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ChemoSense

EDITORIAL

Pain and Healing

By Graham Bell

Editor

g.bell@unsw.edu.au

The more we learn about the nose and tongue the better and safer we can live, eat and breathe. Now Bartoshuk and Snyder suggest how inhibition produced by the taste system can be harnessed for clinical benefit of sufferers of oral and central nervous system pain.

ChemoSensory technologies can help businesses export more effectively through understanding foreign consumers.

What prospects are there for exporters to South Africa, eight years after the end of the apartheid? Has "regime change" been good or bad for this country?

Australia's efforts to stimulate lucrative exports of sea urchin roe to Japan, using sensory knowledge, are described by Blount et al.

Olfactory ensheathing cells may help regenerate damaged spinal cords. A radical program aimed at healing human paraplegic volunteers has begun in Brisbane. It compliments more conventional science using rats, at UNSW, Sydney.

This edition completes four years in the life of *ChemoSense* ■

Taste and Oral Pain

Linda M. Bartoshuk and Derek J. Snyder

Surgery (Otolaryngology)
Yale University School of Medicine
New Haven, CT 06520-8041 USA
Linda.Bartoshuk@ Yale.edu Derek.Snyder@Yale.edu

Peripheral Oral Pain

Taste and oral pain are linked anatomically in both the peripheral and central nervous systems. In the periphery, taste buds on the mobile part of the tongue are located in fungiform papillae (which are named for the button mushrooms they resemble). These round structures can be seen easily if we swab blue food coloring on the tongue. The fungiform papillae do not pick up the dye, so they stand out as pink circles against a blue background (Miller & Reedy, 1990). Each fungiform papilla contains an average of six taste buds; each taste bud is surrounded by a basket-like cluster of pain fibers (Whitehead et al., 1985; Finger et al., 1994).

The number of fungiform papillae varies genetically. This variation is associated with taste blindness to bitter compounds like PROP (6-n-propylthiouracil): nontasters (who cannot taste PROP) have the fewest fungiform papillae and supertasters (who perceive the most intense bitterness from PROP) have the most (Bartoshuk et al., 1994). Because of the anatomical association between taste buds and pain fibers, individuals with large numbers of fungiform papillae (supertasters) also have large numbers of oral pain fibers. Consequently, oral irritants (alcohol, the capsaicin in chili peppers, etc.) produce considerably more intense oral burn to supertasters than to nontasters (Snyder et al., 1996).

Although the perceived intensity of capsaicin is much greater to supertasters, all individuals, regardless of PROP status, experience desensitization of pain receptors when capsaicin is topically applied (Green, 1989; Karrer & Bartoshuk, 1991). On the outer body surface, capsaicin desensitization is relatively ineffective

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INSIDE:

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Taste and Oral

Laurie Lucchina applies blue dye to her tongue. (Reproduced with permission of L M Bartoshuk)

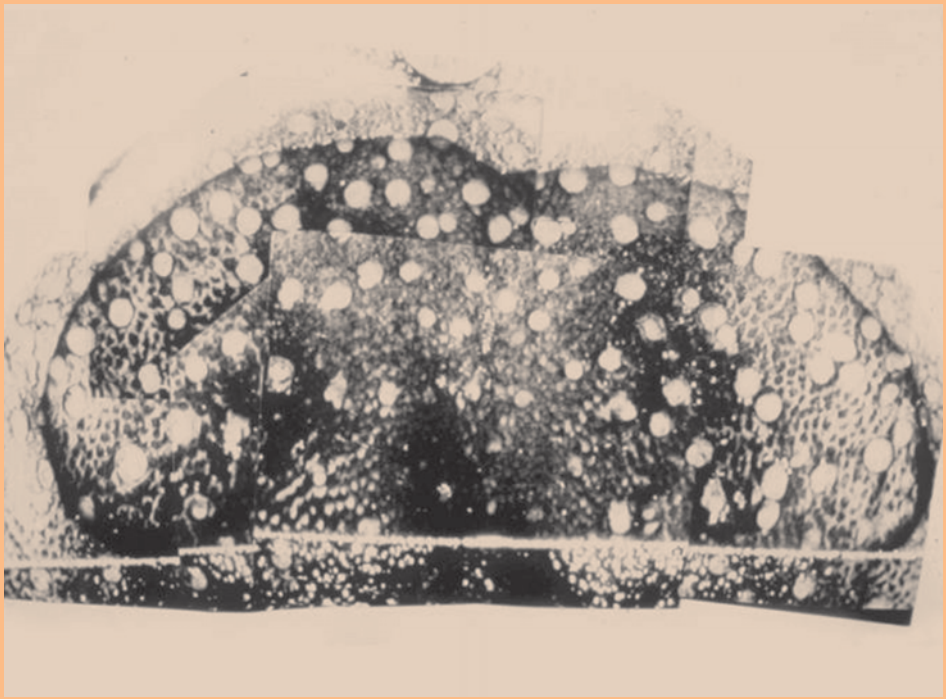
because the skin is a good barrier to capsaicin. However, in the mouth, capsaicin can reach pain receptors much more easily. This effect can be used to produce clinically useful oral analgesia. Desensitization of oral pain by capsaicin has been used in folk medicine since the time of the Aztecs (Sahagún, 1961). In the modern era, one of the most debilitating examples of oral pain comes from mucositis, a side effect of chemotherapy or radiation treatment for cancer. Because these interventions take a special toll on cells that divide rapidly (like those in the mouth), the oral mucosa is especially prone to damage. Under the supervision of Ann Berger, a physician specializing in palliative care, we used candy to deliver capsaicin to oral lesions in cancer patients (as suggested by Wolffe Nadoolman, then a medical student at Yale). The candy initially burns for about 10 minutes, but when that burn fades, pain from the lesions fades as well. Candy with 7 ppm capsaicin diminished pain an average of 75% (Berger et al., 1995).

Central oral pain

Input from the taste system appears to inhibit brain areas mediating oral pain. From an evolutionary perspective, this feature may have developed to allow animals with tongue injuries to eat normally; eating would stimulate taste, which would in turn inhibit oral pain, thereby insuring normal energy intake and enhancing survival odds. While this mechanism could protect an animal from starvation, it comes with a cost. When taste is damaged, the ability of taste to inhibit oral pain is abolished, which leads to abnormal activation of brain areas mediating oral pain. This results in the perception of oral pain in the absence of any painful stimulus. We call these sensations oral pain phantoms. Burning mouth syndrome (BMS), a clinical disorder especially prevalent in postmenopausal women, may be an example of such an oral pain phantom. The pain produced by BMS often occurs on the tip of the tongue; it can last for years and can become disabling. Fortunately, this pain can be treated clinically in about 70% of patients with the drug clonazepam (Grushka, Epstein, & Mott, 1998). Inhibition produced by taste is thought to be mediated by the inhibitory neurotransmitter GABA. Presumably, taste damage reduces the amount of GABA available to inhibit oral pain, resulting in phantom pain sensations.

Counting the fungiform papillae disclosed by the blye dye. (Reproduced with permission of L M Bartoshuk)

Pain continued

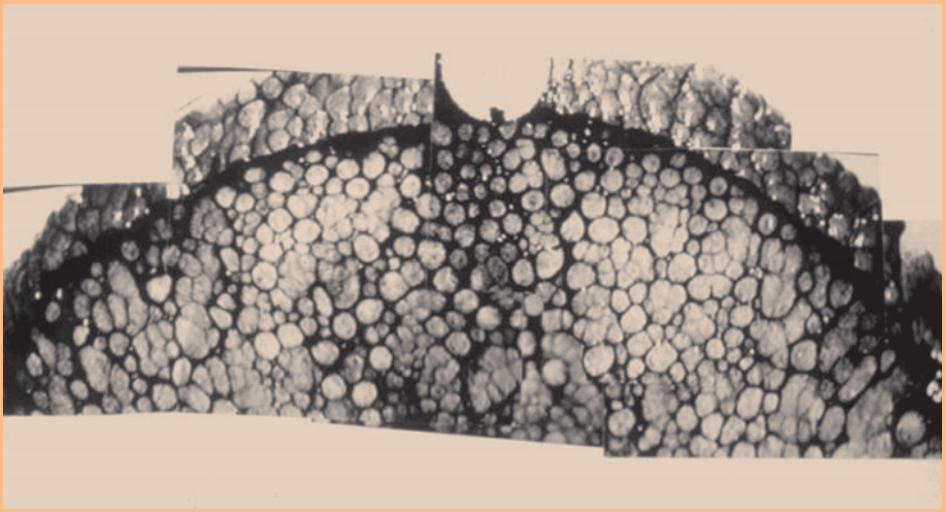


Fungiform papillae on the tongue of a PROP nontaster (Reproduced with permission of L M Bartoshuk)

Clonazepam is a GABA agonist; it mimics GABA and reestablishes normal inhbition of oral pain.

In order to test this "release of inhibition" mechanism, we took advantage of a technique used to produce local anesthesia of the ear drum. Lidocaine injected just under the skin in the ear canal near the ear drum moves into the middle ear behind the drum, where it contacts the chorda tympani taste nerve as it passes through the middle ear on its way from the front of the tongue to the brain. Anesthesia of the chorda tympani intensified the perception of oral irritation (tested with capsaicin) on the front of the tongue. This intensification was related to the density of fungiform papillae: nontasters perceived virtually no intensification, while supertasters perceived almost double the oral burn (Tie et al., 1999).

If BMS is an oral pain phantom produced by release of inhibition, then tests of patients with BMS should show that they have suffered damage to the taste system. Further, we would expect the intensity of their pain to be related to the density of fungiform papillae on their tongues. This has proven to be the case. Patients with BMS showed particularly severe deficits in their ability to taste bitter on the anterior tongue. At the same time, the density of fungiform papillae was correlated with the ratings of the most intense pain experienced from BMS; that is, patients with the most severe BMS are supertasters (Grushka & Bartoshuk, 2000).



Fungiform papillae on the tongue of a PROP supertaster (Reproduced with permission of L M Bartoshuk)

Clinical Implications

In some cases, oral pain may result from a combination of peripheral and central causes. Duffy (Duffy et al., 2002) suggested that since cancer therapies may damage taste, the pain of mucositis might reflect pain from both the oral lesions and a central phantom. This suggests that a combination of capsaicin desensitization and treatment with clonazepam could benefit these patients. We now believe that the inhibition produced by taste has broader effects. In general, it appears to protect intake by suppressing a variety of activities incompatible with eating (e.g., cough, gag, nausea). Early evidence for this came from a study by Duffy and her colleagues (Sipiora et al., 2000) showing that women who experience severe vomiting during pregnancy have taste damage. In addition, given that taste plays a role in preparing the digestive system for the arrival of food (e.g., by promoting gastric secretion), damage to taste may have downstream effects on digestion.

All of these findings suggest ways to harness the inhibition produced by the taste system for clinical benefit. We could do this by stimulating taste, or we could potentiate the central inhibition normally associated with taste using clonazepam or other GABA agonists. We are planning future studies aimed at both approaches (Bartoshuk et al., 2002) ■

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Tasty Times at ECRO 2002

By Graham Bell

The antique Bavarian town of Erlangen and nearby Pommersfelden, recently hosted a feast of scientific communication on the chemical senses: the European Chemoreception Research Organisation (ECRO), plus three satellite symposia: olfaction in drosophila; trigeminal chemoreception; and sensitivity to PROP. An excellent social program enhanced this very well-organised meeting. There were about 300 attendees, from 25 countries, and over 200 papers and posters were presented. For those of us who have seen and tasted little of German culture, this was a greatly enriched learning experience. As in all conferences, the intellectual stimulation breathes life into one's own thinking, but also, and more importantly, the friendships and contacts made are of inestimable value. Good weather, cheerful surroundings and the delights of the local food and beverages made this a memorable meeting.

Entwined Sensations

Intellectual discourse began with the chemesthetic (trigeminal) symposium: a session that set a very high standard. The psychology, physiology and chemistry of chemical irritation continue to become clearer. While progress in understanding basic membrane mechanisms emerges at the receptor level (Alimohammadi and Silver; Paul, Hatt and Wetzel) most of the "news" concerns trigeminal interaction with the other chemical senses.

Green reported that virtually all sensory irritants might be capable of stimulating the gustatory system, particularly at the back of the tongue,

ECRO included a walking tour of Bamberg with its 800-year-old cathedral, and a river that flows through its antique town.

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Japanese YEN for Australian Sea Urchin Roe

Craig Blount[1], Duncan Worthington[1], and Graham Bell[2]
[1]NSW Fisheries, Cronulla Fisheries Centre, P O Box 21, Cronulla 2230, Australia
[2]Centre for ChemoSensory Research, UNSW, Australian Technology Park, Sydney 1430, Australia

Large populations of sea urchins exist on the eastern coast of Australia. This stock of wild sea urchin may be sufficient, if sustainable, to create a viable and lucrative export trade, to countries where sea urchin roe is consumed, particularly Japan, where "uni," as it is called there, is very highly valued. A field trip to Japan was undertaken to gain a better understanding of the characteristics of high value roe and how these might be obtained or enhanced in Australian stocks. A market profile for fresh sea urchin roe must be developed to refine enhancement and processing techniques. The results, summarised here, and have been reported elsewhere in more detail (Blount et al., 2001).

Despite long-standing interest in the fishing of sea urchins and their roe in Australia (Ward, 1975, James, 1990), attempts to develop an export industry of the roe or the whole urchins has met with very limited success. It is only recently that sales of Australian roe to Japan have become measurable: 3449 Kg in 1999, valued at ¥20,676,755 or AUD$333,496 (conversion rate = 62 ¥/AUD$). The largest exporter to Japan in that year was USA with over 2 million Kg. Although the Australian product was exported in low volume compared with most other countries, it fetched one of the highest prices (¥5995/Kg or AUD$97/Kg), indicating the potential Australian urchin has to compete on quality in that market.

Australian sea urchin is a valuable resource with potential to generate significant Australian foreign trade earnings, provided management of wild stocks can produce high quality product and sustainable yields.

Raw roe is the value-added form of the sea urchin product. The eggs are tiny: almost indistinguishable by eye. They form a smooth mass, contained in five leaf-shaped egg sacs which hold their integrity when carefully removed from the animal. These sacs are sold as a highly prized delicacy, "uni", throughout Japan, with individual servings of raw roe selling in top restaurants for ¥5 000 per 20 gm serve (AUD$4000 per Kg).

Australia can capture part of this value-adding process by supplying raw roe directly to the Japanese market.

Our fisheries authorities need to know the value of the wild stocks, the kinds and quantities of urchin contained therein, and how to manage these stocks in order to achieve a viable and sustainable sea urchin industry.

This study was undertaken in the field in Japan in November, 2000, in order to gain an understanding of the market forces that might operate on Australian sea urchin roe exports particularly from the view-point of what consumer drivers of acceptance of uni must be met by Australian exporters.

The field excursion also provided an opportunity to see Japanese uni processing and sea urchin aquaculture operations, as well as to meet people involved in importing sea urchin and see the methods for distribution of uni at Tsukiji market in Tokyo.

Demand

In Japan, sea urchin roe is regarded, along with tuna, lobster and abalone, as a premium seafood product. Consequently, there is a strong demand for sea urchin roe throughout Japan. Traditionally, sea urchin roe has been eaten mostly at sushi bars and restaurants. Japanese consumers generally prefer local products over imports, and this is quite evident at the premium sushi restaurants in Tokyo, who serve, it is said, only Japanese sea urchin roe. Observations in Osaka, Tokyo and Hakodate (on the northern island of Hokkaido) confirmed that uni is popular and ubiquitous in sushi restaurants, of which there are many thousands in Japan. Expert opinion is firm that demand for uni in the restaurant trade is as strong as it ever has been. General demand can be expected to vary with disposable income and product availability.

More recently, sea urchin roe distribution has widened, becoming available to a new market of Japanese consumers: supermarket shoppers.

Hokkaido: The centre of Japanese uni industry

Japanese consumers can now obtain uni at many suburban supermarkets, where prices for food to be consumed at home are expected to be lower than for food prepared in restaurants and sushi bars. This has created an

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Japanese YEN for Australian Sea Urchin Roe continued

outlet for lower grade imported sea urchin roe being sold on supermarket shelves. Demand for uni throughout Japan is therefore likely to rise, as supermarkets are relatively new to Japan and with relaxation in laws controlling retail shop sizes being gradually relaxed throughout the country (Bell et al., 1992). The high position of uni in Japanese cuisine will also drive this increase in demand for supermarket-bought product.

There are regional differences in consumer demand for sea urchin roe, and the Tokyo and Osaka markets in general demand a higher quality product than the regions, as indeed they do for most goods in Japan. These two cities are the portals for entry of imported sea urchin and centres of maximum demand by consumers of the product.

Although the economy of Japan is presently experiencing low growth, Tsukiji market stakeholders gave assurance that this has not affected demand for uni.

Whole uni in cool store awaiting processing

It is likely that the demand for both high and low grade product will increase, due to a continual decline in production of local high grade material, and an expanding supermarket trade. Australian producers can aim to send their product into either or both the Tokyo and Osaka markets.

Prices of Australian product should benefit from competitive pressures originating from the various sources of demand in Japan.

Supply

There are two crucial factors affecting supply of sea urchin roe Imported into Japan: Firstly how much acceptable sea urchin roe a country can produce, and secondly, whether the time of harvest (normally outside the spawning period) coincides with demand, affected by local supply and competitors' ability to supply uni to market.

USA, Mexico, Chile and Canada provide the bulk of imported sea urchin roe to Japan by volume, although substantial amounts are also imported from China and Korea. Sea urchins from most supplying countries have a harvesting period complementary to most Japanese species, but price advantage is not necessarily accrued, as most imports generally fail to compete with Japanese sea urchins for the premium end of the market.

Diminishing Japanese stocks reached a point recently when it was estimated that less than half of the total volume of sea urchin roe consumed in Japan is produced locally. Further decreases are expected due to declines in local fisheries. Reasons for the decline are unclear, but overfishing, pollution, El Nino and other environmental factors are of some concern. Australia needs to study the experience of the Japanese in this regard, in case lessons may be applied to Australian sea urchin resource management.

The reputation of Japanese sea urchin as the best available and its price premium sustains the pressure on local supply. Japanese processors interviewed believe that the quality of their labour in fishing, handling and processing the product, and some secret knowledge concerning temperatures and chemical composition of the process-baths, allows them to produce products of a much higher quality than imports.

Handling the product optimally from the water to the customer is in every Australian sea urchin exporter's best interest.The importance of handling, processing, packing for best presentation, and cold-chain effectiveness is even greater than country of origin of the sea urchin. This is evidenced by reports to the team by Hokkaido processors who told of quantities of whole urchin arriving from the Boston, USA, being processed in Hokkaido and the roe sold under Japanese label.

So, sea urchin products that are produced in Japan generally sell at a premium regardless of the source of raw material, and imported products processed under a local brand name, can be sold as Japanese product, at the usual premium.

Quality and Price

Japanese culture and tradition underpins the variables determining the perceived quality of sea urchin roe. Because Japanese consumers prefer products produced in Japan, the highest prices paid for sea urchin roe are from local species. For example, *Bafun* uni can easily fetch five times the average price of imported sea urchin roe. The message to overseas producers is clearly to process sea urchin roe so it looks as similar to Japanese products as possible. This is possible for some species (eg *S. droebachiensis,* East Coast of USA), which are sometimes shipped whole to Japan and processed and sold under a local brand name, so they appear to the consumer as local product. One hundred grams of *S. droebachiensis,* processed in Hokkaido, can fetch up to ¥12,000 (AUD$193) at auction. However, the majority of imported sea urchin roe is much larger, and is impossible to be made to look like the roe of Japanese sea urchins. These products will always be down-graded, as they will be recognised as foreign.

Variability between countries in the quality of sea urchin roe leads to a range of prices paid for imported product.

Colour is widely agreed as a factor in determining the value of the roe. Yellow, with gradation of colours to orange is highly regarded as is a yellow ochre colour that is the basis for the Japanese word "bafun" applied to a highly valued species of local sea urchin, meaning horse droppings.

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NEWS

Tasty Times at ECRO 2002 continued

while some bitter tastants can stimulate irritant-sensitive nerve endings at the front of the tongue. The paper complimented another by Toda et al., which showed that non-gustatory reception (polymodal nociceptors) plays a role in bitter sensation. Simons showed that suppression of taste by oral irritants occurs in the mouth when the stimulus is capsaicin, but centrally when the stimulus is nicotine. Hummel and Futschik noted that loss of olfaction is usually accompanied by decreased trigeminal sensitivity. The field is increasing our appreciation of the mechanisms possessed by organisms against toxicants and other harmful agents. This information is building a foundation for safer, healthier living.

Fruitful Facts from Flies

Insects have a central place in chemosensory science, being some of nature's finest chemical communication machines. The wealth of established knowledge of the fruit fly's anatomy and genetics, makes it a good candidate for basic chemosensory research. Ten papers of high quality were contributed to the special symposium on olfaction in *Drosophila melanogaster,* the Biologist's favourite fruit fly. Identification of ligands for specified receptors may progress with apparent comparative ease in this animal than in vertebrates. The symposium reported encouraging results in this regard (Stortkuhl and Hovemann; van der Goes van Naters et al.). We can expect significant practical payoff from this work in the foreseeable future in several areas. Greatest need is the control of crop pests without insecticides and eradication of insect-vectors of diseases such as malaria and sleeping sickness.

What is the significance of the PROP gene?

Many individuals cannot taste PROP (6-*n*-propylthiouracil) because they lack a gene underlying the perception of its bitter taste. In addition, of those who can taste it, some rate the sensation among the strongest imaginable. These latter individuals show up as a bump at the high end of the distribution curve for all tasters.

The PROP symposium was sadly diminished by the absence its most enthusiastic exponent, Linda M. Bartoshuk. Nevertheless, the participants presented much new data, and speakers attempted to "review" as well as "report". Evidence was presented by Prescott et al.; Noble; Tepper; and Duffy et al., to show that PROP taster status determines a number of related sensitivities: to other oral stimulants including fat and chemesthetic stimuli. These findings have implications for diet selection and health: non-tasters maintain the highest body mass indices (Tepper), and intense tasters prefer foods with less fat but eat fewer vegetables than non-tasters (Duffy et al.).

Critical analysis of the field was supplied by Mattes who concluded that the data supporting the relationship between PROP taster status and food choice is limited. Drewnowski presented a number of research studies in which no such relationships were found. This stimulated a vigorous discussion. The genetic underpinning of PROP tasting is perhaps more complex than previously established but is nevertheless not disputed (Reed et al., Bell and Song). By contrast, the significance to human individuals and to consumer populations requires further research and testing of assumptions. There remain strong indications that PROP status will be useful to the flavour and food industries in understanding food choice, as well as to the wider practices of good nutrition and health.

Photograph: Graham Bell

PROP Symposium-goers pass by the impressive Hugenot sculpture and fountain in the Schloss gardens of Erlangen University.

The Main Event

Each of the four daily sessions began with a plenary lecture: Zuker on sweet, bitter and amino acid taste receptors, Mombaerts on olfactory targeting, Schwob on repair and regeneration in the peripheral olfactory system, and Lancet on human genome studies and olfaction.

A continuous stream of oral sessions then ran from 9.15 a.m. to 6 p.m. There were no parallel sessions, except for the posters which were available from 9.15 a.m. to 1p.m. Poster sessions generally did not overlap in time with the same or similar oral topics - a bugbear of many conferences, requiring invocation of quantum physics to enable attendance of both simultaneously. A notable and useful trend was the production by many poster presenters of one-page printed copies of their poster, allowing you to look at the detail later. This saved on eye and brain strain.

The oral and poster sessions covered all contemporary aspects of chemosensory research, including psychophysics, nutrition, cognition, emotions, behaviour, clinical issues, imaging, irritation, plasticity, olfactory bulb, molecular biology, transduction, neuroethology, perireceptor events, genetics, taste, environmental issues, central mechanisms, perception, plasticity, e-noses and instrumentation.

Demonstrations of e-noses, endoscopy, magneto-encephalography (MEG) and evoked potentials were run from 7.15 a.m. to 8.00 a.m. After an evening of beer, sauerkraut and sausage, this was quite a challenge.

ECRO's abstracts of papers will be published in the journal *Chemical Senses* in a few months. A book of the PROP symposium papers is in preparation. *ChemoSense* will carry more information on this book around the time of its publication ■

Japanese YEN for Australian Sea Urchin Roe continued

Colour, size, and texture must be consistent among the trays in a batch. The study team watched uni packers plying their art with great dexterity. The less perfect specimens are used as "filler" and the most beautiful ones are layered over them. The colours are varied so that the overall impression is of an average, good coloured set, even though the individual sacs do have many different shades of colour. Reputation of the supplier depends on consistently good presentation of the product.

Japanese we interviewed agreed that freshness is determined from the look of the uni: they must be firmly integrated and not oozing or dry.

Very little is known about what, and to what degree, flavour and mouthfeel (texture) attributes play a part in grading the quality of uni. Buyers at auction at the Tsukiji market have an opportunity to inspect and request a taste of the uni on offer. Cuisine experts reported to the team that sweetness is very important. The uni must "melt slowly on the tongue like a good European chocolate, infusing the mouth with its many delicate flavours," said a Tokyo chef interviewed.

Bitter roe (such as roe from Chile, we were told) fetches a low price, even if the colour is reasonable, indicating that bitterness is a negative driver of product acceptance. There is not a lot of sourness or saltiness in uni, and the roe are often eaten with a sour and salty sauce, such as soy sauce.

Texture in the mouth is also important: the uni must not be rough, but creamy, yet the feeling of the uni disintegrating on the tongue and releasing flavours is linked to a perceivable amount of granular texture.

It should be possible for Australian expert tasters to learn to rate the taste of uni on the same criteria once these can be quantified. An expert sensory panel could be used to monitor quality of the Australian product. At this stage of the development of the Australian industry it would be advisable to monitor taste using trained expert sensory evaluation rather than by encouraging the development of "fashion gurus" as are found in the wine industry. Feedback from market price obtained will be the feedback upon which to base the ultimate sensory benchmark.

Of all the attributes that are used to judge quality, colour and taste (flavour) appear to be the most important. The industry needs clear sensory guidelines for colour and flavour.

NSW and Eastern Victorian Sea Urchin

The sea urchin industry in NSW (and eastern Victoria) involves the harvest of three species. The red sea urchin (*H. tuburculata*) and green/white sea urchin (*H. erythrogramma*) have the best taste, but the colour of the roe in these species is variable, and the harvestable quantity of these species is small in comparison to the third species, the purple urchin *(C. rodgersii*). Despite a somewhat bitter taste in the roe immediately after the spawning period, purple sea urchin can be caught in vast quantities and, if harvested from the right area, the roe can be of a consistent yellow colour. There is also a window in the Japanese market during the harvest period for purple sea urchin (December - June), as the US and Canadian sea urchin spawn at this time. Further research is needed on purple urchin to determine if selective harvesting or other variables might maximise the desirable qualities (such as sweet taste).

Red sea urchin can be harvested all year round, due a protracted spawning period, and the green/white urchin are best harvested from July - December. These complementary spawning periods allow the possibility of a continuous supply of roe from NSW and Eastern Victoria to Japan, and year round employment for divers and processors.

Hatchery and Re-seeding

Aquaculture is used in Japan to re-stock locally depleted areas of sea urchin. In fact, the sea urchin industry in Japan is totally dependent upon a re-stocking program. Other countries are also finding that their wild fisheries are not sustainable at present levels of harvesting, without some form of enhancement. In Japan, sea urchin are grown for one year in tanks and released to areas where they are left to grow for another year. At two or three months prior to harvesting, they are given a seaweed supplement to feed upon. This apparently, increases the yield, colour and taste to a desirable level. Many advances are presently being made in the field of sea urchin aquaculture around the world. Australia is no exception, and presently a research program, based in South Australia, is on the way to developing a commercial enhancement technique for cultured green/white sea urchin.

Final grading and packing of Japanese uni

Urchin hatchlings are in themselves a valuable product. The specimens measuring 1-2 cm in diameter produced at the hatchery visited in Hokkaido are sold to the local fishing industry for 10 cents each. A subsidiary industry is possible from the direct sales of the small urchin to areas needing re-seeding or as another export product to producer countries.

Australia stands to benefit from learning more of the pioneering work of Japanese hatchery and re-seeding operations.

Future use of chemosensory techniques

The importance of sensory quality of "uni" was found to be paramount.

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E-MAIL from South Africa

Graham Bell, revisits the country of his birth, after a long absence and reflects on the changes: good and bad.

At first all you can see is the razor wire. Perhaps Christo the artist, who specialises in wrapping huge objects, has passed through with a new and cruel medium: loops of wire with barbs like scalpel blades. But hush my keyboard, first the good news: there is plenty of it.

Revisiting South Africa for the first time since Nelson Mandela took over, eight years ago, I am expecting to face some harsh realities of a country in decay, a currency in tatters and a people traumatised by murder and mismanagement. So it is a great relief to find, on both sides of the wire, enormously positive change and people thriving; the country well-organised and clearly on the way to economic recovery.

It is winter, yet food is not in short supply: meat, rice, mealies (corn) and potatoes abound. Life at the bottom of the economic scale is still tough. But it seems to me that all the way up the scale, things are better - certainly since the sixties and seventies. A beer today costs less than an Australian dollar. Durban ladies buy pre-diced carrots and beans - imported from Zimbabwe, no less! Services are running well, the customs officers smile, people of all shapes, sizes, and yes, colours, generally look happy to me. The casinos (there's one about every hundred Km) are never empty. Large denomination Rand chips (AUD$1 = R5) are piled up, scattered and raked in with never-ending monotony. Somebody can afford this, and somebody is getting fat - and it isn't Mamma Cass.

Free at Last!

I feel optimistic for the first time in 30 years. The walls of oppression, apartheid - racism enacted by law - have dissolved away. They have not been smashed down with hideous ruin. This is a triumph for the forces of life and peace against the evils of destruction and death. Peaceful coexistence has come to this country, at last. It is a true miracle of our time. I hear the distant voice of Martin Luther King, Junior: "Free at last! free at last! thank God Almighty, we are free at last!"

Children play at Mitchell Park, Durban. (Photo by Graham Bell)

New houses with power and water

The squatter camps that were growing out of control in 1994 are nearly all gone. In their place, mass housing projects, sadly reminiscent of the old regime, now painted happy colours, sprawl across the landscape. Most have electric power, piped water, telephones, and television (Soweto had none of these when I left the country in 1972). The new houses may resemble the old "locations" but they are very different. They are bought and sold as freehold. They may be humble, but they belong to their inhabitants who have had some real degree of choice in the matter: economically constrained, yes, but the choice has been that of the free purchaser, not that imposed upon a virtual slave by an arrogant overlord. No-one said it would be easy. The question is now, will everyone staying on please assume ownership and stop despoiling the place? I think most sincerely that this is happening.

The Aussies have landed!

No, not the rugby players - they are here too. A new exhibit at the Pretoria zoo proclaims itself from a roadside billboard: "The Aussies have Landed!" The picture shows koalas! Goodonya mates!

Tourism for local and international markets has massive potential here. It's happening and is going to grow out of sight in the next ten years. When I mention this to friends here they look at me as if I have been caught breaking wind. South Africans could gain valuable perspective on their future by studying the Australian experience. Currently tourism, as a source of foreign earnings and as an employment category, does not even rate a mention in the statistics I have seen. This is very similar to Australia in the mid-eighties. If there is one future path of progress in South Africa, it is the tourists' track. Australian investors and exporters should take note. Tourism on a big scale will

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E-MAIL from South Africa

come here and be a big earner and of massive benefit. I believe the benefits will flow to the local people, at all levels, despite what the cynics say, and it will add a vital new sector to the economy.

Roads tamer and safer

Road traffic, which was unruly in the extreme, eight years ago, is back under control, speed limits are being enforced, and the appalling road death toll (more than ten times higher than Australia per 10 000 vehicles) will soon start falling. It's early days. Overloaded mini-buses still collide, killing 20 or 30 people at a time. If only some of the money spent on car and home security would be spent on education and enforcement of road safety. Every automatic speed camera set up in Johannesburg's streets, I was told, is stolen or shot-out within three weeks. Another argument for gun control: it improves road safety.

Car-jackers ahead

Official traffic signs actually warn drivers of the prevalence of car-jackings at certain "hot-spots". At these intersections, drivers don't stop. It's a case of run the gauntlet: get through unscathed, crash into an on-coming vehicle, run over a car-jacker or other by-stander (selling coathangers or t-shirts). Stop and you risk ending up in the mutie: that is, your car is stolen, and you are killed for your body parts, which are used in medicines and potions. Yum! Advice: Know where to drive and don't take unnecessary risks. Oh yes, and have your vehicle anointed with a strong potion of root of hemlock, eye of newt, jaw of salt sea shark, nose of Turk and Tartar's lips, toe of frog, wool of bat, etc (for full recipe, see MacBeth 4.1). It'll stink but it can't do any harm, lassie.

Does it hurt? Only when I laugh!

I think people here at times feel like the joke about Colonel Custer, who, when shot full of arrows was asked: "does it hurt?" To which he replied: "only when I laugh." People are still laughing and telling jokes here: but no longer with the almost insane abandon I remember from the early eighties, when the gold price was riding high (it peaked at US$800 an ounce).

Then, all the world was the butt of the humour, from the cable car on Cape Town's Table Mountain to the "booze cruise," up the Zambezi at Victoria Falls. Australians were a favourite target, as I had once learned to my cost. The humour is now rather sardonic and the fall guy isn't a foreigner or someone from another race group. Now many jokes are cynical and directed at life behind the razor wire. But not always: the human spirit which laughs in the face of adversity is ever-present, thank goodness. Graffiti on a dusty car says "I wish my wife was this dirty". A beggar at the roadside holds up a sign which reads: "Hell why lie, I need a beer".

That great source of clever humour, the South African Jewish community, is shrinking below a kind of social critical mass. This I measure by the fact that the Jewish school my mother once taught at (Carmel College, Durban) has been sold and is now one of a chain of elite private schools (Crawford College).

Free at last. This playground was once reserved for "whites only". (Photo by Graham Bell)

Opportunities await those who are prepared to change. The forces of "positive discrimination" - I find this an odious reverse apartheid which attests to the wisdom of Jonathan Swift (Gulliver's Travels) that people are slow to learn from their mistakes - has opened up new markets for those who are now excluded, or feel standards have fallen too low, and who are able to pay the premium to get what they need and want. These new markets, born out of reverse apartheid, are open to all-comers. So in a strange way, new unexpected development is blossoming - a new racially integrated top end of the market is emerging.

Areas with apartments: Hillbrow (Johannesburg), Sunnyside (Pretoria), Albert Park (Durban) are being occupied by people in the lower socioeconomic strata. Those leaving are having to spend their savings or borrow again to afford newly-built, swanky, gated communities further out of town: a short drive in the BMW. These developments give people work, free up capital and put down new and lasting infrastructure. I like the look and smell of it: the development builds confidence, smells of growth and good fortune and not of luckless stagnation and decay.

Monash in Johannesburg

Private education is a growth area here. Monash University has a smart new campus in greater Johannesburg at Roodepoort. Watch its progress with interest, or better still, Australian students, come over and do some Australian accredited university courses and have a breathtakingly adventurous year. Bring your dollars.

HIV-AIDS and Crime Impedes Prosperity for All

Crime is an upshot of the "transformation" process which needs urgent attention by the relevant authorities and policy makers. As the domestic fortifications bear witness, crime now stalks every street in every town and city across the country like a vengeful curse upon the new Pharoahs. The cost of security, insurance and payouts on theft and violence to people and property is wasting vast resources that could well be spent on health, housing and education. Security (low and high technology) and the insurance industry are the winners.

The Grim Reaper at the bowling alley

Australians may remember the controversial Australian TV advertisments when AIDS arrived in the eighties. The Grim Reaper was shown bowling people of all ages down indiscriminately. It was scary and shocking and was taken off because it had such a negative message that the authorities thought it would

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continued

Nature preserved and tourism untapped: sable antelope. (Photo by Peter Mombaerts)

panic people. Yet, this scenario seems to be manifesting itself in South Africa, although there is no obvious panic. They tell us HIV-AIDS is now moving rapidly by heterosexual transmission. Every estimate I hear sounds preposterous by Australian (and US) standards, yet terrifying if true: 20, 30, 40% of whole population groups are infected. Overall infection rate across the 44 million people in 2002 is approximately one person in five (20%). This year 42.8% of all deaths will be AIDS deaths. Without interventions this will rise to 65.9% in 2010 (Badcock-Walters, 2002). The pandemic will slow South Africa's population growth rate and possibly even put it into decline in the years 2010 to 2025. By that time, tens of millions of South Africans will have died of AIDS-related causes.

Aid agencies from abroad as well as the South African Government (unfairly maligned on the issue, I feel) are weighing in to fight the problem and prevent a disaster of truly biblical proportions. Clearly the country is facing disastrous social, demographic and economic consequences. Careful planning and every measure to educate and prevent the spread, and to treat the sick needs to be taken. The irony of a viral, sexually-transmitted genocide is not lost on many cynical white South Africans.

Paranoia, Immigration, and Parasites

Now, with AIDS in the equation, some unfortunate South Africans have more to fear than ever. Rape of a virgin, it is said, is believed by some AIDS sufferers to effect a cure. Lock up your daughters! I have met some truly tormented people since my arrival. Many are "packing" for countries including Canada, New Zealand, Australia, USA, UK, Ireland, Holland, Germany, Uraguay and Paraguay. There are great bonanzas being extracted in visa fees and other parasitic processes by individuals and authorities in these countries. Australia is, I'm sorry to learn, also at fault here. Long gone is the quick and happy assisted passage for these applicants. (In 1972 I emigrated from South Africa, on an assisted passage of about $350 and the whole application process and travel took little more than three months.) In its place there are now years (3 to 8 are not uncommon) of waiting on top of the financial costs: enormous fees (thousands of dollars), plus commissions to several kinds of "agent", who are in on the act. It must be unbearable to be left hanging on, while being bled by the fat ticks of this loathesome immigration industry. The only consolation is that life does go on for these folk and they are not sweltering or freezing in a refugee camp in the middle of a desert. I wonder what those who wait patiently here think of our so-called queue-jumpers. I would expect them to be unsympathetic, yet understanding of their shared frustrations and despair.

HIV-AIDS and crime are the new life-threatening, economy-sapping "terrors" that South Africa has to face up to. These are possibly far worse than anything it has ever faced in its bold (albeit sometimes sordid history): the Colonies, the Great Trek, the Gold and Diamond Rushes, the Zulu Wars, the Boer War, the First and Second World Wars, and latterly the Apartheid Regime. There is a distinct element of national crisis about both crime and HIV-AIDS. If South Africa can control and reduce crime (which I believe it is starting to do), it can deploy resources to use in education and medical science and hospital services to reverse and ultimately defeat HIV-AIDS. The world can help in the latter fight, in South Africa and of course elsewhere in Africa.

South Africans, like Australians, like to think they have a huge economy. But they don't. The value of what the USA eats, exceeds the whole of the production of the entire Australian economy (GNP) each year. Similarly and in the same perspective, South Africa with about 44 million people has a GNP smaller than New South Wales, despite all their (largely foreign owned) gold and diamonds, other minerals, mealies and sugar. Nevertheless, in the African context, the country is the power-house of its region. The rest of Africa now looks to South Africa for guidance and support. So Australia's relationship with South Africa is a key to much influence in Africa as a whole. Africa has small economies but it can serve as valuable and interesting niche markets for what Australia has to offer. A lot of what we can offer can be in the form of investment and know-how. We can also sell food and luxury items into the "top end". We once did quite good trade in Holden cars, I believe.

You will be staggered and delighted by the game parks, the wild animals, mountains, bushman's rock art, rivers, canyons, waterfalls, wildflowers, foods, wines, smells and tastes of South Africa. The foreign earnings from tourism will benefit people at all socio-economic levels here. It is a very fair trade: you come and look, enjoy, get excited, destroy nothing, and leave valuable revenues in exchange.

As I munch on a strip of dried ostrich meat, called biltong, and sip cold Windhoek beer, I feel sure that a very bright future is dawning in South Africa. It is a new day, not a deja-vu day. "Winds of change" have blown away the past and so much that was bad has clearly gone forevermore. South Africa's economic growth has been retarded, yet it has turned the corner and is on the mend. When it drives out the Grim Reaper (HIV/AIDS) and restores safety to its people in the suburbs and streets, the growth and prosperity now visible, will accelerate and once again there will be a golden time for all the peoples south of the Limpopo. Australia and South Africa can make significant mutual gains now through trade and co-operation which will bring this vision more rapidly to realisation ■

Reference:

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Upcoming Events

28-29 October 2002	**The 2002 Allergen and Food Safety Conference** Novotel Melbourne on Collins Melbourne, Australia http://www.ibcoz.com.au/foodsafety
17-20 November 2002	**The 8th Pacific Rim Biotechnology Conference** Sheraton Hotel, Auckland, New Zealand Contact: info@biotenz.org.nz
3-5 December 2002	**Third Asia Pacific Symposium on Neural Regeneration** Sheraton, Perth, Western Australia Contact: Sarah Dunlop, Ph. +618 9380 1403 sarah@cyllene.uwa.edu.au http://neuro.zoology.uwa.edu.au/symposium.html
5-6 December, 2002	**Detection Technologies - The Next Generation in Identification and Analysis** Marriott Crystal Gateway, Arlington VA, USA http://www.knowledgepress.com/events/7191716.htm
7-11 December 2002	**Australasian Association for ChemoSensory Science (AACSS)** Fifth Annual Scientific Meeting Heron Island, Queensland, Australia Contacts: Wendy.Burchmore@tq.com.au g.bell@unsw.edu.au
6-10 April 2003	**Australian Water Asociation Ozwater Convention and Exhibition "Innovations in Water"** Burswood, Perth, Western Australia http://www.awaozwater.net
9-13 April 2003	**AChemS XXV** Sarasota, Florida, USA http://www.achems.org/index.html
20-24 July, 2003	**The Pangborn Sensory Science Symposium** Boston, MA, USA http://www.Pangborn2003.com
5-9 July, 2004	**XIII International Symposium on Olfaction and Taste (ISOT) / JASTS** Kyoto, Japan Jasts@hus.osaka-u.ac.jp ■

NEWS

Melbourne's Human Water Sentinel

Despite recent advances in technology, the human nose is still the most sensitive instrument that we have available for the detection of taste and odour. However, the ability of individuals to perceive tastes and odours can vary considerably, and people need to be selected and trained to be sensitive and reliable in judging drinking water quality. To better understand the aesthetic quality of water delivered to customers, South East Water Limited has established an in-house taste and odour panel. South East Water Limited is one of three water retail companies that supplies treated water from the wholesaler (Melbourne Water) to the southeastern suburbs of Melbourne.

The aim of the panel is to act as a sentinel tool by providing early detection of water quality changes, to prevent and reduce water quality complaints, and provide a mechanism for evaluating the effect of maintenance operations on aesthetic water quality. The long-term goal would be to involve South East Water Limited's customers on the panel.

Members of the panel have been selected for their taste and odour sensory abilities. Six to eight members are engaged on the panel in any one session, with members being rotated into the panel on a weekly basis. Staff training has been undertaken in-house by SE Water staff who have undertaken intensive training with the Centre for ChemoSensory Centre of UNSW in Sydney.

Such a panel is recognised internationally as being the most effective method for evaluating taste and odour. To obtain consistent results, trained panelists commence their testing by calibrating their senses. This involves tasting and sniffing a series of standards, and ranking their relative strength. The panelists then analyse the water samples. Each panelist rates the observed taste and odour individually. They then discuss their experience to arrive at a consensus description, strength rating and indicators of possible odour notes which can assist the Company's chemists and engineers to track any problem that might have arisen, or to give assurance that quality meets a quality specification. Their sensitivity and ability to reliably identify compounds dissolved in water ensures very early detection of changes to water quality. Their trained sensory acuity far exceeds that of most water consumers ■

With panel training is in full "swig" at South East Water Ltd. Managing Director, Dennis Cavagna (left), Graham Bell, Director of CCR UNSW (Centre), and SEWL's Water Quality Panel Trainer, Katie Dudley (right) drop in for a sniff of the action.

Olfactory Cells May Repair Spinal Cords

Every year accidents to the neck and spinal cord leave people paralysed for life. A careless dive into a shallow pool, a fall from a horse, or seemingly simple motor vehicle injury, can result in the nervous tissue of the person's spine being irreparably damaged.

Researchers in Australia are pioneering research in animal models and actual human patients, that may bring relief to people who face the extreme difficulties of paraplegia or quadriplegia. Prof. Phil Waite and her UNSW colleagues are studying the possible benefits of transplanting ensheathing cells from the olfactory epithelium of rats into damaged rat spinal cords.

Meanwhile at Queensland's Griffith University, Dr Francois Feron and Prof. Alan Mackay-Sim have started a study of human patients, in collaboration with Dr Tim Geraghty and a team from the Spinal Injuries Unit of Princess Alexandra Hospital in Brisbane. Volunteers with paraplegia will have ensheathing cells, from their own olfactory biopsies, grown in the lab then transplanted into their damaged spinal cords.

The olfactory ensheathing cell normally supports and insulates the olfactory nerves as they pass from the nose to the olfactory lobe of the brain. These cells help promote normal regeneration of olfactory nerves. The researchers hope that the regenerative properties of these cells can be harnessed to repair the injured spinal cord. The Griffith and UNSW researchers are collaborating on this possibility, using rats.

A limited trial with four transplanted patients and four paraplegics who have not received the transplant, has begun in Brisbane. Great care is being taken to ensure that no harm is done by the procedure. The eight volunteers will be carefully observed for the next three years ■

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Postdoctoral Associate for Sensory Neurobiology Group

to study cellular/molecular signaling in taste buds (e.g., Chaudhari et al, 2000, Nat.Neurosci. 3:113; Caicedo & Roper, 2001, Science 291:1557; Caicedo et al, 2002, J. Physiol in press). Seeking dedicated, enthusiastic PhD, MD, or DVM to join a team investigating transduction mechanisms and cellular microphysiology in gustatory receptor cells. Experience in calcium imaging, patch-clamp, or closely-related field required. See http://chroma.med.miami.edu/physiol/faculty_pages/sroper.htm

Salary up to $50K depending on experience.

Send CV and names of references to Dr. S. Roper, Physiol/Biophysics (R430), U Miami Medical School, 1600 NW 10th Ave., Miami, FL 33136 USA roper@miami.edu ■

Coming up in ChemoSense

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Japanese YEN for Australian Sea Urchin Roe continued

Australian product cannot succeed in export markets if it does not meet expectations of the palate of consumers in those markets. This study found reference to flavour evaluations from the processing and grading steps, to the market agents and buyers and throughout the market's route to Japanese consumers of uni.

In summary, expert sensory panels can be used as a resource management tool and as a market development tool. The immediate need is to develop the techniques needed for an expert sensory panel to serve resource management issues and overall enhancement of roe quality in sea urchins from wild populations.

An expert panel could be located in either country: Japan or Australia. The key perceptual judgements of the experts are identified by correlation of their assessments of uni with the acceptance score of the Japanese consumers. Once an Australian panel is trained to assess the key characteristics it can be put to work regularly in pursuit of the aim of enhancement of roe quality in sea urchins from wild populations. It would regularly assess urchins from various regions etc, so that production variables can be related to the key product quality attributes. The knowledge thus gained would be used to guide fishery management practices so that the resources remain sustainable and of maximal economic value.

The local uni industry could then be educated in the establishment of its own panels for quality assurance, production improvement and market development purposes. These panels would be independent of the research panel.

Acknowledgements

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NEWS

Recognition for Invention of Novel Chemical Sensor

UNSW's Centre for ChemoSensory Research and School of Chemical Sciences have invented a novel optical sensor for odours of unsafe and degraded foods. The research team was recognised for its work, in September 2002, by the project's principal funders, the CRC for International Food and Packaging Science (CRCIFMPS). The sensor uses a novel material coating which emits light when a particular species of molecule touches it. This can provide a number of technological applications for early warning of spoilage in food. A spin-off company, Rendzan Pty Ltd., has been created to further develop and commercialise this patented technology. The Food and Packaging CRC recently completed its seventh year and its mission ■

The CRC congratulates the UNSW team: From the left are Don Barnett, Graham Bell, John Keniry, Peter Barry, Brynn Hibbert, David Doran, Doug Graham and Roger Edwards.

Readership Survey Extended

Readers now have until 30 November to respond to the ChemoSense Readership survey and have a chance to win several fabulous prizes, including a bottle of Penfold's Grange Hermitage. The winners will be announced in the first issue of 2003. ChemoSense thanks those who have already sent in responses: they will be included in the final draw in December. Good luck ■

Heron Meeting Update

Excitement is mounting in anticipation of the Fifth Annual Scientific Meeting of the Australasian Association for ChemoSensory Science to be held at Heron Island, Queensland, Australia, from 7-11 December 2002.

Over 85 people have booked and the organisers have exceeded their targets. Six students have accepted offers of support. Students will come from Australia, the Philippines, the UK and USA. This will be the largest gathering in 30 years of ChemoSensory experts from overseas, including Japan, Sweden, France, the Netherlands, Germany, UK, USA, New Zealand and Bermuda!

The program is now in the final stages of construction, and attendees are urged to send in their abstracts to meet the 30 September deadline.

Anyone still wishing to come is advised to e-mail or call Wendy Burchmore of Tourism Queensland, Groups and Conferences, without delay. A confirmed booking is the essential first step to attending the meeting. Conference rates are no longer guaranteed to late entrants, as we have exceeded our negotiated quota of rooms (congratulations to Wendy and to everyone who has booked!). However, if you have not yet booked, do act now by contacting Wendy:

Wendy.Burchmore@tq.com.au
Phone +61 7 3535 5837
Fax: +61 7 3535 5045

Meeting Registration Fees:

Non-student AUD*$120
Student AUD$60
Payable on arrival at the Island.

* 1AUD$ is approximately equal to 54 cents US (September, 2002).

IMPORTANT DATES:

Abstract Deadline: 30 September, 2002
Meeting: 7-11 December, 2002

IMPORTANT CONTACTS:

Heron Island Accommodation:
Wendy.Burchmore@tq.com.au

Meeting Organiser: g.bell@unsw.edu.au

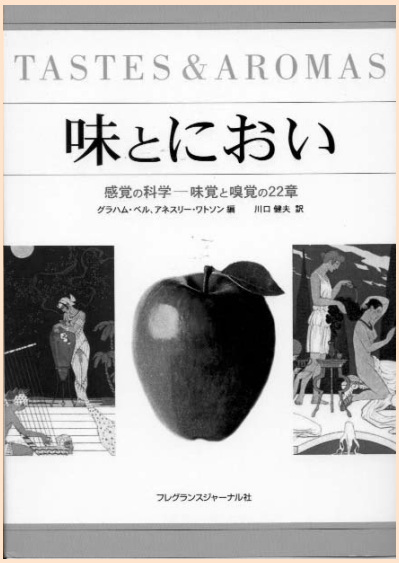
Program Chair:
John.Prescott@stonebow.otago.ac.nz

Web info: www.chemosensory.com

SEE YOU IN PARADISE!

Our Book into Japanese

The book "Tastes and Aromas: The Chemical Senses in Science and Industry" (UNSW Press and Blackwell Science, 1999) has been completely translated into Japanese. Members of the Japanese chemical sensory community, including Dr. Sachiko Saito and Dr. Nobuyuki Sakai, assisted with the translation. This is the first time a UNSW Press publication has been translated into Japanese ■



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Web: http://www.chemosensory.com

Production Team
Editor: Graham Bell, Ph (+61 2) 9209 4083 g.bell@unsw.edu.au
Advertising & Subscriptions:
Brian Crowley, Ph (+61 2) 9209 4082, b.crowley@unsw.edu.au
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