Fax From Hong Kong

by Graham Bell

My host switches off his mobile phone and reaches across the table to offer me some more fish. His Rolex glints beneath his immaculate Dior cuff. Times are tight, he's lost a lot of money in the past year. The Year of the Rabbit will have to be better or a lot of people in Hong Kong will start hurting.

We visit a new French supermarket. It bulges with imported high-value-added products. Red, white and blue is everywhere. Not much of the green and gold. We go to another supermarket called ParknShop. Bread and baked products greet me - but isn't this rice-eating China? No, it's cosmopolitan "Honkers". Every shelf is stuffed with Aussie competitors. Our products again are sadly under-represented, but our wine and meat are doing their bit to be seen. I talk to our client: shelf space costs are prohibitive and slow performers get wiped out even after paying the 'key money'. We talk to consumers and do some sensory research. The people are not familiar with our products. There's a long road ahead.

Back at the cash register the money keeps moving. I ask the waiter in an 'Irish Pub': "What Irish beers do you have?"

He looks blank - "I don't think we have any." He looks genuinely sorry.

I point to the Guinness coaster.

"Would you like a Guinness?" he says.

Who cares, a drink's a drink.

Impressions of Hong Kong:

People: LOTS of 'em. Slim figures. "Young." About 30 years old predominantly.

Food: New Supermarkets: Carrefour, ParknShop, Welcome. Bread in prominent position. Didn't see any minibakeries.

Thai is very popular. LOTS of Western-style processed food, but Australia is under-represented.

Economy: Prices high. Plenty of money flowing. Business people worried. Cautious optimism. Infrastructure very impressive.

Politics: From street level there is no visible sign of 'takeover' by China. New flag is everywhere. Main China flag is only very rarely on the odd building. People at ease generally, but worried about economic future.

Tourism: As many tourists as ever - all nations.

Lifestyle: High average. Still lots of people living in the old style. Mobile phones, designer clothes and high-price watches abound.

Coming up in ChemoSense

Coming Up in ChemoSense...

In November TheHOT TOPIC is CHILI

Wayne Silver reviews the trigeminal system

In February The POWER of PERFUME

Laurence Dryer on human ORs

Mimi Halpern on snake vomeronasals

Bets Rasmussen on elephant olfaction

...plus NEWS from around the world

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THE UNIVERSITY OF NEW SOUTH WALES

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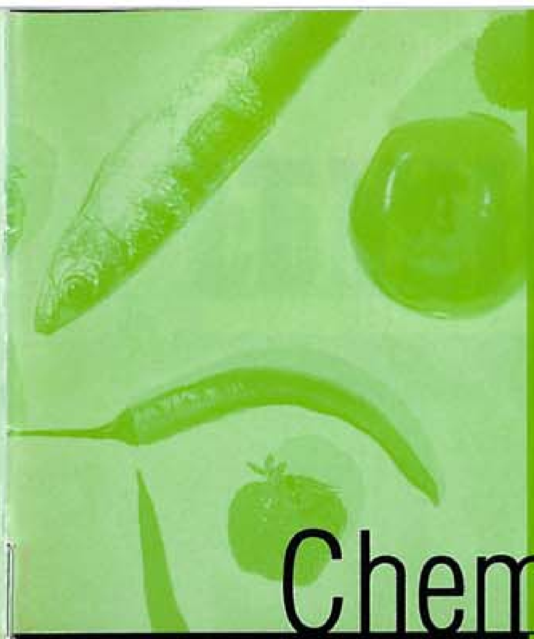

ChemoSense

Articles from World Leaders...

This issue: BUGS, RHYTHMS & FOOD QUALITY

Does time of day affect sensitivity to odours? Could it be that biological clocks are regulated by smell as much as by light? Insects comprise more than 70% of all animal species on earth, but this class of creatures does not usually spring to mind when we contemplate the sense of smell.

Stuart Dryer and colleagues from the University of Houston have just released their discovery of a circadian clock in insect olfaction. This research, just published in the journal Nature, is reviewed by them in our exclusive article. The implications of this study are far-reaching and should excite anyone interested the fruits of olfactory research.

Gert Stange of the Australian National University discusses how an increasing knowledge of the mechanics of smell in the moth could lead to advances in biosensor design. We have much to learn from the elegant way nature copes with tasks of great complexity.

On the topic of food quality in industry, we have an exclusive article from Annesley Watson of Arnotts Biscuits, Australia. Sensory science can have a lot to offer in terms of value, but is your company using it to its greatest advantage?

All of this, plus news and upcoming events in the world of the chemical senses.

Circadian Clocks Regulate Olfactory Responses

by Stuart E. Dryer, Balaji Krishnan and Paul E. Hardin
Department of Biology and Biochemistry and Biological Clocks Program, University of Houston

Olfaction, and associated sensory modalities such as the vomeronasal system, provides critical environmental information in nearly all animals. Olfactory cues allow animals to detect food, avoid predators, and recognise other members of the same species. Olfactory cues also allow many species to engage in specific social behaviours including reproductive ones.

The extent to which chemosensory cues regulate social behaviour in humans is unclear, in part because humans seem (at least on the surface) to be more attuned to visual stimuli and language.

Biological clocks

Most sensory systems exhibit various forms of desensitisation or adaptation, in which continued presentation of the sensory stimulus leads over time to a diminished sensory response. These processes have been extensively studied in both the visual and olfactory systems, and there are notable similarities between the two.

In visual systems, it has long been known that sensitivity to light can be regulated on very long time scales, specifically on the 24-hour scales associated with the normal terrestrial light-dark cycle. In many species, ranging from arthropods to mammals, this very long-term modulation of visual sensitivity is regulated by circadian clocks. Circadian clocks are biological oscillators, with periods of close to 24 hr (*circa dian*), that drive many behavioural, physiological and biochemical rhythms.

cont. pg 2

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INSIDE:
In our new 12-page format

CIRCADIAN RHYTHM continued

The defining feature of circadian clocks is that they continue to generate rhythmicity under constant conditions devoid of external time cues. Circadian clocks can be entrained by external timing cues such as ambient light-dark cycles, but they are not dependent on these cues for continued cycling.

As a general rule, visual systems exhibit an increase in light sensitivity during the night; in some species the difference in sensitivity can amount to orders of magnitude. These daily changes in sensitivity 'free-run', i.e. they continue in animals maintained in constant darkness.

Do circadian oscillators also regulate the olfactory system?

This is a reasonable question given the importance of olfaction to most animals, and the many molecular similarities between visual and olfactory transduction. Indeed, there have been reports that certain insects exhibit diurnal rhythms in olfactory sensitivity. A diurnal rhythm, as opposed to a circadian rhythm, refers to a change in sensitivity as a function of the time of day in animals maintained on normal light-dark (LD) cycles. However, it is important to note that not all diurnal rhythms are driven by circadian oscillators. Therefore, these types of experiments are not sufficient to demonstrate endogenous circadian control, which requires at a minimum that experiments also be done in constant-darkness (DD).

Evidence that chemosensory cells express circadian oscillators came from molecular studies in *Drosophila*. Circadian oscillators are comprised in part of genes whose protein products regulate their own transcription, with a delay of several hours. In *Drosophila*, key clock genes include period (*per*), timeless (*tim*), Clock (*dclk*), and Cycle (*Cyc*). Three of these, *per*, *tim*, and *dclk*, are rhythmically expressed, and null-mutations in the *per* and *tim* genes lead to behavioural arrhythmicity. Orthologs of all of these genes are present in mammals.

Steve Kay and his co-workers at the Scripps Institute engineered several lines of transgenic *Drosophila* in which a so-called reporter gene (encoding a light-emitting protein called luciferase) was placed under the control of the *per* gene promoter. In this way, it was possible to determine when and where *per* is normally expressed by simply monitoring luminescence. With this elegant system, circadian rhythms in *per* expression were observed in several tissues, including known 'clock' neurons in the brain, as well as in the antennae and other peripheral chemosensory cells.

Importantly, circadian rhythms in *per* expression persisted for several cycles in antennae that had been excised from the animal and cultured under constant conditions. These results indicate that the antennae contain the molecular components of a circadian oscillator, but they do not demonstrate if the oscillator is functional, i.e. connected to some measurable physiological output.

To address this question, we measured olfactory responses in *Drosophila* using an electrophysiological technique known as electroantennogram (EAG) recording. It is possible to make EAG recordings in the absence of visible light ensuring that circadian systems are not perturbed by visible light during the dark phases of LD cycles, or in animals free-running in DD.

We found that EAG responses in wild-type flies to two different odorants were highly rhythmic. Olfactory responses began to increase towards the end of the day, peaked towards the middle of the night, and returned to baseline before the end of the night. The odorants used in this study, ethyl acetate and benzaldehyde, evoke very different behavioural responses in *Drosophila*. Importantly, we observed identical patterns in flies maintained on LD cycles or on the second day of DD. In other words, the rhythms in olfactory responses free-run. Moreover, these circadian rhythms were not observed in flies bearing null-mutations in the *per* or *tim* genes.

cont. pg 3

Is the daily rhythm in olfactory responses dependent on central or peripheral circadian oscillators?

In order to address this question, we also performed experiments on a transgenic line of *Drosophila* in which *per* expression is limited to the brain. In these flies, *per* is not expressed in any peripheral tissues. These flies show circadian rhythms in locomotor activity. However, circadian rhythms in the olfactory responses to ethyl acetate were abolished. These results indicate that peripheral, and presumably antennal, circadian oscillators are necessary for circadian rhythms in olfactory responses. At this time, it is not known if circadian oscillators in the brain are also necessary, but they are clearly not sufficient.

One surprising feature of these results is that the largest olfactory responses were observed at times of day when the flies were relatively inactive. Why this should be the case is a matter of speculation. One possibility is that this time of peak response helps the animal optimise its foraging behaviour. According to this theory, a relatively low olfactory sensitivity during periods of high activity could prevent flies from expending excessive energy by moving towards faint odorant sources located too far away. In other words, it could prevent the animal from expending 500 calories to find food worth 100 calories.

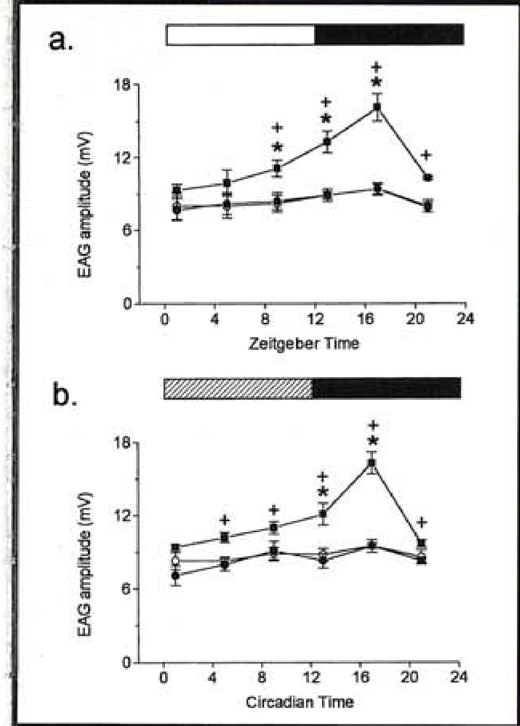

Figure legend

Circadian rhythms in olfactory responses to ethyl acetate, an odorant that to humans smells like banana. Drosophila are strongly attracted to this odorant. The ordinate shows mean electrophysiological responses in the antennae evoked by application of ethyl acetate at different times of day, shown on the abscissa. In graph a, the flies are maintained on a 12 hour-12 hour light-dark cycle. In graph b, the flies are maintained in constant darkness. Squares indicate wild-type flies. Note that the daily rhythms in olfactory responses persist in constant darkness, but are abolished in flies bearing null-mutations of the timeless (closed circle) and period (open circle) genes, which encoded essential components of circadian clocks. This figure is modified from Krishnan et al. (1999).

If circadian oscillators control olfactory responses, is the converse true? In other words, can olfactory stimuli entrain circadian oscillators?

The most powerful stimulus for entrainment of circadian oscillators is the environmental light-dark cycle. We are unaware of any reports of pure olfactory entrainment of circadian oscillators in any species, but we are currently pursuing this question in *Drosophila*. There are many reports of entrainment of behavioural rhythms by presentation of food, but this is a complex stimulus. The consumption of food could certainly lead to physiological responses that affect central oscillators (especially the main circadian oscillator of vertebrates, which is located in the hypothalamus). However, an olfactory component to this response is certainly possible. It should be noted that if olfactory stimuli can reset circadian clocks, it might suggest a strategy to ameliorate problems associated with trans-meridian travel, shift-work, and short photoperiods.

In summary, several lines of evidence converge to indicate that olfactory systems in insects are under the control of circadian clocks, and it is possible that olfactory systems in turn control circadian systems. These may prove to be phylogenetically widespread phenomena, and, at the very least, it indicates that time of day needs to be carefully considered in design and interpretation of biochemical, physiological, and psychophysical studies of olfaction.

Recommended reading

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2. Hardin, P. E. (1998). Activating inhibitors and inhibiting activators: A day in the life of a fly. Current Opinion in Neurobiology 8: 642-647.

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Vol 1. No.4. August 1999

DISCOVERING THE INSECT NOSE

By Gert Stange, PhD, Research School of Biological Sciences
Australian National University, Canberra

The insect olfactory sensillum excels in modular design, extreme compactness, high selectivity, as well as a sensitivity that approaches the theoretical limit. As more knowledge emerges about the inner mechanisms of an insect's 'sniffing' equipment, scientists are provided with hints for the design of new biosensors for airborne volatiles.

To anybody who has been plagued by mosquitoes or has chased away the flies from a barbecue it is obvious that insects do have a keen sense of smell. Insects can detect many thousands of olfactants relevant to feeding, oviposition or mating, ranging from butyric acid, geraniol and hexenal down to carbon dioxide and ammonia.

Insects of the same species communicate with each other via pheromones. Females of the polyphemus moth (1) release a sex attractant pheromone, a blend of E,Z-6,11-hexadecadienyl acetate and hexadecadienal, producing a scented plume that is carried by the wind and will attract males across a distance of 1 km. Male polyphemus moths carry conspicuous antennae with a large surface area (2). The detection mechanism of the male is not only highly sensitive, but also highly specific to the female of the same species, and even minimal modifications to the pheromone composition render it inactive.

In the last century, the idea that the sense of olfaction in insects is located on the antennae gave rise to a long-lasting and acrimonious debate among scientists.

Where is the nose?

In the last century, the idea that the sense of olfaction in insects is located on the antennae gave rise to a long-lasting and acrimonious debate among scientists. The opponents argued that a nose must be wet in order to function. Antennae are obviously not wet, at least not on the outside; indeed they would dry out rapidly if they were not covered entirely by moisture-impermeable chitin.

Nowadays, we know that organisms ranging from bacteria to vertebrates detect odorants using chemosensitive receptor molecules that are embedded in cell membranes. We also know that there is always an evolutionary conservation, necessary to their function, of an aqueous layer covering the receptors.

How then is this conservation achieved in insects, which do not live in water in the first place, and cannot afford to continuously humidify an olfactory mucosa like we do?

Olfactory sensilla

The chitinous exoskeleton (cuticula) of insects is produced, during development, by the layer of epidermal cells that covers the entire body surface. Certain epidermal cells secrete cuticular structures that usually have the shapes of hollow hairs or pegs. A few of the epidermal cells below each structure differentiate into bipolar sensory neurons. These neurons consist of the distal dendrite (which carries the sensory receptor molecules), the cell body, and the proximal axon (which connects to the central nervous system). The combination of specialised epidermal cells and cuticular structures is known as a sensillum. (See figure.)

In insects and other arthropods all sensory modalities except vision are mediated by sensilla. The 50,000 pheromone-sensitive sensilla on the antennae of male polyphemus moths are each punctured by about 36,000 pores. As the pores are very fine (about 10 nm in diameter), they have little effect on the mechanical strength of the cuticle; on the other hand, as there

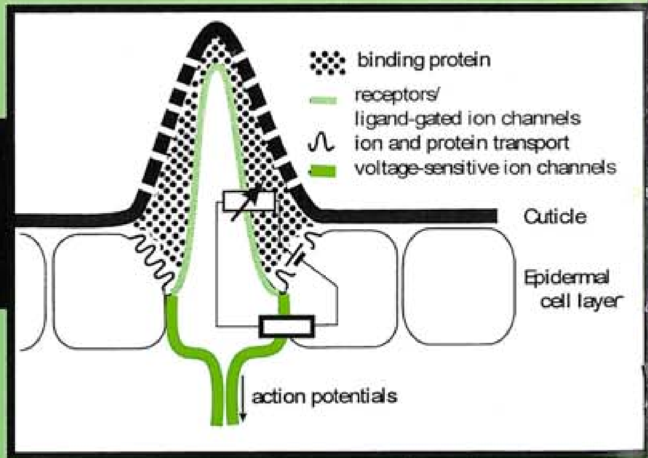

Diagram of an insect olfactory sensillum

are very many pores, odorant molecules can easily penetrate the hair wall and enter the interior.

Each pore is plugged with a material of unknown composition that is impermeable to water but does not limit the entry of odour molecules. Thus, drying out is prevented, meeting an essential prerequisite for the functioning of any wet-membrane based sensor.

Transporting olfactants

An odour molecule that has reached the inside of the sensillum wall is still separated from the dendrite cell membrane by a gap.

cont. pg 5

The gap is filled with sensillum lymph, an aqueous phase that is analogous to the nasal mucus in vertebrates.

The water solubility of many odorants is negligible, meaning that they cannot cross the lymph without a specific transport mechanism. Similar to the nasal mucus in vertebrates, insect olfactory sensilla contain high concentrations of soluble proteins, known as odorant-binding proteins (OBPs). The pheromone- binding protein (PBP) found in pheromone-detecting sensilla of the polyphemus moth has a molecular weight of 15,000 and occurs in a remarkably high concentration of 150 g L^{-1}.

Its presence in such a high concentration suggests that the PBP is of major functional importance, and three possible functions have been suggested: (1) transport of odorant toward the receptor sites in the cell membrane, (2) inactivation of the odorant after it has interacted with the receptor site, (3) active participation in odour discrimination, as a filter for odorants, prior to the receptor activation.

Modelling an insect's nose

It seems contradictory at first that a single PBP could fulfil both the functions of encouraging odorants to bind to receptors, and then inactivating them. However, an odour molecule cannot escape once it has entered a sensillum, and without an 'unbinding' mechanism the receptors would soon all become occupied, with the result that the system would become permanently desensitised. Experiments show that this does not happen. Therefore, there must be a powerful early inactivation mechanism that sequesters an odour molecule once it has interacted with a receptor site.

On the basis of in vitro experiments, scientists at the Max Planck Institute (3) recently formulated the following model that is remarkably consistent and reconciles this apparent contradiction:

Experimental evidence has shown that the PBP exists in a reduced and an oxidised form. A pheromone molecule that has entered the sensillum is sequestered by reduced PBP. The resulting complex eventually comes into contact with a receptor molecule in the cell membrane. The contact causes the receptor molecule to undergo a conformation change that triggers a transduction cascade, resulting in the opening of ion channels, and at the same time, the contact leads to the oxidation of the PBP, rendering the PBP/pheromone complex inactive. The receptor molecule then returns to its native state, accompanied by closure of ion channels.

Thus, the PBP acts both as a carrier and an inactivator, albeit in two different forms. Its occurrence in a high concentration means that it can act as a buffer for a large amount of pheromone, possibly enough to last an insect's lifetime, and that the ultimate disposal of pheromone molecules by enzymatic degradation can occur at a slow rate or be absent altogether.

This leaves the question of whether the PBP also actively participates in odour discrimination. Both compounds of the sex attractant pheromone have the same side chain, suggesting that this is what the PBP binds to. Pheromone sensilla of the polyphemus moth usually contain two receptor dendrites, one responding to the acetate and one to the aldehyde component of the pheromone.

According to this, the PBP does not participate in discrimination between the two pheromone components of the polyphemus moth, but it discriminates against the pheromones of other species that carry different side chains. Thus, the discrimination task is achieved in a two-stage process, whereby the PBP recognises the side chain and the membrane-bound receptors discriminate between different functional groups.

Towards new biosensors

In this way a consistent functional model of the insect olfactory sensillum is emerging, making reverse-engineering it a feasible option. It must be emphasised that the present description is simplified and that many details remain to be worked out. However, inexpensive arrays of biosensors that mimic the specifications of the insect nose could find applications in many diverse fields such as the grading of coffee with single bean resolution, the detection of emanations from buried explosives in land mines, and the diagnosis of diseases by identifying volatiles in breath.

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Vol 1. No.4. August 1999

Getting Value from Sensory Research in the Food Industry

By Annesley Watson, Arnotts Biscuits, Sydney

Häagen-Dazs in Japan – competing successfully in the global market by knowing consumers.

What is value?

To address the issue of the value of sensory science in the food industry, it is really first necessary to define what we mean by 'value'.

The value of any process or activity in an industry is usually ultimately measured in terms of the dollar ratio of the cost of development and operation to the potential profit. The time it takes to generate those profits is another important consideration. A forecast of these factors is the basis for most of the investments companies make.

Key processes or activities that can benefit or favourably drive the cost/profit ratio include: MINIMISING production costs, new product development time and risk of failure in new product release (that is, maximising consumer expectation match); and MAXIMISING product quality consistency and competitive position.

Can sensory science contribute to these processes?

There is no doubt that the application of appropriate sensory methodologies in each of those areas can and does contribute positively. For example, minimisation of costs is a constant process for all food manufacturers. Whether cost reduction is achieved by a change in ingredients or in processing methods, sensory science can contribute by minimising the risk of this alteration being consumer-detectable.

The sensory tool used to measure the risk in cost reduction activities is usually some form of difference testing. Sensory research has provided us with a wide range of difference testing tools, each of which is suited to certain situations. We look to sensory research to continue to increase and refine our set of tools for this and other purposes. This requires investment. Investment will be made if the buyer is convinced of its value. Which brings us back to where we began!

General Ideas of Value Adding

Let's step back a little and have a look at the broad areas in which sensory science can be active in the food industry. There are really only two broad areas if you take a grand view. They are:

1. Quality monitoring and maintenance and
2. Product development

Quality monitoring and maintenance will involve sensory activities that contribute to such things as specification development, quality assurance, quality control, quality auditing and problem resolution or trouble shooting. Many food companies may only be active with sensory testing in the last item on the list, others will have decreasing activity going up the list. High activity is seen in problem solving as it is usually a 'must do' in order to maintain production or sales - an immediate benefit.

Few companies will have high activity in sensory specification generation. The reason generally given for this is in the cost of the process. Where high involvement in the more expensive sensory activities in quality monitoring and maintenance is seen, senior management has been convinced of the long-term value. They have also been convinced of the flow-on in the greater effectiveness (and value) of the routine quality management activities when good sensory specifications have been developed.

Using sensory science earlier

In product development a range of sensory activities can occur: from in-house product testing for such things as differences and shelf life, to consumer testing in focus groups, central location tests or in-home tests for hedonic responses, purchase intent and feedback on product optimisation.

Often food companies will spend vast sums on consumer testing going through repeated cycles of testing at the very end of the development process, only to go to market with a product that might not be optimal and may have high failure risk attached.

As a sensory scientist I find it interesting that such large sums of money can be spent at the end of the process. If more investment could be made in the initial sensory activities of the development ensuring that the developers have understood consumer needs and expectations and interpreted them appropriately in the sensory attributes of the new product, less funds need be spent at the end.

The last process of consumer testing in product development should be regarded as a confirmatory step not a development step. If the heavy end process expenditure is occurring, there has been a failure to convince senior management of the value (in terms of the key activities noted earlier) of increased early sensory activity in the development process.

The future

Sensory scientists working within the food industry look to sensory researchers to help to communicate the value of sensory tools and services. This is the case for the two broad areas just discussed, where benefits can be clear and immediate, and it is also the case where benefits can be more long term. But there is a long list of issues that sensory scientists working in the food industry see as hindering the effective application of sensory science. A few of these include:

Sensory Methodology where there is a need for constant review and education about method usage and application What testing should be carried out in-house and what is most appropriately handed on to consultants?

Drivers of consumer liking and choice where key questions are: What determines the acceptability and palatability of specific foods? What role do smell, taste and pungency and their interactions have? What is the role of texture? What specific sensory drivers are there? How do consumer behavioural issues impact?

Designing products for different markets Sensory scientists are pushed in these times of globalisation to assist in the design of products for markets that are no longer limited to national borders. There is high risk involved in not taking into account an understanding of market variations in sensory expectations.

Is there value in sensory research?

To repeat what was stated previously: Any process or activity will only be invested in if it can demonstrate a value to the business. This is so fundamental it seems trite, but it's basically the only way that changes are made or that the introduction of anything new occurs.

My assessment is that the value of sensory science to the food industry is great. The generally perceived value, however, is reflected by the level of sensory activity in each company, which varies considerably. I believe that sensory science and research are not contributing as much as they can to the development of the food industry in Australia. In order to change that, we, food industry sensory scientists and researchers, need to continue to communicate in an even more frequent and focused way. It is my belief that real advancements are begun when individuals come together. Through personal interaction the germ of a new idea or a new approach to an old problem can be generated.

About the author: Annesley Watson graduated in 1975 with an honours degree in Food Science and Technology form the University of New South Wales, Sydney, Australia. Since then she has divided her time almost equally between teaching sensory science and practising it in the food industry. She is currently the sensory analyst for the major Australian baking industry member, Arnotts Biscuits, which is a part of Campbell Soup Company Group.

news from the CCR

Centre for ChemoSensory Research

TRAVELS IN ASIA AND BEYOND

So far this year we have travelled to Singapore, Hong Kong, Indonesia, Japan, the UK and the USA, pursuing research interests and consultancy work. For information about upcoming opportunities to join us in our sensory research in overseas markets, **contact Marilyn Styles on (02) 9209 4086.**

OUR RESEARCH INTERESTS GROW ...

Training of an expert tasting panel has begun at the CCR, and we will soon be able to offer their services for the investigation of off-flavours, the description of subtle flavour and texture characteristics, and general quality assurance.

In response to growing interest in the food industry the CCR is also now heavily involved in research on functional ingredients for common foods.

CENTRE HOSTS ART SHOW

Visitors to our Sydney Centre have admired the paintings and prints on display, by Australian artist Pamela Griffith. Recently Pamela's work was exhibited at The National Gallery in Canberra and was opened by the Governor General Sir William Deane.

Late in 1999 the Centre is to be honoured with an exhibition of some of Pamela's most 'sensory' works. Sales will benefit research into the chemical senses. To guarantee an invitation please call **Marilyn Styles on 9209 4086.**

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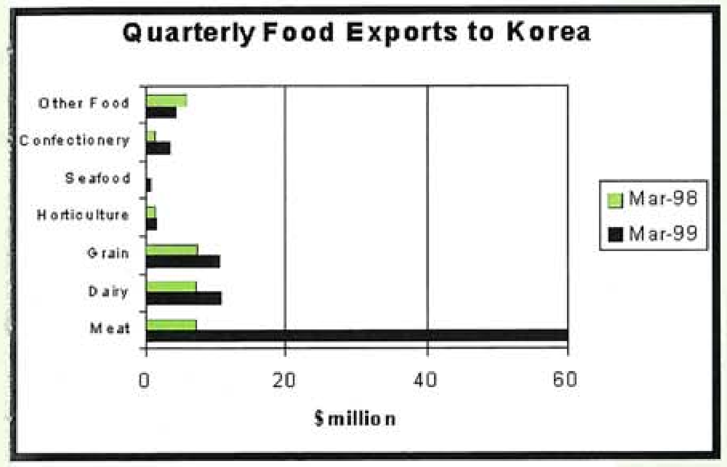
ASIAN UPDATE - KOREA REBUILDS



In the November 1998 issue of ChemoSense BIS Shrapnel provided a forecast of recovery for the key countries of Asia, indicating that 1999 would bring the beginning of economic re-growth for the troubled region.

These predictions were borne out with the release of a report by the Supermarket to Asia Council in March this year, outlining signs of recovery in three of Australia's top four food export destinations in Asia. Detailed analyses of the political, economic and social changes occurring in The Republic of Korea, Malaysia and Indonesia show that the outlook for Australian food exporters to these countries is very encouraging over the next three to five years.

Jim Kennedy, Supermarket to Asia executive director says "It is up to Australian food companies to secure market position now for the anticipated improvements in the medium to long term."

The Centre for ChemoSensory Research has been following the situation in Korea closely as we have an established capacity to perform sensory research there. In the November 1998 issue of ChemoSense we affirmed our belief that Australian companies should not give up on this market.

The East Asia Analytical Unit (EAAU) of the Australian Department of Foreign Affairs and Trade has recently released a publication entitled "Korea Rebuilds, from Crisis to Opportunity". The report shows that the reforms implemented by the Korean administration during 1998 have paid off as the Korean economy is expected to grow from 2 to 4 percent in 1999, from 4 to 5 percent in 2000 and 6 percent in following years. This is after experiencing a contraction of 5.8 percent in 1998.

The EAAU also reports that "In the medium term, as the economy recovers and non-tariff barriers decline, there are good prospects for Australian exporters of processed food and beverages..."

Figures from the Australian Bureau of Statistics reported by Supermarket to Asia in May this year compare Australian food export trends to Asia in the March quarter 1999 to the March quarter of the previous years. The statistics are very encouraging, showing a growth of exports in many cases to levels above pre-crisis ones.

While food exports to The Republic of Korea fell by 46% (from $58m to $28m) during the March 1998 quarter, they rose by 221.2% (to over $90m) during the March 1999 quarter. This is 80.9% greater than the level of exports recorded for the March 1997 quarter.

Clearly, great opportunities exist for companies wanting to break into the Korean market. The overriding message from the EAAU is an optimistic one:

"The immediate post crisis period (1999 and 2000) presents an historic chance to acquire reasonably priced corporate assets and achieve a foothold in Korean and North East Asian markets; Australian firms should ensure they do not miss this window of opportunity."

In the NEWS

Fragrant toxins ...

Man-made fragrances permeate every aspect of modern life, from the cosmetics we wear to the garbage bin liners we use. As consumers have come to expect pleasantly perfumed products, researchers have worked on creating more robust smells. The problem is that synthetic odour molecules are turning up where they shouldn't be: in the environment and accumulating in human and animal tissue.

A July report commissioned by The World Wide Fund for Nature has listed over 350 contaminants in human breast milk. (The executive summary of the report "Chemical Trespass: A Toxic Legacy" can be downloaded from http://www.wwf-uk.org). Appearing on the list, along with the usual suspects like pesticide residues and heavy metals, were compounds commonly used within the fragrance industry. Synthetic musks, benzophenone, and octyl methoxy cinnamic acid, are used as fragrances in cosmetics, detergents, soaps, shampoos and sunscreens, and also have suspected carcinogenic, neurotoxic, mutagenic or endocrine disrupting properties.

Concerns raised about the toxicity of some fragrancing chemicals has been an issue for the fragrance industry for some time now. The safety of these materials is monitored by the industry itself. The Research Institute for Fragrance Materials (RIFM) and the International Fragrance Research Association (IFRA) collect and evaluate toxicological data concerning fragrance chemicals. For information about their roles, see **http://pw1.netcom.com/~bcb56/RIFM.htm.** Public awareness is also on the increase as many people experience health problems linked to household chemicals (see the Fragranced Products Information Network **http://www.ameliaww.com /fpin/fpin.htm**).

Not natural, but ...

Until the late 1800s perfumes were derived from natural sources, with musks coming from whales, musk deer, civet cats, muskrats and other animals. Arguably the most famous perfume of all is Chanel No. 5. First sold in 1921, it was the first perfume to use significant amounts of synthetic aldehydes, although natural materials still dominated the formula.

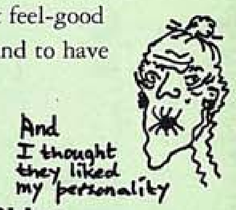
Harking back to the animalistic origins of perfume, trappers in British Columbia in Canada have recently used Chanel No. 5 to lure wild lynx into traps in order to relocate them to the Rocky Mountains of Colorado where they have almost been wiped out (The Daily Telegraph (UK) 10/2/99). Users of Chanel No. 5 should be reassured by this demonstration of the scent's appeal.

Sniff a granny ...

Forget patchouli oil and lavender, in an interesting twist to the whole idea of mood-altering smells (see 'Smell and Mood', ChemoSense, Nov 1998) researchers at Monell Chemical Senses Centre in Philadelphia have found that the smell of an old lady is more uplifting than that of a child.

Body odour samples taken from subjects in their seventies were found to have a positive effect on the mood of volunteer sniffers, with elderly women producing the most feel-good odour. The body odour of small children was found to have little effect on volunteers.

(New Scientist, July 3rd, 1999)



What People are Tasting in ... China

At the Baked Pig Face restaurant in Beijing they serve, well, baked pig faces for a start. Diners pay $17 for the whole head of a pig which is baked for 12 hours in 30 herbs and spices. The restaurant chain's founder has patented this dish along with his special recipes for baked pork rinds and, you guessed it, roast ox penis.

At Scorpion King, another chain growing in Beijing, diners line up to buy fried scorpions garnished with ants.

Surveys have shown that while Western food outlets like KFC and McDonald's are doing extremely well in China, around two thirds of city-dwellers prefer to dine on Chinese-style fast food.

(Sydney Morning Herald, 22/6/99)

Bad Taste Beer

Good news! Scientists in Belgium have identified the chemical that causes the off flavour of alcohol-free beer.

The compound 3-methylthiopropionaldehyde, or methional for short, is usually broken down by fermentation or masked by other flavours in full-strength beer.

This piece of detective work was carried out using a gas chromatograph to separate the chemical components of alcohol-free beer, full-strength beer and "wort" (which is beer before yeast has been added and fermentation has taken place). A team of human sniffers was then used to smell each compound individually. Mass spectrometry was used to identify the foul-smelling methional.

Hopefully this is a step towards producing more palatable no-alcohol drinks.

(New Scientist, 12 June 1999)

Upcoming Events

Australia, 1999

Aug. 18	Aromatherapy: Towards a Scientific Explanation, presented by Christine Broughan from Coventry University, The Centre For ChemoSensory Research, Australian Technology Park. Contact: Marilyn Styles, (02) 9209 4086, Email: m.styles@unsw.edu.au
Aug. 30-31	Australian Food Congress, Sydney Convention and Exhibition Centre For more information: www.ausexhibit.com.au/food
Oct 6	Annual Meeting of the Australasian Association for ChemoSensory Science (AACSS), Garvan Institute, Sydney. For more information contact John Prescott (John.Prescott@stonebow.otago.ac.nz) or Anne Cunningham (a.cunningham@garvan.unsw.edu.au)
Oct. 3-8	10th World Congress of Food Science & Technology, Sydney Convention Centre, Darling Harbour. Contact: Ph: (02) 9241 1478. Email: exhibition@icmaust.com.au
Dec 5-7	Advanced Australian Fare: The Future of Food-Related Innovation, Sydney For more information: http//www.foodscience.afisc.csiro.au

International Events, 1999

Sept. 23-24	European Sensory Network Symposium, "Successful Food Product Marketing to the European Consumer", Sala Giunta - Confindustria, Rome, Italy, Contact: Mrs Stefania Sabatini, Email: cosmondial@publime-dianet.it
Oct. 3-7	23rd World Congress of the Int'l. Society for Fat Research, Brighton, England, Contact ISF Secretariat, Fax 217-351-8091; Email:meetings@aocs.org.
Nov. 29-Dec. 3	Chemosensory Bioresponses in Man II. ECRO-Mini-Symposium, Held in conjunction with the Annual Meeting of the Workgroup Olfaction and Taste of the German Society of Oto-Rhino-Laryngology (Dec 3-4), Erlangen, Bavaria, Germany, Internet: http://chemicalsenses.uni-erlan-gen.de

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