Vol. 7 No.4 Sept 2005

Chemo sense

EDITORIAL

By Graham Bell

Director, Graham Bell and Associates

g.bell@atp.com.au

A longstanding goal of sensory science is to identify and measure compounds as they are released from food in the mouth and to relate these to sensory perception of flavour. In this issue, Andy Taylor and colleagues from the University of Nottingham, using real-time instrumental analysis of flavorants released in the mouth, bring us closer to being able to predict perceived flavour from the composition of a food.

Further insight is provided on the role of sensory analysis in wine production in our exclusive interview with *the flying vine doctor*, Richard Smart.

Why not join us at the "ultimate" in sensory conferences: AACSS at the Great Barrier Reef (2-6 December 2005)? This issue is stacked with information you need to participate. Act *now*. See you in paradise!

Industrial and community needs for real-time, continuous monitoring of air quality, are being met by the sponsors of *ChemoSense*, E-Nose, Pty Ltd ■

Flavour Release and Flavour Perception

Andy Taylor

Division of Food Sciences
University of Nottingham
Loughborough LE12 5RD
UK

Andy.Taylor@nottingham.ac.uk

Historically, flavour scientists developed methods like GC-MS to measure the flavour content of a food. Our thinking was that it is the fraction of aroma that reaches the receptors that is important in establishing the sensory perception and that we should measure this aroma profile in vivo rather than in vitro. In other words, flavour composition in the food does not necessarily correlate with delivery of compounds to the receptors. Consequently, methodology was developed (Linforth & Taylor 1998) to investigate how flavour is delivered during eating, by directly measuring the stimulus (flavour molecules) close to the olfactory receptors, by monitoring exhaled air from the nose during eating on a breath-by-breath basis.

The net results of several years of flavour delivery studies have revealed: the realities of flavour release under the high gas flows encountered in-vivo; the impact of human physiological factors (such as chewing and swallowing) on flavour release; the effect of flavour molecule interactions with other food components; the importance of the physical chemistry of the flavour molecules themselves; the significance of interactions between flavour, taste and texture at the perceptual level; and has also allowed fundamental studies into the generation of flavour itself.

cont. pg 2

INSIDE:

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Vol. 7 No.4 Sept 2005

Flavour Release and Flavour Perception continued

Real-time flavour analysis

A technique based on Atmospheric Pressure Chemical Ionisation - Mass Spectrometry (APCI-MS) was developed at Nottingham to monitor volatile compounds in breath dur8ng eating (Linforth *et al.* 1996; Linforth & Taylor 1998). An analogous technique for environmental sampling was developed by Lindinger in Innsbruck based on Proton Transfer Reaction - Mass Spectrometry (PTR - MS) and subsequently applied to food aromas (Hansel *et al.* 1995). Both systems relied on the same reaction to ionise the analytes; the transfer of a proton from protonated water ((H2O)nH+) to the analyte (M) itself (Equation 1). Once ionised, compounds were separated from one another on the basis of their mass to charge ratio (m/z; for small volatile molecules, effectively the molecular weight). The ionisation reaction on both systems was "soft", such that minimal fragmentation occurred resulting in simple spectra that were easy to deconvolute.

$$(H_2O)_nH^+ \ + \ M \ \cdot \ MH^+ \ + \ nH_2O$$

Equation 1

APCI-MS can measure the aroma in the headspace (the gas phase above a food product) yielding a mass spectrum which is effectively a fingerprint of the compounds present. Ions formed from the analytes above a fruit flavoured cough sweet (Fig. 1) show major ions corresponding to both the fruity component of the flavour (m/z 117, ethyl butyrate; 145, ethyl hexanoate) and the soothing minty cooling compounds (m/z 139, menthol; 155, menthone).

The ions observed for the majority of the compounds are the protonated molecular ions MH^+, apart from menthol which is the exception as it loses water during ionisation to form MH^+-H_2O, a reaction typical of alcohols.

Such analyses are rapid (<30s) requiring only a few scans to be collected since there is no chromatographic separation (the sample headspace was simply drawn into the source via the inlet tube), allowing fast sample comparison. In addition to simplifying deconvolution of the spectrum, the minimal fragmentation that occurs also enhances sensitivity, since any given molecular species predominantly forms ions at one mass. Strong fragmentation (typical of electron impact mass spectrometer) distributes the charge across a range of masses giving lower ion intensities and a worse signal to noise ratio.

As well as headspace ion profiling, the APCI - MS was designed to be capable of breath analysis with high temporal resolution. This was achieved by minimising any volumes associated with sample inlet tubes and ensuring that areas such as the source, were efficiently swept with nitrogen gas rather than forming dead volumes. In addition, inert materials were selected for the surfaces in contact with the analyte stream, which were heated to minimise condensation of water or flavour molecules. Thereafter, transmission through the MS itself was virtually instantaneous.

Breath - by - breath analysis of the strawberry flavoured cough sweet showed temporal profiles with a series of peaks and troughs for each ion (Fig. 2).

The wide troughs are formed during inhalation when air from the atmosphere (with minimal volatile content) is sampled into the mass spectrometer. During exhalation large peaks are observed, increasing in magnitude as the breath flavour concentration increases (signal intensity is directly proportional to volatile concentration), these then decline as the sweet is swallowed and the potential for further flavour release decreases.

The signal for menthol declines at a slower rate than that for ethyl butyrate. This is due to its lower vapour pressure (Linforth & Taylor 2000; Hodgson *et al.* 2004) which causes it to be absorbed by the mucus layer on the nasal/throat epithelium forming a reservoir for further release. The higher vapour pressure of ethyl butyrate ensures that it is swept from these surfaces and shows minimal

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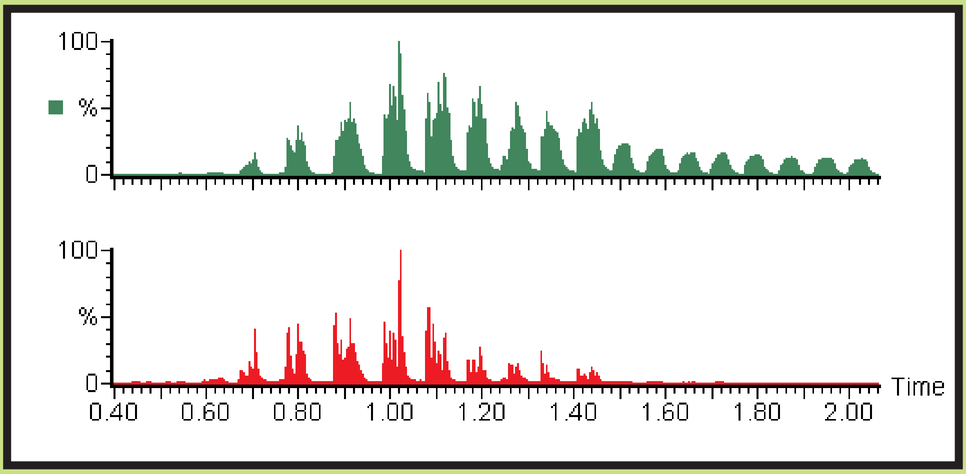

Figure 2: Breath - by - breath release profiles of menthol (upper) and ethyl butyrate (lower) during the consumption of a strawberry cough sweet. The panellist placed the sample in - mouth 0.4min after the start of the "chromatogram".

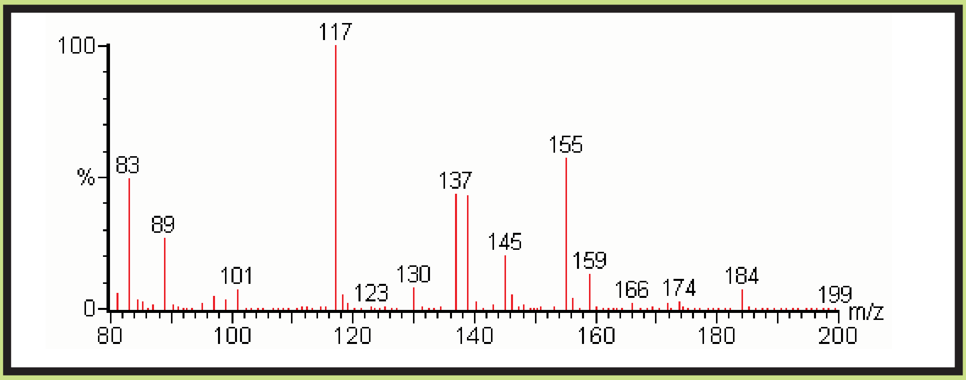

Figure 1: The mass spectral profile from APCI-MS analysis of the gas phase above a strawberry flavoured cough sweet.

Vol. 7 No.4 Sept 2005

Come join us in Paradise !

8th Scientific Meeting of

The Australasian Association for ChemoSensory Science (AACSS)

2-6 December 2005 at Heron Island, Australia

Heron Island - built on a tiny coral atoll in the Great Barrier Reef, surrounded by rich coral and marine life, this luxury resort offers one of the most beautiful and exciting conference venues imaginable.

For additional information please contact:

- Wendy.Burchmore@tq.com.au
  (Accommodation booking by 31 August)
- John.Prescott@jcu.edu.au
  (Program Chair, abstract and symposium submission by 31 August)
- Graham Bell, g.bell@atp.com.au
  (conference organiser, early bird registration by 1 July)

aacss HERON ISLAND 2005

Flavour Release and Flavour Perception continued

persistence.

The signal for the major peaks corresponding to exhalations are typically not smooth (which would occur if the breath volatile content was constant during exhalation), instead each exhalation has distinct peaks and troughs within it. These are caused by pulses of flavour molecules pumped into the exhaled air stream as the volume of the mouth changes during chewing (Hodgson *et al.* 2003, Linforth *et al.* 2004). After the individual has finished chewing the sweet (about 1min into the eating time course), these pulses of flavour disappear and the peaks corresponding to each exhalation are smoother. The mouth is no longer acting as a major source of flavour molecules (unless the individual makes significant mouth movements such as swallowing) and the flavour compounds in the breath are those desorbed from the nasal/throat epithelium. Such observations can only be made if the system is both sensitive and has good temporal resolution.

The effect of dynamic conditions on flavour release

Numerous studies of different flavour systems and food matrices have revealed some of the key basic factors affecting volatile delivery. The dynamic nature of the flavour release environment is characterised by high gas flow rates and a short time scale. Exhalation and inhalation flow rates are in the region of 150 to 200mL/s (Hodgson *et al.* 2003), designed to rapidly transfer air between the atmosphere and the lungs, despite the limited cross-section of the passages of the upper airway (Damm *et al.* 2002). Equally the mouth (although a side chamber of the upper airway) has a 13mL tidal flow of air with every chew, which given that we chew approximately 100 times a minute is also a highly dynamic environment.

Marin and co-workers (1999) measured and modelled the behaviour of flavour molecules partitioning between aqueous solutions and the gas phase in vitro using APCI-MS. They found that flavour release under dynamic conditions was correlated with the air/water partition coefficient (K_{aw}) determined under static situations. This is because, this ratio determines the proportion of molecules present in a solution that have to enter the gas phase to achieve equilibrium. The lower the K_{aw} the smaller the proportion of molecules that have to move from the solution into the gas phase to reach equilibrium compared with compounds with higher K_{aw} values.

Under dynamic conditions, it is only the immediate interface that appears to participate in volatile exchange due to the limited time for bulk convection or molecular diffusion to occur, effectively a small volume. When high K_{aw} molecules in this small volume partition into the gas phase (which is typically much larger) in an attempt to maintain thermodynamic equilibrium, they rapidly become depleted at the interface and the actual gas phase concentration observed is far from equilibrium. However, compounds with lower K_{aw}'s need to move relatively fewer molecules into the gas phase to reach equilibrium and readily achieve concentrations much closer to equilibrium. The net effect of this is that under dynamic conditions the gas phase concentrations of low K_{aw} compounds are relatively stable whereas, those for high K_{aw} compounds fall. Consequently, the absolute concentration of these different compounds will be much more similar under dynamic than under static conditions.

This is paralleled in-vivo, where the environment is even more dynamic than in the in vitro studies. Compounds with high K_{aw}'s are inefficient in their delivery compared to the low K_{aw} compounds (Linforth *et al.* 2002) minimising the absolute concentration differences between them.

Development of sensory science in parallel with instrumental analysis

In order to understand flavour perception, at least two measurements are required; a measure of flavour perception from a human individual, and quantification of the stimuli involved. The latter are usually the tastant and volatiles present in the food, or more importantly those that reach the receptors. Judgements are then made under the controlled environmental conditions found in a sensory facility such as the Sensory Science Centre at Nottingham. Accurate objective judgements require panellists to become familiar with the nature of the particular flavour attribute under study, and to be trained in the use of the specific scale chosen for recording intensity. Trained panellists can evaluate flavour intensity using a range of techniques including rating scales and magnitude estimation. When the eating event is long e.g. chewing gum or a piece of chicken, the Time Intensity Technique enables panellists to record changes in flavour intensity with time, usually by moving the position of a cursor on a scale on computer screen as they eat. Incorporating the APCI-MS alongside a sensory facility enables the simultaneous measurement of in-nose volatile stimuli and flavour perception data, and comparing the two has allowed us to understand more clearly the role of the volatile stimulus in flavour perception.

Combining sensory analyses with instrumental measurements

An interesting facet of flavour perception is that the sensory stimulus which best predicts perception for a specific food has been found to vary with product type (Cook *et al.* 2005). To a certain extent this reflects the multisensory nature of flavour. For instance, when investigating the perceived rosemary flavour of a range of crumbed coatings, we found a direct temporal correlation between panellist time-intensity traces and the aroma signal measured in-nose by APCI-MS (Cook *et al.* 2005). Thus, there was a close correlation between sensory and aroma release measurements in terms of both temporal variations in intensity and the duration of the flavour experience.

However, in other systems, monitoring aroma release in-nose has not proven sufficient to predict flavour perception. A typical example of such a product is mint chewing gum (Davidson *et al.* 1999). The hydrophobic base of chewing gum forms an excellent reservoir for terpene aroma compounds, such as menthone or menthol, which predominate in mint aroma. So much so, that aroma release from gum which has been chewed for 15 minutes remains close to the maximum levels observed from fresh gum. However, as we know from common experience, the perceived mintiness of chewing gum declines substantially over much shorter time periods and far more rapidly than would be the case if the sole mechanism responsible was adaptation to the in-nose aroma signal. Davidson *et al.* (1999) found

cont. pg 5

Flavour Release and Flavour Perception continued

that sensory perception of mint flavour from chewing gum followed saliva sweetener concentration, as measured by a tongue swabbing technique. This correlation was observed repeatedly with both sucrose and artificial sweetener gums and for both stick and tablet varieties of chewing gum.

We now understand these results in terms of a taste-aroma interaction (Noble 1996) between sweetness and mint aroma. Because sweet taste and mint aroma are frequently encountered together (e.g. in sweets or in toothpaste), the brain processes them as a joint construct. The implication of this has been observed in many sensory studies, wherein aroma intensity can impact upon perceived taste intensity and vice versa. Combinations of stimuli which enhance each other in this fashion are termed 'congruent' (Schifferstein & Verlegh 1996). Several studies have indicated that taste is the predominant driver of perceived flavour intensity in systems where such interactions were observed. For example, a reduction in perceived saltiness was shown to decrease perception of single character impact flavours such as garlic (diallyl disulfide) or mushroom (1-octen-3-ol), whilst aroma delivery in-nose remained unchanged (Cook *et al*. 2003). An interesting consequence of such findings is that in systems where taste intensity is suppressed, for example by the addition of food hydrocolloids, it is possible to increase the amounts of tastants in order to restore the flavour balance of the thickened system (Cook 2003). This is clearly something which has been appreciated anecdotally in the kitchen for some time, as it is common practice to add extra seasoning when thickening sauces and the like.

The multisensory nature of flavour extends beyond taste and aroma signals to include input from the trigeminal nerve relating to oral irritation, temperature and tactile stimuli. For example, the sensory definition of 'creaminess' is known to include elements of aroma composition (requiring appropriate dairy aroma notes), but also has a tactile component relating to oily mouthfeel and the appropriate particle size distribution for a particular product (Kilcast & Clegg 2002).

When investigating taste and aroma perception in viscous hydrocolloid solutions, we found that perceived flavour intensity could be predicted by a physical measure of the oral viscosity of the solutions (Cook *et al*. 2003). Despite the fact that aroma release in-vivo was not significantly affected by solution viscosities ranging from water to a thick sauce consistency, magnitude estimates of flavour perception declined sharply in the more viscous solutions. Since flavour perception in systems employing a wide range of thickeners could be correlated with a stimulus for oral viscosity, it was hypothesized that this might reflect a direct texture-flavour interaction. However, it is also possible that increased viscosity slowed the transport of sugar to taste receptors due to in-mouth mixing effects. If the latter is true, this represents a further example of taste-aroma interactions where perceived flavour intensity (banana) was driven primarily by taste intensity (sweetness).

Understanding sensory phenomena

Instrumentation has been developed at the University of Nottingham to control the supply of tastants and aromas to assessors over longer time periods than those experienced in traditional sensory experiments. A schematic of the flavour delivery system constructed can be observed in Fig. 3.

Computer controlled pumps dispense solutions at a pre-programmed rate, which are then combined at a manifold. The combined sample is delivered continuously to the assessor's mouth for a specified length of time. By adjusting the flow rate of each pump the composition of the sample can be varied with time, but the overall flow rate remains constant. The system allows several aspects of flavour perception to be investigated, for example, adaptation, the impact of pulsing volatiles and tastants into the mouth and the interaction between different taste and aroma compounds.

It has been used to investigate the interaction between sucrose and isoamyl acetate on perceived banana flavour intensity (Hort & Hollowood 2004). Panellists continuously consumed a solution for 150 seconds simultaneously recording banana flavour intensity. The pumps were programmed so that during the first 30 seconds a combined 100 ppm isoamyl acetate and 3% sucrose solution was delivered. For the subsequent 90

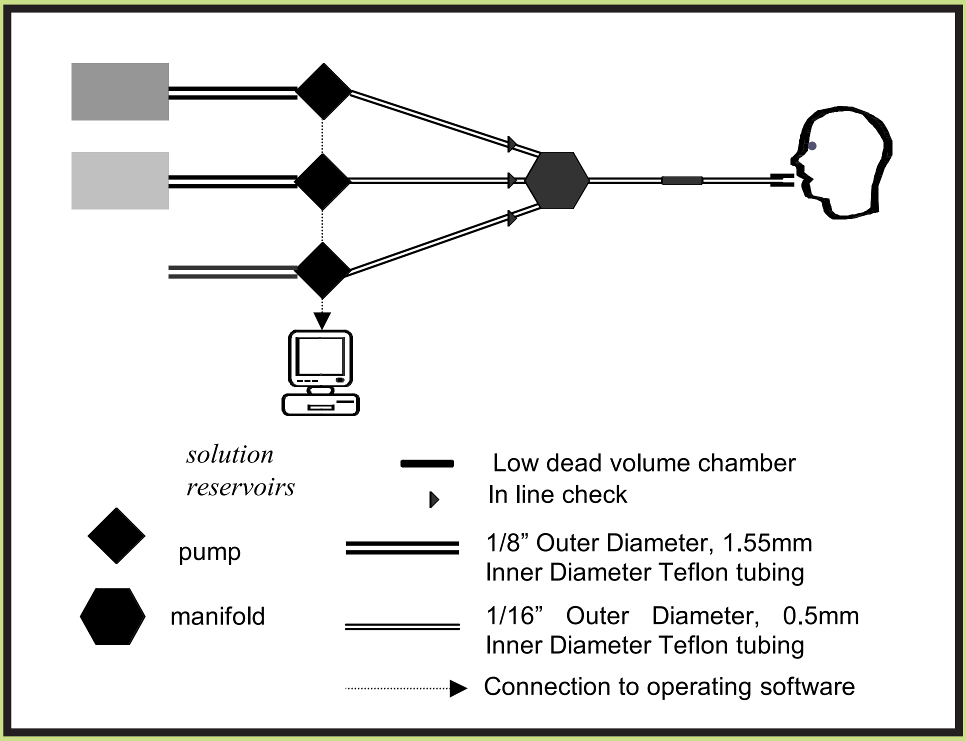

Figure 3: Schematic of the Flavour and Taste Delivery System. The pumps deliver solutions (via check valves) to a manifold they then pass through a small chamber (to mix the solutions) before entering the panellists mouth.

cont. pg 6

Flavour Release and Flavour Perception continued

seconds the sucrose element was replaced by water. It was then reintroduced for the final 30 seconds. APCI-MS monitoring of in-nose volatile content showed that no change in the level of the aroma stimulus occurred during this time and yet the panellists recording of flavour perception did. The time intensity data was subjected to principal component analysis to identify groups of behaviour. Fig. 4 shows the average flavour intensity perception of each of the identified groups.

Analysis of the data indicated that different types of perceptual behaviour could be observed. When the sucrose was removed, the banana intensity always dropped and when it was reintroduced it increased, suggesting that the presence of the 'sweet' signal is important in the recognition of banana flavour in the brain. However, interestingly the extent of this decrease varied across groups. For some panellists it disappeared completely (Group2), whereas for some (Group 4) intensity only decreased to about 75% of the original level. It is possible that past experience of banana flavour drives how important the sucrose stimulus is in determining our perception of a banana flavour. For example, for those whose experience of banana is milkshakes and confectionery sucrose may more important than those whose experience is restricted to the fruit. e.g. compare banana milkshakes and sweets (which are very sweet) with the fruit itself.

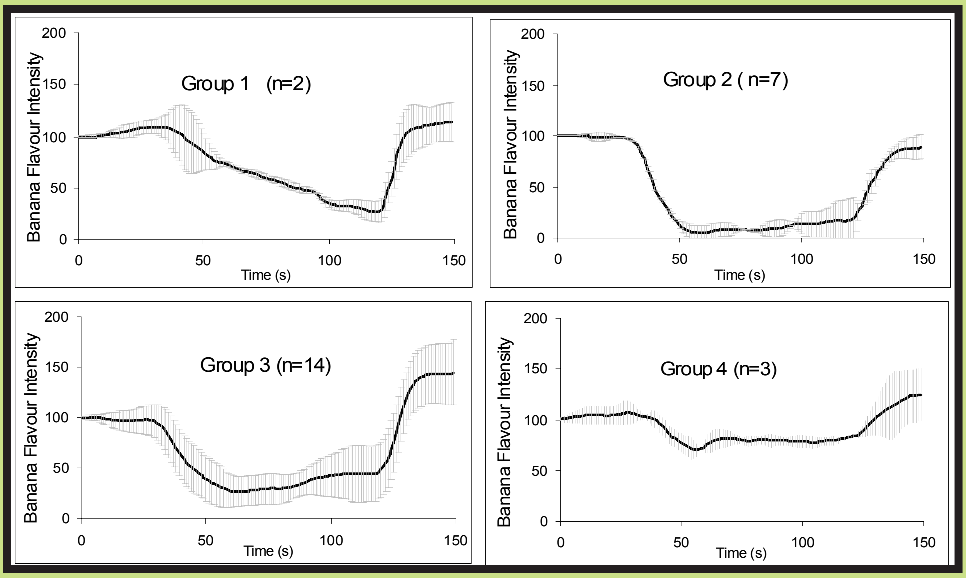

Figure 4: Average time intensity curves (±1sd) for observed groups of panelists fed solutions with a continuous level of isoamylacetate, but, which only contained sugar for the first and last 30s.

Ultimately, measures of activity in the different sensory processing areas of the brain would help further to understand this perceptual phenomenon. We are currently working with the Physics department at the University to use functional magnetic resonance imaging (fMRI) techniques to understand how the brain processes the signal from sensory stimuli during food consumption to further our understanding behind the mechanisms driving multimodal flavour perception.

Summary

The potential to simultaneously perform sensory analysis, whilst measuring the stimulus delivered to the olfactory areas, has enabled a better understanding of the link between flavour delivery and perception. Many perceptual changes were in the past attributed to the effects of solutes (sugars and salts) on in-mouth physical chemistry affecting flavour delivery. These phenomena now appear to be more linked to taste-aroma interactions and the effects of in-mouth physical chemistry and physiology has been clarified. Further understanding will undoubtedly come with the integration of flavour delivery and perception studies with techniques such as fMRI, which will allow us to see how stimuli and our senses are integrated in the brain. The on line techniques are also being applied to study the Maillard reaction and fruit ripening phenomena ■

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aacss HERON ISLAND 2005

AACSS at Heron Island 2005

Fourth Announcement: Final Calls

If you have missed the deadlines, ACT NOW! The gate is still open! (23 September for Abstracts and Accommodation)

The Australasian Association for ChemoSensory Science (AACSS) will hold its 8th Scientific meeting at Heron Island, Queensland from 2-6 December, 2005.

All members of the Australasian and International Chemical Senses communities are cordially invited to participate.

Who should attend?

Researchers and applied scientists in the chemical senses from research institutions and academia, industrial delegates, and accompanying families/guests, (who may stay at the Island at AACSS accommodation rates) are welcome. Admission to the meeting will be at the discretion of the AACSS Organisers.

PROGRAM

Exciting Program Taking Shape

The Conference Program will consist of Plenary Sessions, Symposia, Platform Sessions and Posters. Timing of the Program sessions will allow optimal enjoyment of the Island during the day. With all meals supplied, excellent use can be made of the days and evenings to integrate sessions with island activities. The first session will be in the early evening of 2 December to allow arrival at the Island and the last session will be in the morning of 6 December, allowing time for a final swim or walk on the coral sand before the boat leaves for Gladstone.

A number of Symposia* will be organised around core topics. Symposium topics include: Neuro-molecular and Physiological Mechanisms of Smell and Taste; Regeneration and Targeting; Chemosensory "Stem" Cells; Aquatic Animal Models; Chemical Communication; Central Nervous System Processes; Taste Mechanisms and Genetics; Neural Imaging; Clinical Issues, Sensory Loss and Aging; Role of Learning and Memory in Chemosensory Perception; Flavour Perception; Large Mammals; Insects, Mechanisms and Control; Human Applied Sensory Issues (Food and Other); Sensors, Electronic Noses, Air Quality Measurement, Robotics and other Applications.

* These may change, as circumstances demand

Submissions of abstracts for symposium, oral and poster papers must be sent to The Program Chair, John Prescott, john.prescott@jcu.edu.au by **23 September 2005**. All abstracts will be refereed by the Program Committee. *(If you are late, send it in NOW!)*

Why Heron Island? The AACSS meeting of 2002 on Heron Island was a great success. This rare geographical jewel in the Coral Sea is two hours by boat from Gladstone, Queensland, or 30 mins by helicopter. Heron Island offers you one of the most exciting conference venues imaginable. Built on a tiny coral atoll, surrounded by rich coral and marine life, it consists of a solitary luxury, low-built resort, and a marine research station. It is, without any argument, one of the most beautiful, exciting, yet relaxing places on Earth. Just do a web-search and see how many people around the world have raved about it. Over 60% of people on Heron Island, at any time, are from abroad. AACSS has negotiated an affordable package of accommodation with ***all meals*** provided in the rates. These are shown below in Australian Dollars (AUD$ 1 = US$ 0.75 in September 2005).

HERON ISLAND RESORT BOOKINGS

A confirmed resort booking and transfers to and from the island is essential for registration at the Meeting. Rates quoted here are at a special 20% discount exclusive to AACSS Meeting participants and their parties. Stays may be extended at these rates before and/or after the Meeting, depending on room availability. *The Resort provides three meals inclusive in the room rates.*

Please make your hotel and island transfer bookings as early as possible. Room numbers are limited and will be available on a first-come first-served basis. AACSS accepts no responsibility for attendees' hotel, transfers or travel bookings or any matters arising therefrom. Attendees must see to their own accommodation and travel arrangements. All bookings must be finalised by the **Hotel Deadline: 23 September 2005.** *(If you are late, ACT NOW, and there may still be a place for you.)*

All your accommodation on Heron Island and launch/helicopter transfers must be made directly by you through Wendy Burchmore of Tourism Queensland Groups and Conferences. Once you have a confirmed booking the AACSS Organisers will contact you regarding registration.

Wendy.Burchmore@slholidays.com.au
Phone +61 7 3535 4837 (or free call within Aust. 1300 738 838)
Fax: +61 7 3535 4235

ACCOMMODATION RATES

Per person, per night ***including*** full buffet breakfast, smorgasboard lunch, 3 course table de hote or themed buffet dinner daily including Saturday night seafood buffet, and many island activities.

All prices quoted in Australian dollars and include 10% GST. The group rates below represent a discount of 20% on nightly tariffs.

TRANSFERS (table below)

The courtesy coach transfer departs Gladstone airport at 10.15 am and the launch departs the Marina **at 11.00 am**. The launch returns to the Marina **at 3.45 pm** with an immediate courtesy coach connection to the airport. **Flights departing Gladstone must depart no earlier than 4.20 pm.**

Helicopter transfers are operated on demand during daylight hours. The above timings are subject to change.

Conference Registration Fees:

AUD$300.00 per attendee (no extra charge for accompanying persons). Students AUD$150.00 (see student assistance information below). Visa (and all card facilities) for conference fee payment is not available. Pay by cheque made in favour of AACSS 2005 Conference and mail to AACSS Organiser, P O Box 488, Gladesville NSW Australia 2111. Payment in ***cash*** can also be made to the Conference Organisers once you arrive on the Island.

Student Assistance Four students have been awarded $500 each in assistance (Congratulations!). Students who have missed out, but intend to come to the meeting, should express interest in any late support that might become available. No guarantees. You must make contact with James St John and make an expression of interest (EOI) by 23 September 2005 (see below).

IMPORTANT CONTACTS & DATES:

Step 1: Deadline 23 Sept. Book your Heron Island Accommodation through Wendy Burchmore: Wendy.Burchmore@slholidays.com.au

Step 2: Deadline 23 Sept. Send Abstracts and Symposium proposals to Program Chair, John Prescott: john.prescott@jcu.edu.au

Step 3: Register and Pay Conference to The Conference Organiser, Graham Bell: g.bell@atp.com.au

Students Assistance Late Comers' EOI Deadline 23 September: Apply to James St John james.stjohn@uq.edu.au

SEE YOU IN PARADISE! ■

Accommodation and all meals	Per person per night TWIN SHARE	Per room per night SOLE USE	Extra Adult*	Extra Child* (3-14 years)
Turtle Room	$200.00	$292.00	$128.00	$80.00
Reef Suite	$228.00	$320.00	$128.00	$80.00
Heron Beachside Suite	$288.00	$380.00	$128.00	$80.00
Point Suite/Beach House/Wistari Suites	$384.00	$476.00	$128.00	$80.00

TRANSFER RATES All prices quoted in Australian dollars and inclusive of 10% GST.

Transfer ex Gladstone	Adult One Way	Adult Return	Child One Way (3-14 years)	Child Return (3-14 years)
Launch	74.40	$148.80	$37.60	$75.20
Helicopter	$291.00	$495.00	$146.00	$248.00

Useful Chemical Senses Book

Tastes and Aromas: The Chemical Senses in Science and Industry, Edited by Graham Bell and Annesley J. Watson. 214 pages. Published by UNSW Press and Blackwell Science, 1999. ISBN: 0-86840 769 0. Hard Cover. Price: US$ 30 / AUD$ 40 (includes tax if applicable, postage and handling). Order from: g.bell@atp.com.au

A limited number of this extremely useful volume are, for a short time only, available at a 50% discount. *Tastes and Aromas* has been hailed as a great teaching aid and resource for the practicing sensory scientist. Written by leaders in their fields as fundamental information, the volume retains its value and is rich in scientific and practical quality. Beautifully packaged in hard cover, it will continue to be a durable reference for many years to come.

Chapters include mini-reviews by (first authors) Stoddart; Bartoshuk; Youngentob; Prescott; Lyon; Weller; Bell; Saito; Lambeth; Noble; Morgan; Best; Barry; Sullivan; Key; Mackay-Sim; Atema; Hibbert; Barnett; and Levy.

Content covers the chemical senses in human culture; fundamentals of smell; taste; pungency; oral touch and pain; applied sensory evaluation; cross-cultural studies; perfumery and flavour chemistry; wine preference; psychophysics; sensory mapping; physiology of odour encoding; anatomy, growth and aging; emerging chemosensory technologies; sensors; marine chemical signals; electronic noses and chemosensory machines.

Avail yourself of a copy while these limited stocks last.

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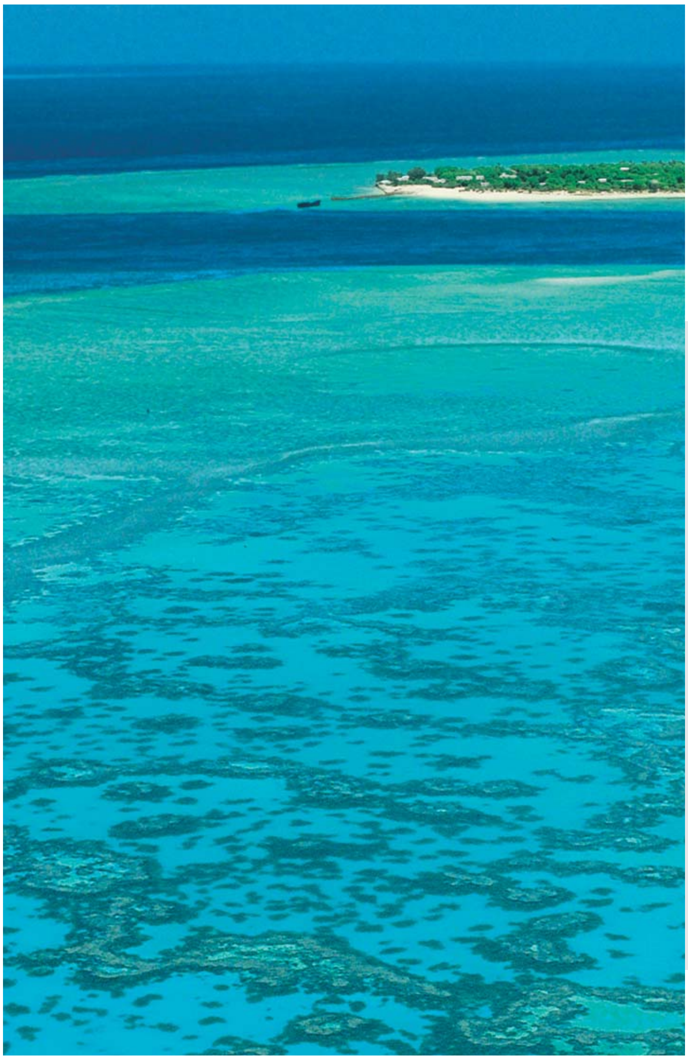
NEWS

AACSS to meet at Heron Island in December 2005



See page 7 for details.

aacss HERON ISLAND 2005

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Vol. 7 No.4 Sept 2005

E-Nose Pty Ltd

E-Nose Pty Ltd was founded in February 2003 by Dr. Graham Bell and six scientists who have pioneered research in smell and electronic noses. The company is owned by these founders and ATP-Innovations, an innovation company based at the Australian Technology Park (ATP), Sydney. The company has offices and a lab at the ATP.

E-Nose Pty Ltd currently employs four staff and several sub-contractors. It is governed by a Board and advised by a Technical Advisory Board. We have close contact with UNSW and University of Sydney.

ABN 14 103 740 567
145 NIC Building
Australian Technology Park
Sydney Australia 1430
Ph. (+612) 92094083
Fax: (+612) 9209 4081
E-Mail: g.bell@atp.com.au

What does E-Nose Pty Ltd do?

We supply continuous, real-time measurement of odour or airborne chemicals (electronic noses or E-Noses). We reduce the worry and costs to factory operators of fines and litigation from EPAs and the Community.

Our devices work on-site, for immediate action, thereby removing the slow and expensive method of bagging air samples for later analysis at a remote lab. E-Noses have, up until now, been laboratory instruments measuring a wide range of chemicals. The Company's strategy is to tailor its robust, industrial-strength products to meet specific customer needs. This results in smaller, faster, more affordable devices and information processing, producing high customer satisfaction.

Sentinels

E-Nose Pty Ltd designs and makes industry-specific devices (with appropriate software) for continuous monitoring of environmental odour.

Two systems have been developed for the red meat industry and the sewerage industry. Customers include four abattoirs and two sewage companies (at mid-2005).

Smell Diagnostics (volatile chemical classification)

A diagnostic system for animal health is under development for The Australian Sheep CRC. Further research is progressing on diagnosis of diseases on the breath of humans. Projects are underway with clinical approval and the collaboration of appropriate expert clinicians, in the fields of diabetes and the early diagnosis of lung cancer. These studies will underpin intellectual property for future devices in the human health domain.

Process Control

Electronic noses can be used to control equipment such as odour abatement infrastructure, to help reduce costs and make it more effective.

A control device for large building air conditioning is in development. It is anticipated that monitoring and process control devices will be applied in many of the same industrial settings.

Pollution Monitoring: The Value to Customers

E-nose offers a cost-effective, reliable and robust odour monitoring service for companies with environmental odour issues. E-Nose offers relief from environmental risk. It provides a site-customised system that facilitates real-time and predictive measurements to enhance odour management. The result is cost savings and reduction of pressures from the community and regulatory bodies. The E-Nose solution offers plant operators useful information with which to run their operations more effectively and at lower cost.

Diagnosis: The Value to Customers

In the area of animal health, rapid assessment of animals for a variety of health conditions offers several benefits to the farmer, the animal and the environment. It will save the farmer time, allow targeted attention to specific animals and reduce unnecessary use of medicines and effort.

Diagnosis of human health from the breath will be non-invasive, safe, relatively cheap and rapid. It will save time and money, and mitigate considerable risk to the patient. The potential markets in the human health field are *huge*.

Intellectual Property

E-Nose has a portfolio of patents for platform and specific applications. It owns all its IP outright. Further patentable IP is continously under development. The company is prepared to work with partners to create new technology and markets

Outlook

The Company aims to develop markets in the region as well as internationally. First sales were made in 2004 and robust growth in sales has been made in 2005. Outlook is excellent.

Further Information

If you are interested in its products and services, or if you need advice on an odour issue, **please call Graham Bell (+612 92094083) or e-mail g.bell@atp.com.au.**
Website: www.chemosensory.com (under construction) ■

The Company disclaims any liability for the use to which the above information may be put.

Vol. 7 No.4 Sept 2005

WineSense: "The Flying Vine Doctor"

Richard Smart interview

vinedoctor@compuserve.com
www.smartvit.com.au

How important is vineyard management for the quality of the finished wine?

Well, it's about as important as the parents you choose to be born from. The composition of the fruit is crucial. If it is not right, there are only limited manipulations that the winemaker can apply. Remember, vineyard management includes choosing the site, the varieties of the fruit, pruning, trellises, irrigation and canopy management.

What does canopy management do for wine quality?

It is extremely important to wine quality as it allows the grower to control an important ripening variable, the exposure of the fruit and leaves to the sun, to be manipulated at important times: to increase or decrease access of much of the vine to warmth and light.

How do you define wine quality?

Wine quality is not well defined chemically or sensorially. It still requires a great deal of empirical observation. The relationship between sensory quality of wine and vineyard management is not well developed. The situation is currently best described as "disjointed", with wine commentators and wine shows massively influencing a wine's reputation, consumer loyalty and what people "see" in a wine. All this mixture of information is really not well correlated with the sensory quality of wine.

Surely things are starting to improve?

Yes, over the past ten years there has been a great improvement in vine management and the use of technology in general and this is why Australia and New Zealand have been internationally competitive: we have had to rely on technology and not tradition. But we are getting complacent, like our current rugby and cricket teams. Europe is taking up the technology more quickly, much of which they have developed, but have usually been slow to adopt. They also import technology, such as the Smart-Dyson trellis system, which is used in California and Spain more so than in Australia. I do not know why.

What is the role of sensory science in the wine industry?

From my perspective there are six important aspects of vineyard quality assurance, and I am attempting to introduce a commercial service in California and Australasia based on these, namely:

- vineyard monitoring
- aerial imaging (using GPS & GIS)
- rapid data analysis using personal data devices (PDAs)
- chemical analysis of grapes and wine
- microvinification (small scale wine making)
- sensory analysis of wine

cont. pg 12

WineSense:
"The Flying Vine Doctor"

Sensory analysis is one of six important tools that will assure the quality of wines in the future. It is very important.

So why then, is sensory science so poorly taken up by the wine industry - it is clearly far behind the food industry in this regard?

There are not enough sensory scientists being trained and not enough going into the wine industry. People in the industry don't see the need for them, partly because sensory scientists have failed to promote themselves to the wine industry.

Is there anything else that Australia and New Zealand should be doing better?

We are doing well, overall. But we have been concentrating on reducing costs and making labour savings and neglecting quality technology. This is where we must improve: shift quality technology to a higher priority.

Your work in India sounds very interesting. What can we learn from this emerging market?

I'm off to India and China again soon. I currently have clients in 24 countries, so I do a lot of flying...hence "the flying vine doctor". What we can learn is that we need more population: we should have more babies! However, if that is not possible, we should encourage the development of a local wine industry in these countries, because an indigenous industry helps the local people to develop a liking for wine, and they will then, in due course, buy more of our exports. In India the rich are developing "western" tastes and that includes taste for western-sty food and wine.

So what wines go best with curry?

None! ■

Upcoming Events

20-24 September 2005
9th ESITO
European Symposium for Insect Taste and Olfaction
Villasimius-Cagliari, Sardinia, Italy
Contact: amheart@unica.it
www.esito-symp.org

3-5 November 2005
Second Interdisciplinary and International Wine Conference
"Bacchus in Bourgogne"
Beaune-Dijon, Bourgogne, France.
Bacchusinbourgogne@escdijon.co
www.bacchusinbourgogne.com

12-16 November 2005
Society for Neuroscience
Washington DC
Info: www.sfn.org

17 November 2005
Australian Winegrape Conference
Mildura, Victoria
Contact: info@helenhealy.com

2-6 December 2005
AACSS on Heron Island
(Australian Great Barrier Reef)
Australasian Association for ChemoSensory Science
8th Annual Meeting
Accommodation:
Wendy.Burchmore@tq.com.au
Conference info: g.bell@atp.com.au
Program info:
john.prescott@jcu.edu.au

8-11 May 2006
Enviro 2006 Conference and Exhibition
Melbourne Exhibition & Convention Centre
Melbourne
Contact: Rosalind Vrettas,
Ph. +61 (0)3 9741 4679
rvquitz@bigpond.com

9-12 July 2006
39th AIFST Convention: "Festival of Food"
Adelaide Convention Centre
Adelaide, South Australia
Contact: aifst@aifst.asn.au

2-4 August 2006
8th Sensometrics Meeting: Imagine the Senses
Ås, Norway.
Contact: www.sensometric.org

21-25 October 2006
Society for Neuroscience
New Orleans
Info: www.sfn.org

October 2006
AACSS
Australasian Association for ChemoSensory Science
9th Annual Meeting
Adelaide, South Australia

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P.O. Box 488 Gladesville, NSW Australia 2111
Ph. (+61 2) 9209 4083 ; Fax (+61 2) 9209 4081

Production Team
Editor: Graham Bell, g.bell@atp.com.au
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