proliferation of OSNs. These results support previous evidence that epithelial cells are progenitors of the OSNs and provide tools to further investigate the cellular and molecular biology of olfactory neurogenesis.

Supported by NIH awards R01 DC 02366 to T.Mc. and DC00312 to C.D.D.

3

ORIENTATION TO COMPLEX ODOR SIGNALS: SPATIAL ARRANGEMENT OF ODOR SOURCES MODIFIES CRAYFISH SEARCH STRATEGIES

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In natural aquatic systems, organisms are presented with odors from multiple sources that are distributed in space and time. Previous work has focused on orientation to one food odor source and does not distinguish between mechanosensory and chemosensory guidance of orientation behavior. However, in natural habitats animals encounter cues from multiple food sources which may impact foraging decisions in varying environments. The present study investigated how the spatial distribution of multiple food cues can affect crayfish orientation mediated by chemical cues. Crayfish, *Orconectes virilis*, were presented with a series of food odors that were separated in an artificial stream. Orientation behavior was filmed from above and digitized one frame per second. Electrochemical recordings were taken to characterize the structure and distribution of the odor plume, and an acoustic doppler velocimeter was used to characterize the hydrodynamic structure of the artificial stream. Crayfish showed significantly altered orientation strategies when presented with different spatial arrangements of food cues. Since alterations of the spatial arrangement of the sources did not impact the hydrodynamics, any changes in orientation strategies indicate that the fine-scale distribution of chemicals is guiding some aspects of the search strategy.

Acknowledgments: This work was funded through the National Science Foundation grant to Paul A. Moore.

4

CHEMORECEPTION IN CORAL REEF SYMBIOSES: SIGNAL IDENTITY, DETECTION, AND TRANSDUCTION

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From the earliest recognition of the existence of a symbiotic relationship between cnidarians (corals and sea anemones) and dinoflagellate algae, it was hypothesized that the partners in the relationship engaged in chemical communication. A number of investigators have sought to identify and characterize a host-derived chemical or mixture of chemicals, known as host factor (HF), that can induce the symbiotic algae that reside in the gastrodermal cells of host animals to export macromolecules containing photosynthetically-fixed carbon. Gates *et al.* (PNAS 92:7430, 1995) demonstrated that a mixture of free amino acids can stimulate such export. Wang and Douglas (Plant Physiol. 114:631, 1997) showed that the sulfonic amino acid taurine alone can act as HF. We show that symbiotic algae possess cell-surface chemoreceptors that specifically bind taurine. Likewise, the phosphonic acid 2-aminoethylphosphonate (AEP), a molecule similar in shape and identical in molecular weight to taurine, and that is present in high concentrations in cnidarians both in free form and as a component of membrane phospholipid, can also bring about the efflux of photosynthetically-generated carbohydrate. AEP also competes for the algal binding of radiolabeled taurine. Membrane-permeable analogs of the intracellular second messenger cyclic AMP (cAMP) also induce photosynthate efflux, whereas membrane-impermeable cAMP itself does not. Finally, we show that organic molecules are exported from algal cells by second-messenger-activated P-glycoprotein-like pumps. Taken together, these results suggest a set of mechanisms by which chemical signals from the host organism effect the translocation of photosynthate and other molecules from the symbiont.

5

DETECTION AND BEHAVIORAL RESPONSES TO A MALE SEX PHEROMONE IN FEMALE SEA LAMPREYS (PETROMYZON MARINUS)

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We recently demonstrated that male sea lamprey (*Petromyzon marinus*) release through their gills two 5?-bile acids, 3 keto-petromyzonol sulfate and 3keto-allocholic acid, upon spermiation. These compounds induce preference behavior and locomotion in ovulating females under controlled laboratory condition, and may serve as a pheromone that attract the mature females to the nests of mature males. It has yet, however, been demonstrated that a synthetic copy of these bile acids stimulate the olfactory sensory epithelium and induce characteristic behaviors in ovulating females. To provide unequivocal evidence that these compounds function as a sex pheromone, we first used electro-olfactograms (EOG) to characterize their potency. EOG results showed that the synthetic compounds are detected at approximately 10-12 M and have a wide range of response dynamics. Cross-adaptation experiments suggest that these two compounds are discriminated from each other, and from the two structurally similar bile acids released by larval sea lamprey. When synthetic 3keto-petromyzonol sulfate was introduced into a section of a spawning stream section to reach a final concentration of 10-12 M, it guided ovulating females to search for and stay at the exact site of introduction. In laboratory conditions, 3keto-allocholic acid in combination with 3keto-petromyzonol sulfate induced in mature females behaviors characteristic of those in response to natural pheromones. We conclude that 3keto-petromyzonol sulfate and 3keto-allocholic acid are two essential components of the male sex pheromone. This research is supported by the Great Lakes Fishery Commission.

presentations continued

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PHEROMONE RESPONSES IN OLFACTORY RECEPTOR NEURONS OF SEA LAMPREYS

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Feeding, migration and reproduction in sea lampreys (*Petromyzon marinus*) depend on olfactory signals. Migrating adults use the presence of unique bile acids, excreted by larval sea lampreys, as a cue for selection of a suitable spawning stream. Sexually mature males, and probably females, release pheromones that attract mature conspecifics of the opposite sex and presumably play roles in mate localization, pair-formation and spawning. The larval bile acids, petromyzonol sulfate (PS) and allocholic acid 3-sulfate (ACA), as well as L-arginine (L-arg) and the sex attractant released by mature males, 3-ketoPS, elicit marked EOG responses in adult sea lampreys. We have used whole-cell recordings to identify voltage-dependent and odorant-activated currents in olfactory receptor neurons (ORNs) from all three sea lamprey life stages: larval, parasitic and spawning. Similar voltage- and ion-dependent currents were observed in ORNs from all three developmental stages. ORNs from each stage displayed spontaneous action potentials, as well as responses to odorants. Responses to PS, ACA, L-arg and 3-keto PS were recorded from ORNs from both larvae and mature adults, indicating that the behavioral relevance of at least some stimuli change during development. Responses to PS and L-arg have also been recorded from ORNs from parasitic stage lampreys. The reversal of odor-evoked currents near 0 mV, as well as similar currents in response to IBMX and forskolin, are consistent with a cyclic nucleotide-mediated transduction cascade. Only excitatory (depolarizing) responses to L-arg have been observed in ORNs from post-metamorphic lampreys, while only inhibitory responses have been recorded in ORNs from larvae, suggesting a developmental change in response-coupling. Responses to 3-keto PS were observed in both mature females and males. Responses to 15- β testosterone have also been recorded ORNs from adult females. These results provide the basis for experiments to examine the mechanisms of pheromone transduction in a primitive vertebrate.

Supported by NIH grant DC04718 and the Great Lakes Fishery Commission.

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INSECT OLFACTION - FUNCTION AND BEHAVIOUR

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The insect olfactory system offers unique opportunities to study neuroethological phenomena, from molecule detection to behaviour elicited. In recent experiments using a method measuring cardiac activity we have shown that molecules are detected with a sensitivity lower than ever recorded before. A few molecules are sufficient to elicit a clear response. In the primary olfactory centre of the CNS, the antennal lobe, we have studied how activation patterns are formed among olfactory glomeruli after antennal stimulation. Odours are often represented by distributed patterns within the glomerular array. We have also shown that within the array functional modules receiving information regarding a certain type of odour compounds are present. Furthermore, gradual changes in the odour molecule result in progressive changes of the activation pattern, where carbon chain length seems to be one of the main determining factors.

Besides pure neurophysiology, one of our main interests is to link neural structure and function with behavioural observations. "Nothing in Neuroscience makes sense except in the light of behaviour." As an example of this endeavour I will conclude my presentation by describing a system using olfactory deceit. A Mediterranean flower fools flies to pollination by smelling like a carcass. The Dead Horse Arum, *Helicodiceros muscivorus*, has over evolutionary time acquired the ability to mimic the odour of a carcass. It has also perfected the deceit by adding further cues impinging on other sensory systems. As a result it has become irresistible to flies.

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THE NATURAL ODOR WORLD OF DROSOPHILA

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A well-defined genome, presence of mutants and extensive possibilities for genetic manipulations make the fruitfly *D. melanogaster* a very important model organism in olfactory research. However, despite all the research invested, very little is known about the ecology of this species. As a consequence, information regarding biologically relevant odor stimuli is lacking. As much future work will rely on the availability of potent odor stimuli in this species, this information is sorely needed. Here we report a number of novel natural odor ligands for fruitfly ORNs, identified through use of a combined gas chromatographic - single receptor neuron recording technique (GC-SC). The active odorants were identified from head space-collected volatiles from preferred food sources. In total, we identified 29 active odorants and found 8 distinct sensillum types characterized through the response profiles of 12 olfactory receptor neuron types. In most recordings a single GC peak would produce a strong response, whereas a few other, often chemically related compounds would produce weaker responses. Dose-response investigations using synthetic samples of the identified ligands revealed a very low response threshold in several of the receptor neuron types described. In addition, we also report the behavioral effect for a subset of the identified ligands. All, except one compound elicited attractive behavior, as we expected, as most of the odorants tested are typical microbial volatiles, thus indicative for the favored food sources of *Drosophila*. The only repellent odor identified is a typical green-leaf volatile, and thus characteristic for non-preferred fruitfly resources.

Abstracts Continued on Supplementary Document

Body odours may reveal early Cancer, AIDS and Smallpox

While scientific interest on chemical communication between humans is gathering pace (for review see *ChemoSense*, 5(1) Dec 2002), recent research suggests that early diagnosis of disease may be possible by using a person's body odours. Scientists at The Monell Chemical Senses Center in Philadelphia have shown that mice can use odour to distinguish animals infected with Mammary Tumour Virus before any overt signs of disease are present. According to Monell's Gary Beauchamp, "there is a wide variety of other viral diseases for which symptoms are slow to develop that could be investigated for unique odor production." "It may be possible to use the non-invasive route of body odors to identify and diagnose certain diseases, such as AIDS and smallpox, before they are otherwise obvious," he said. Further basic research is called for. Monell is investing resources in the identity and effect of chemical signals, with the aim of enhancing knowledge of human reproductive function, social behaviour, technologies for detection and diagnosis of human disease, and development of sensors for security applications. Monell's Charles Wysocki sums up: "As we begin to see that humans have the potential to communicate with chemical signals, we're finding that human behaviour and physiology respond much more to chemical communication than we originally believed."

Monell sets out to raise US\$8 million

Over the next three years, Monell Chemical Senses Center plans to raise US\$8 million to renovate two floors of a building adjoining the Market Street Center, into much needed laboratories. Among the first donors was Jesse Tordoff, daughter of researchers Danielle Reed and Michael Tordoff, who donated \$10, this being half of her tenth birthday money. If you too wish to make a donation of whatever size, (tax deductible in the USA) contact Mary Chatterton on +1 215 898 4236 or e-mail: chatterton@monell.org

Source: The Monell Connection, Spring 2003.

For more information see Monell's web site:
www.monell.org ■

NEWS

US Food Retailers Fed Up with Country of Origin Law

New food labelling law, requiring retailers to take responsibility for showing country of origin on food products, has raised strong concerns among the 2,300 members of the Food Marketing Institute (FMI). The value of food sold in retail stores in the US is put at AUD\$755 Billion. Now all stores will have to ensure that all this product is labelled with country-of-origin, or face penalty. FMI has complained to the US House Agriculture Committee that the retailer "is the one link in the chain that has no first-hand knowledge or control over this information." The people who do, are the manufacturers or importers. Deborah R. White, of FMI, anticipates that US retailers will source only from those suppliers who can afford to document and label their products. Smaller suppliers, including many "growers and ranchers, will have a difficult time affording the costs imposed by the law," she said.

Source: foodonline.com/content/news/article.asp (30 June2003) ■

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MEDIA RELEASE

BUSINESS OF FOOD GETS SMARTER

BUSINESS OF FOOD GETS SMARTER

Australia's food industry was given a boost today with the announcement of an Australian-first specific food business management program based at Monash University.

The executive (post-graduate) program is an initiative of the \$102m National Food Industry Strategy (NFIS) which aims to increase export growth, innovation, skills, quality and sustainability in the Australian food industry over five years.

"The business of food is big business," said Chairman of NFIS Ltd and SPC Ardmora Managing Director, Nigel Garrard.

"The size of the Australian food chain is approximately \$231 billion annually, and food manufacturing is the largest single manufacturing sector employing around 225,000 people in cities and towns all over the country."

Mr Garrard said the food industry contributes significantly to Australia's trade position with over \$26 billion in exports and less than \$5 billion in imports.

"As an industry, if we are to remain competitive in the global marketplace, the skill levels of our workforce must also be at world best practice levels," he said.

"The Monash Food Business Management course will be an important element in developing the next generation of leaders in the Australian food industry."

Mr Garrard said the course was initiated in response to concerns by food business CEOs about the overall management skills within the industry.

"Research showed us that almost 80% of the CEOs in the industry believed there was a need for an industry-specific management education program to help address gaps in the skills base of the existing workforce."

Mr Garrard said the Monash program will ensure that content remains relevant and responsive to industry and that the educational value of the program meets industry's needs.

"Obviously, the more skilled people working in the industry, the more productive and efficient they become, and the more competitive our industry is. That's good for the individual; it's good for the industry; and it's good for Australia," said Mr Garrard.

Monash University was selected to design and deliver the food business management course after a tender process open to all Australian higher education institutions. Seed funding of \$345,000 has been provided by NFIS Ltd to support the initial phases of the program with the aim that the program be self-sufficient within three years.

The program will involve world leading academics, executive in residence and intensive teaching blocks to facilitate learning and networking amongst high potential executives from food companies across Australia. It will involve four units leading to a Graduate or Executive Certificate in Food Business Management from Monash University.

Program Director with Monash University, Dr Lawrie Dooley, said the year-long program will involve two residential periods, with one each in Sydney and Melbourne.

"The course will focus on four areas vital to the future of the industry – value chain management, innovation, leadership and strategy."

Dr Dooley said the program will be able to build on established programs in retailing, marketing, supply chain management and agribusiness already offered by Monash.

"Importantly, what the food business management course offers is an appropriate context for the participants," Dr Dooley said.

"Everyone on the course will be from the same industry; the case studies will be industry specific; and the course work will be company specific. It's a highly effective model for adult learning and we look forward to contributing to the leadership profile of the industry in this way," he said.

Dr Dooley said the first intake of industry participants will start in the 2004 academic year.

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E-MAIL

from Beijing (Memories of SARS, June, 2003)

By Marilyn Styles

At the Green Elephant Pharmacy in downtown Beijing, I watch dozens of people, all wearing masks, line up to buy paper wrapped packets of "babei yao", a concoction of 8 dried medicinal herbs and spices supposedly recommended by the ministry of health as a preventative against the dreaded disease. Store managers say they have sold 1,000's in a matter of days. I don't know quite what to think nor what actions to take.

There's a hot-line number to call, extensive news coverage, announcements at the bus and train stations about the disease and how its spread, posters about SARS and hygiene at local schools and colleges. All public gatherings of over 50 people are banned, hence theatres, restaurants, gymnasiums and sporting competitions are cancelled for business. Most people are as confused as I am.

Reactions range from cavalier indifference, to cautious vigilance, to near total panic. It's been hard to separate rumour from fact: hard to know what information sources can be trusted.

It's easier to have a firm opinion on events happening at home in Australia: the resignation of the Governor General; and stories of our other national celebrities: Dame Edna; Steve Irwin and René Rivkin.

This crisis is so close to my place of residence and affects all of our lives so directly, that I find perspective to be elusive. Initially, as my freedom became restricted, like many of my friends, I was indignant. The whole thing had been blown way out of proportion, with fear spreading far faster than SARS. Why worry so much about this particular disease when a host of other pathogens- as well as any number of cars and buses- can kill you just as dead, and are far more likely to do so?

Even after SARS cases were announced in Beijing, all of this struck me as a preposterous overreaction to a statistically insignificant threat, as panic taking root all too easily in a global climate of fear. The cancellations and the closures affected all of us; our livelihood was threatened by irrational fear. I told everyone who asked, that there was nothing to be afraid of. I was even able to joke about it: The Rolling Stones cancelled their tour and The WHO came to town instead (no, not the band, the World Health Organization).



Anti-SARS billboards in Beijing proclaim: "The SARS will surely be conquered by our government under the leadership of the Communist Party of China."

Now I am a little embarrassed at having been quite so dismissive. Rationally, I still understand the statistical improbability of myself or close friends contracting the disease. But over the last two months I grew increasingly concerned about it as the numbers mounted and as it struck closer and closer to home. We witnessed with shock as a student of this campus, who shares a room with 7 others, became a suspected SARS patient, and was collected by people in astronaut-like suits and sped off to a SARS hospital, where no family or friends may have contact.

Then two neighbouring universities were closed, with students locked inside, after a student and a professor died of the disease.

The father of a close friend is an Army officer and has been locked inside the compound with the other officers for the past 2 months, with no estimated date of release.

I have come to realize that there is far more to the story than the disease itself. The reaction of Chinese authorities to the crisis; their evolving relationship with international bodies; the sociology of popular response; important changes in the relationship between the state and domestic media, are all part of the bigger story. But that is too much to explain now.

We have had a number of days now, when the nightly SARS news report has stated zero SARS deaths, zero new suspected cases and a growing number of previous SARS patients released from hospital. This and the sharp, sterile smell of carbolic acid that greets me as I enter my building, is a comfort to me ■



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