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ChemoSense

EDITORIAL

The Air We Breathe

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An old joke has it that because air is free certain people have big noses. Air is no longer free, and it is coming at an increasing price. In his lead-article to this issue, Jim Walker of Florida State University's Sensory Research Institute draws attention to a cost to the USA of between $10-100 Billion a year from the effects of breathing unclean air. Add to this the cost of actively cleaning up, cooling, warming, humidifying and dehumidifying air in buildings, cars, factories, mines, road and railway systems, subways and tunnels. Some entire states, such as Florida, have been economically transformed because air-conditioning made it comfortable for people to live and work there. Globally, the air industry is worth Trillions.

Outside of man-made structures, air is also no longer free. Towns and cities are wafted with unwelcome airborne pollutants and even whole regions of the world, such as South East Asia, have experienced harmful and annoying pollution of their outdoor air. Smoke, recently caused by bushfires in Indonesia, grounded air traffic, and brought

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Odor as an Environmental Impact

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For at least the past 25-30 years, there has been increasing public concern about acute or short-term effects of airborne environmental chemical pollution. To some, all chemical pollution is a threat to human health while others assert that complaints of chemical exposures are largely a reflection of psychological problems on the part of the complainant. In the middle ground, however, one finds many instances where clear diminution in health or quality of life ensues from exposure to indoor or outdoor pollutants. Lest one think this is purely academic, it should be noted that a recent and very credible estimate of the annual cost in the US of the outcomes of inadequate indoor air quality was 10-100 billion US$. Effects included in this estimate are impacts on information processing speed, headache and psychological state or mood. (Fisk and Rosenfeld, 1997).

This paper aims to *show the importance of odor as a response* to short-term chemical exposure; *explain how and why research has contributed so little* to the understanding and amelioration of odor-related pollution issues; *describe some of the consequences* of the relative lack of engagement of academic olfactory experts in this real-world area; and *suggest remedial actions* for understanding and using odor as an environmental impact in everyday life.

Pollution often smells

Odor is the most frequently reported effect of indoor or outdoor air pollution. Building occupants may complain of the odor resulting from smoke, carpets, paint or cooking. Suburban residents may report that, whether inside their home or outside, they are annoyed by odors from sources such as factories, excavations, water

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The Air We Breathe, continued

many cities in the region, e.g. Singapore, Jakarta and Kuala Lumpur to a near standstill.

Airborne pollution takes many forms including photochemical, gaseous and particulate. It can be deadly and undetectable to the human, such as carbon monoxide, but mostly it is accompanied by a smell sensation. Growing community disquiet about odour in air is driving the authorities and the polluters to seek ways of measuring these problems.

Unfortunately, our knowledge of odour is lacking in breadth and depth and what good information is available is being largely ignored by virtually everyone concerned. It is time for chemosensory scientists to assert their skills to create the knowledge that is needed, and to be involved directly in air issues. It is also time for the people concerned to start paying for the research that is needed. The alternative is for airborne pollution costs to continue to grow, while real solutions take longer and cost more to achieve ■

Odor as an Enviro

treatment plants and agriculture. Despite the regulations, lawsuits, political debate and government-sponsored conferences, extraordinarily little effort and investment is put into understanding the problem.

What has this to do with chemosensory science? To the degree that human perceptions of odor is a driving force in these complaints, the answer is "a great deal". Consider the following:

1. It is regrettably common to find that those responsible for the sources of pollutants and those that deal with odor complaints typically exhibit little knowledge or interest concerning human responses to odor. Worse still, both groups often appear to value sound data and methodology less than evidence that it is easy to make critical mistakes in the design and execution of odor measurement studies. Instances where odor detectability or aversiveness is altered (or even wholly accounted for) by mass hysteria, depression or stress are often recounted, but not to show the need for more careful research.

2. Similarly, decision-making concerning odor pollution is not optimally informed by scientific data in the area of cognitive bias. Dalton (1996) and Distel and Hudson (2001) have shown that people respond differently to an odor stimulus, in terms of its intensity and its aversiveness, depending in part on what they have been told about the stimulus, or how familiar the odor is to them. The establishment of standard measurements of odor pollution must incorporate what is known about human response biases to odor if they are to become useful and credible standards. For example, we need to know how long response biases persist and under what conditions they occur. Can cognitive bias be manipulated, and if so can manipulations be resisted? Ideally the variable of cognitive bias will eventually be integrated into comprehensive models that incorporate at least most of the variables known to affect odor responses. In this way, the relative importance of this variable, and its persistence over time, can be determined.

3. Unfortunately for those addressing environmental odor problems, the literature in this area is spread over many journals and decades, deals with quite narrow questions in highly controlled settings and offers no actionable principles not available elsewhere. Topics seem to be vigorously studied for periods of a decade or so and then set aside without clear-cut resolution. The few practitioners with the temerity to wade into this area depart with no real answers and little or no guidance as to how applied odor research would be most effectively conducted. An agricultural engineer, for example, may seek answers to open-ended questions, such as: "Does transport of

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odorous molecules on particles help account for the intensity of hog farm odor?"; "How do different chemicals combine to give a given odor strength?"; "If hog farm odor is described as 1000 times threshold, will it be about the same strength as another smell that is the same multiple above threshold?"; "Is the odor really too strong or do the complainants just hate it at any strength (because I, the modern pork producer, have become 'the enemy')?" The literature, at the moment, offers little help for these questions. Even more astounding and frustrating for the novice is the fact that there is not agreement on such fundamental questions as the odor threshold concentration for a variety of common compounds or the most valid method for determining threshold.

4. Given the lack of solid data and consensus on methods from the odor research community, the demand from policy-makers for some kind of basis for decisions has led to a number of operations and standards and definitions that have only a thin veneer of validity. Perhaps the two best examples in this regard are the *olf-decipol* approach of Fanger and colleagues (e.g., Bluyssen and Fanger, 1991) and the CEN draft standard titled "Air Quality-Determination of Odour Concentration by Dynamic Olfactometry" (European Committee for Standardisation, 1997).

Enter, and exit, the olf

The *olf* was originally offered as a unit of measurement 13 years ago (Fanger, 1988), based on a study of the responses of 168 observers to the bioeffluents of over 1000 individuals, and it denotes the pollution load of a single individual. To take into account the effect of dilution of these bioeffluents, the decipol unit was created

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Electronic Noses and Electronic Tongues

Screening tools for simplifying Quality Control in food, beverage and pharmaceutical industries

One of the key benefits of our instrumentation (E-nose and E-tongue technologies) is that it allows sensory quality of food ingredients like edible oils, starch and derivatives, flavors and finished products to be monitored easily and cost effectively to ensure excellent quality consistency over manufacturing plants and batches of production. The implementation would lead to reduction in product recalls, re-processing and also ensure that sub-standard raw materials are not used..

The New αGemini Electronic Nose provides an automated olfactory fingerprint analysis in less than 5 minutes per sample. This instrument specializes in making a direct VOC measurement comparing product conformity of an unknown sample to a gold standard. The user friendly software produces Statistical Process/Quality Control (SPC/SQC) data to monitor process/product quality variability and the quick training phase (less than 1 hour) allows rapid implementation of the system by untrained personal. (Figure 1).

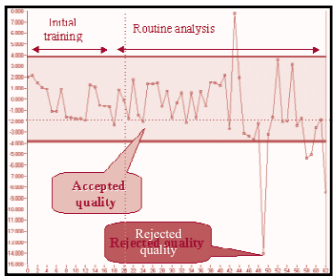

Figure 1: Statistical Quality Control Chart showing the initial training step of the quality variability followed by the analysis of unknown batches.

In pharmaceutical industry, electronic noses provides valuable insides into:

- chemical stability
- degradation processes
- quality control or raw materials
- process control
- effluent control
- changes in product flavor

After several years of research, Alpha M.O.S has just introduced our new aASTREE Electronic Tongue instrument for liquid and taste analysis. Taste formulations of paediatric drugs are made easier by our new αASTREE Electronic Tongue. A high throughput of measurements are made objectively without problems of fatigue and subjectivity. Neither will there be problems of availability of panellist or convincing your panel that the formulations are not that bad. The αASTREE with a 16 position autosampler allows fast comparison to standard references to give bitterness indications. The instrument allows your taste panel to be used more sparingly and more efficiently on the αASTREE 'selected samples'. This helps reduce the work load of these very important panellist to concentrate on their main responsibilities.

The αASTREE is very versatile and with a different set of 7 optimised liquid sensors for beer allows the αASTREE to quantify beer by Bitterness Units (BU), identify off-taste and off-flavours like soapy or detergent like, cardboard and DMS. No sample preparation or de-carbonation of the beer is required. The αASTREE system can be configured for taste formulations in pharmaceutical, beer, soda and soft drinks applications easily. These applications are covered by our full range of sensors that are available for each application. These sensors and the easy to use pattern recognition software are proprietary technologies of Alpha MOS SA. The αASTREE can also be configured easily for R&D and QC/QA applications. Once a training phase has been completed for each application, the instrument can be configured to give simple answers for production staff or help R&D screen formulations for most promising mixtures.

In summary, electronic noses and tongues can be used routinely to give objective and reliable answers in a few minutes in a variety of applications at the manufacturing plant.

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Trial by Odour

Evaluation of five types of cat litter by e-nose, expert panel and in-home placement.

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Pet owners are increasingly under pressure to keep their pets and their homes in good odour. Dog owners must scoop the poop on pain of fines from the Local Council Ranger and cat owners may soon find moggie-dearest has to be bailed out of jail, if not gone forever, for destroying the Australian native flora and fauna, or the neighbour's chickens.

Against this pressure comes an opposing force in the form of evidence that pets are good for people: they give unconditional love to young and old alike and are a positive influence against social breakdown in families and companionship against loneliness and depression in individuals.

To derive the benefits of having a cat as a pet, it is becoming necessary to keep the cat indoors at night and to provide litter for its evacuative needs. But which litter? Several kinds are offered on the market, made from minerals, clay, compressed waste paper and recently, rice husk. Which litter will "last longest" or to put it plainly, stink the least?

Odour trial

The Centre was engaged by the manufacturers of rice husk litter to evaluate the relative merits of two forms of their product (fine and coarse) and three competitor products: one made from zeolite, one from clay and one from paper. The main concern was how long the products would last, in use, before the smell became objectionable to the pet's owners. Does one form of material retain odour better than others?

The five types of litter were evaluated before and after cat usage in three ways: by an electronic nose device (e-nose), by a small panel of five trained humans ("the experts") and by 25 consumers who normally buy cat litter (in-home placement).

In the latter case, all five products were assessed, blind-coded, in randomised order, over a five week period. The pet owner rated the products initially for odour strength, odour unpleasantness, freshness and ease of pouring. The cat was then allowed to use the litter as it normally would and the owner recorded how many days it took for the litter to become objectionable and to require changing. At that point they rated the odour strength, unpleasantness, urine, faeces and ammonia odours as well as freshness and ease of cleaning.

The experts and the e-nose had slightly different tasks, but more fun. They received samples of clean and used samples (produced over 1 to 5 days of use by a group of cats) and were required to sniff the headspace of blind-coded jars containing the samples. The experts rated the samples for odour strength, unpleasantness, urine and faecal notes, ammonia strength and overall freshness. A parallel set of samples were analysed by an 8-sensor "e-nose" array.

In-home results

Despite claims on the packages, the products were used for the same number of days: 4 to 5 days. However, some products were considered clearly superior to others and one (zeolite) was unacceptably stinky from day 2, yet was changed on day 4 or 5. People will tolerate a stinky cat litter box. The rice husk products had a faintly unpleasant (organic) smell initially, but had significantly lower odour strength and unpleasantness ratings after use. Paper and rice husk products had highest freshness ratings after use and lower rating for faecal and urinous odours than the mineral and clay products. Ratings of ammonia intensity did not differentiate the products.

Expert and e-noses

The experts found the task quite onerous after a couple of days and stopped the ratings after three. The e-nose suffered a kind of "burn-out: it could not differentiate the strong odours from each other even one day after use, so the e-nose was of little value in these conditions. It may be of further use in studying the adsorption of odours to particles of the material but this will have to be done in a lab experiment using more dilute samples.

Expert assessment confirmed rice husk as the least unpleasant smelling material after cat usage. Paper and rice husk had lower urine, faecal and ammonia notes than did the mineral and clay products over three days. The fine version of the rice husk product actually increased in freshness rating between days 2 and 3.

Ecological advantage of litter made from rice husk

As a result of this research, the client went on to increase investment in machinery to produce the finer of the two products. It repositioned its product both as an effective cat litter and one which confers ecological advantage, being a natural by-product of the rice industry and fully biodegradable.

Acceptable forms of disposal of cat litter will probably become the next issue in the urbanisation of the feline species.

Acknowledgement

Client: Coprice Feeds, P O Box 561, Leeton, NSW, Australia 2705 ■

Meet CCFRA

Campden & Chorleywood Food Research Association Group (CCFRA) - a world class scientific and technical resource for the food supply chain

Chipping Campden is a typical example of a beautiful Cotswold town with 'chocolate box' thatched cottages and ancient stone buildings. Tourists visit Campden throughout the year to admire the scenery and enjoy the pubs and teashops, unaware that less than a mile from the centre of this historic town is the largest membership based food research organisation in the world.

CCFRA has a long history, established on the site at Chipping Campden in 1919 to conduct research into the canning of fruits and vegetables as part of the University of Bristol. Many changes have taken place over the past 80 years, broadly developing our expertise in all areas of the agri-food industry, and providing practical scientific and technical services. Most recently, merger with the Flour Milling and Baking Research Association at Chorleywood, and the establishment of a new site in Budapest, Hungary has created a Group business with around 400 staff, and enabled long-term investment in buildings and equipment to provide state-of-the-art facilities for staff across all disciplines.

The Research Association is independent and owned by its member companies. Our activities are guided by panels and committees made up from industry representatives of 1500 member companies. Members have a direct influence on the research conducted, providing guidance and focus to our programme of applied research funded through their subscriptions. Further funding for research from Government, European Union and other research budgets provides a comprehensive research base on which our contract and training services are built. Staff at CCFRA are particularly recognised for their practical approach to problem solving, and acting as the 'bridge' between academic research and the practical needs of industry.

Department of Consumer & Sensory Sciences

With 36 members of staff, the Department of Consumer & Sensory Sciences is certainly the largest group in the UK dedicated to the development of sensory and consumer research methods and their application in industry. We employ scientists recognised world-wide for their continuing contribution to the science, and many sensory and consumer scientists working in academia or industry in Europe have worked alongside us, either as ex-employees, as research collaborators, through training at CCFRA or as customers of our contact services. In 2001, the Department moved into extensive new facilities for sensory and consumer research, which includes 20 computerised tasting booths, commercial style preparation facilities, quality assessment laboratory, panel training room, sample preparation laboratory and domestic-style kitchen.

The work of the Department is divided into four sections: Market & Consumer Insights, Sensory Services, Data & Support Services and Sensory & Consumer Research. Each has its own specific activities, but all sections work together as an integrated team to provide maximum synergy and use of resources for the benefit of client companies.

Market & Consumer Insights employs professional home-economists and market research specialists. This group is concerned with consumer product testing and market awareness, and uses extensive knowledge of the marketplace to understand consumer trends and to help companies to brainstorm new product concepts, make and test kitchen recipes, and evaluate products with a 'critical' consumer eye. Knowledge and expertise of this group is essential at the early stages of new product development when much can be learnt from marketplace knowledge to guide the development process.

The team uses an extensive network of field-force contacts, built up to enable both qualitative and quantitative market research and product guidance tests to be organised and conducted throughout Europe. Consumers are recruited to quota according to the requirements of clients and tests conducted according to best practice guidelines. The same rigorous approach to consumer testing is also followed for research purposes, to ensure that new research methods are evaluated under realistic and practical situations.

Sensory Services offers clients practical support in the application of good sensory analysis techniques in industry, either by using our in-house panel of trained assessors on a contract basis, or by training company-based panels in sensory principles. CCFRA was the first sensory laboratory in the UK to receive accreditation for sensory methods (through UKAS - United Kingdom Accreditation Scheme). Laboratory accreditation is essential to be able to demonstrate to clients that our sensory practices are documented and under control, important for the scientific credibility of our sensory service, but particularly necessary when the results of sensory analysis are used for regulatory purposes, or in cases of dispute on product sensory quality. Our team currently leads a major European Union funded project (PROFISENS) to write guidelines for proficiency testing in sensory analysis. These guidelines will offer a common approach to inter-laboratory test comparisons to determine the performance of individual laboratories for specific sensory tests, and proficiency testing schemes based on these guidelines will be developed for participants worldwide.

The much used 'Guidelines for Sensory Analysis in Food Product Development & Quality Control', now in a 2nd edition, was the result of close networking with member companies through our Sensory & Consumer Technical Advisory Panel. Sensory and consumer scientists representing industrial companies meet on a regular basis to discuss common issues on methods and management of industry sensory panels, and to guide our research to develop new methods and procedures. Monitoring the performance of descriptive sensory panels has been a 'hot topic' for CCFRA members for the past few years. A number of data sets were shared and analysed by several participants and resulted in useful discussions on the merits of different approaches. A guideline document will be published soon providing practical information on a range of methods from simple graphical

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tools through to more formal statistical methods. Further guidelines are being written for the selection and training of sensory assessors. Whilst research papers and standards exist, they are often specific for particular methods, and many companies have adapted these methods or developed their own in-house methods for particular situations. This information is highly relevant but not always freely available to other sensory scientists within the food and drink industry, and great benefit can be derived from sharing knowledge. These new guidelines will be a user-friendly guide to the selection and training of descriptive sensory assessors, will summarise existing methodologies and training processes, and will suggest novel techniques for panel training, motivation and performance monitoring.

Sensory panels at CCFRA are experienced in all the traditional approaches to discrimination and descriptive sensory analysis, but we are particularly keen to adapt methods to suit practical requirements. Our approach to benchmarking the sensory quality of products allows companies to monitor the performance of key sensory attributes 'in real time' during production, and to take necessary actions to ensure that sensory quality is maintained within the target range. Working with Compusense Inc, Canada, we have jointly developed the Compusense QC software package as a cost effective system for monitoring the data from sensory benchmarking, allowing companies more effective management of their sensory QC panels.

Data & Support Services provides the highly practical support to project managers and clients in routine sensory and consumer data analysis and systems support. This section manages our software systems and packages for sensory data collection, and provides training and guidance on the practical analysis of sensory and consumer data. This group further provides the data outputs necessary for the panel leaders to monitor assessor performance, and panel feedback to maintain motivation and performance of assessors.

Sensory & Consumer Research section maintains the link and collaboration with other research institutes, and manages long-term projects aimed at improving our understanding and developing new methods and approaches to industrial problems. We have an expanding, but changing research portfolio, and our current projects include:

- Preference mapping and cluster analysis - aimed at communicating the use and application of preference mapping and cluster analysis techniques more widely.
- Consumer driven food product specifications - work to investigate methods to incorporate consumer views into food product quality specifications.
- Consumer expectations - a project to use and develop methods that will enable industry to identify and prioritise what consumers expect from products, and thereby produce products that match consumer expectations.
- Consumer Issues - a critical analysis of consumer issues as perceived by industry and the real issues in food as perceived by consumers in focused consumer research.
- Quality function deployment - research to accelerate the product development process and to ensure that the voice of the consumer is represented at all times. The project will demonstrate how the QFD process and its specific stages can be applied effectively to the identification, measurement and control of sensory quality in food development and production.
- Food choice and the elderly - an EU approach to determine how European elderly people deal with food related issues, and in particular to explore the barriers to eating healthily in old age.
- Domestic handling of meat products - mutlidisciplinary research to explore qualitatively and quantitatively the way in which consumers prepare and handle meat products, and whether this leads to cross contamination issues in the domestic kitchen, and subsequent health risks.

These current projects, together with the wealth of background research already published, has provided industry with greater understanding of and access to a wide range of sensory and consumer methods to help them produce and market products to provide customer satisfaction.

We firmly believe we can justify a claim that the Department of Consumer & Sensory Sciences at CCFRA is innovative, progressive, dedicated and capable and offers a wide experience in all aspects of sensory and consumer sciences to clients and collaborators alike. Our group is experienced and large enough to manage and deliver on complex projects, and the multi-million pound investment in new research facilities for sensory and consumer sciences in 2001 by CCFRA supports the strong future ahead for the Department. The next time you are enjoying the teashops and pubs of Chipping Campden, think of your colleagues down the road - and pay us a visit too! You will be most welcome!

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For more information about CCFRA, please visit our website at www.campden.co.uk ■

Odor as an Environmental Impact

and defined as the perceived air pollution caused by an "olf's worth" of pollutants around which is passed 10 liters per second of clean air. To those accustomed to clear operational definitions, and not schooled in the belief system from which this approach sprang, dealing with these terms is rather like trying to pick up mercury. Since olfs and decipols are inferred entirely from measurements of the percentage of individuals reporting that they are "dissatisfied" with the air, the terminology only *appears* to solve a problem or provide information. Attempts to relate these imaginary units to what is known about human psychophysics or psychology, or the olfactory (or trigeminal) system, are futile, given the lack of mechanistic investigation of how air chemistry interacts with human physiology and psychology to generate a probability that a given exposure will cause either of two binary outcomes (satisfied or dissatisfied with air). This conceptual isolation also precludes critique of the many assumptions that underlie the use of olfs and decipols as though they were real entities that could be used to elucidate real-world environmental odor problems. In sum, these terms may serve, by adding confusion but no information, as quite effective barriers to communication among the scientific disciplines that could bring clarity to the questions at hand.

The OU: used and abused?

The CEN draft standard titled "Air Quality-Determination of Odour Concentration by Dynamic Olfactometry", being much more concrete than the olf-decipol "paradigm", presents difficulties that are more obvious and more easily corrected. The standard arose because of the need, noted earlier, for a scientific basis upon which odor regulations could rest. The key concept here is the *odor unit (OU)*, which originally had a straightforward definition: the factor by which a given stimulus had to be diluted to reach odor threshold. The draft standard, in its present form, has two categories of deficiencies: it fails to make adequate use of prior work in its prescriptions for generating valid threshold values and it advocates uses for OUs that are not valid.

Typically air samples from various locations are brought to the odor laboratory and diluted until a panel odor threshold is calculated. If, for example, panel threshold was reached when 99 volumes of clean air were combined with 1 volume of the sample, the sample is said to have 100 OUs since a 100-fold dilution was required. The "rules of the game" offered in this document, for all of the mechanics by which an OU is estimated for a given air sample, reflect compromises reached by committees that were strongly influenced by practical concerns such as cost. This is understandable, but what is unnecessarily lacking is a clear distinction between the

procedures best supported by prior laboratory research on odor and those agreed to in the draft standard. The degree of divergence, concerning various aspects from transport of air samples to number of trials per panel member, would help greatly in efforts to understand the (frequently encountered) difficulties in accounting for variation over time for a given odor source and among laboratories for the same source. In the long-term, it is likely that the effort to make rational policy based on sound odor measurement would be most efficient (and cost-effective) if there were a greater bias toward maximal weighting of scientific and less tilt toward practical compromise.

Even if one were to stipulate that the OU protocols in the CEN draft standard were optimal, issues concerning the use of these OUs would remain. Put simply, the meaning of the term is allowed to wander and expand well beyond what can be justified by the procedures used to obtain the numbers. OUs are treated as though they represented supra-threshold odor intensity, for example; this results in the unsupported use of OUs to determine the severity of the odor complaints. For example, a factory with an 80 OU problem is assumed to pose less of a problem than a livestock operation rated at 90 OU. Equally troubling is the use of OUs as though they refer to physical units. This misuse is attractive since it allows conventional dispersion modelling to be used to make predictions about OU magnitudes at different locations relative to a source. The products of such efforts are of predictably low value.

In short, the present situation is unnecessarily confused. The (admittedly flawed) scientific information that does exist is *not being used* to maximum benefit in understanding (and then ameliorating) smell-related problems. The chemosensory research community has shown little interest thus far, perhaps due to there being so little incentive provided toward solving environmental odor problems. When pragmatically oriented individuals from outside the scientific community fail to locate clear guidance on conducting valid research on human responses to environmental chemicals, they typically either assume that nothing is known or they favor the "applied" approaches. The latter, as we have seen, offer solutions far more apparent than real. Simple-sounding solutions that have serious shortcomings may ultimately waste time and money, delay sound solutions or lead to bitter disputes or lawsuits. In rare cases, easily preventable harm may result from faulty methods.

So what is needed to at least improve this situation?

Firstly, those that study odor or other short-term responses to environmental chemical exposures should develop and disseminate

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continued

clear and empirically based standards. Ideally such standards should incorporate provisions for parameters of odor perception other than simple detectability, whether the duration is short or long and whether the stimulus is chemically simple or complex. These standards need not necessarily be as formal as those promulgated by ASTM and similar organizations but they should be clear, have a well-grounded and thoroughly explained origin in scientific data and be of value in identifying the most pressing research needs. Some examples of parameters for which standards could either be offered now or over the next few years are:

1. Odor detectability of single compounds expressed in physical/chemical units of concentration
2. Odor detectability of complex chemical mixtures expressed in terms of number of dilutions required to reach a defined criterion of detection
3. Intensity difference discrimination ability
4. Quality discrimination ability
5. Odor identification ability
6. Recognition of target odorant against noisy odor background
7. Hedonic valence of odor

The objective of the above research would be a sound and agreed-upon method that can be picked up and used by non-specialists, with confidence. Perhaps the best way to express the rigor required is to consider the elements that a standard would include. These would apply to all of the seven performance parameters above:

- **Stimulus generation and delivery**
  Specify the degree to which various stimulus parameters should be controlled and verified (e.g., concentration; purity; total flow rate of air stream, if dynamic air dilution olfactometry used; relative humidity; and temperature of air stream). In addition, the guiding principles to be followed in presenting the stimulus to the subject should be spelled out. Note: The emphasis is on meeting various experimental conditions, not on how this is achieved.
- **Intensity (ies) at which comparisons are made**
  Parameters such as quality discrimination should be measured at prescribed perceived intensities. (This, of course, presupposes that methods for determining perceived intensities have been worked out). This feature is one of several that have hampered the integration of data from different laboratories. With this element of a standard in place, direct comparisons could be made across chemical compounds and studies, since quantitative measurements of discrimination abilities would not be confounded by differences in the ranges of intensities at which the testing was conducted. (As a side benefit, this feature would allow much better comparisons between human and animal capabilities).
- **Communication with subjects**
  Provide minimum criteria for how the task is communicated to the subjects. Include a requirement that investigators communicate what exactly the subjects were asked to report, how they were instructed about the scales or any other aspects of entering their responses and how biases were considered and dealt with.
- **Sampling requirements**
  Call on the investigator to justify experimental decisions on the amount of sampling of responses for each subject-by-stimulus combination. This will require taking into account what is known about variation within and among individuals and how this variation depends on the nature of the stimuli, the individual and the type of information being gathered.
- **Data processing**
  Specify the procedures by which raw data are processed to yield summary functions and conclusions. The manner in which conclusions flow from raw data should have three characteristics: a) clear communication so that other investigators may replicate explicitly; b) sound statistical procedures and prior work; c) end product provided in several forms for ease of comparison among stimuli and laboratories.

Apart from setting sound standards and communicating them to participants in the field and to outsiders, greater collaborations between those within the human olfactory research community and those non-specialists in need of sound methods and data should be encouraged. There are many opportunities now for chemosensory scientists to enrich their professional lives by adding, where possible, applied work with the stimuli of airborne pollution that can speak to real world issues. There are intellectual challenges and financial rewards awaiting those scientists who make the effort.

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Smart Foods Centre
ARC Key Centre of Teaching and Research
University of Wollongong

Contemporary Issues in Food and Nutrition

The Smart Foods Centre at the University of Wollongong is conducting three short courses this Spring on Contemporary Issues in Food and Nutrition. All courses will be held at the University of Wollongong.

Short Course 1: 30 and 31 August
Nutrition Today: Did we get it right? What are the opportunities?

Diabetes, cardiovascular disease and obesity - the mysteries of metabolic disorders. What are the key issues? Can we implement strategies to address them?

Short Course 2: 20 and 21 September
Growing Well: Active Ageing - The Nutrition Factor

What constitutes good nutrition throughout the lifecycle? Sifting through nutritional issues at different stages, revisiting fortification, RDI's and looking at the latest in physical activity recommendations.

Short Course 3: 25 and 26 October
Emerging Issues: Nutrition tomorrow - what does the future hold?

What are the upcoming nutritional challenges likely to be? How is the science helping to reshape the future food supply? Understanding food and nutrition trends and the potential directions they may take us in the future.

The short course program can be accredited towards a core subject in the Nutrition Management degree on successful completion of the assessments associated with each short course.

For further information:
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Email: smart_foods@uow.edu.au

Smart Foods Education Program

The Smart Foods Centre is an ARC key centre of teaching and research at the University of Wollongong. It provides educational offerings focussed on supporting a food supply based on nutritional science and application in the food industry.

Degree Programs

The formal qualifications offered include the Graduate Certificate in Nutrition Management, Masters of Nutrition Management and Masters of Science. The degree programs in nutrition management and continuing professional education would be of interest to food industry personnel, nutrition researchers, dietitians and postgraduate students.

The key research programs within the Smart Foods Centre and the University of Wollongong, Faculty of Health and Behavourial Sciences are highlighted in the education program. This provides the opportunity for students to be exposed to cutting edge research. Course material is presented by experts in the topic area, including senior research scientists from universities, research bodies, food industry and professional organisations.

What is happening this year?

This Spring Session the University of Wollongong Smart Foods Centre is conducting three short courses on contemporary issues in food and nutrition.

What is in the Contemporary Issues in Food and Nutrition short courses?

These series of short courses introduce students to ideas on the causes, nature and effect of current food and nutrition issues. This includes the alteration of nutrient composition in the development of foods to meet specific needs and the impact of the food regulatory environment on product development and nutrition communication. These short courses will address the interaction between biological, sociocultural and lifestyle aspects of human behaviour, changes in the food supply and the role of government and professional groups.

The short courses will look at the following issues in depth:

- Past and potential ways to manage our key health and nutrition issues, examining the key issues surrounding metabolic disorders and current strategies to address them
- Good nutrition throughout the lifecycle - Sifting through nutritional issues at different stages
- Emerging nutritional challenges and the role of science and medicine
- The food and nutrition trends of tomorrow and the directions they may take us.

Why are these short courses needed?

The short courses are presented as a two-day intensive seminar and include presentations by senior researchers and experts in the area of food and nutrition. They make it possible for new students to build up a learning profile as their needs arise and interest grows. Short courses can be accredited towards a core subject in the Nutrition Management degree programs on successful completion of the assessments associated with each course.

Dates for upcoming short courses:

August 30 & 31 Short Course 1
Nutrition Today: Did we get it right? What are the opportunities?

Diabetes, cardiovascular disease and obesity - the mysteries of metabolic disorders: What are the key issues? Can we implement strategies to address them?

September 20 & 21 Short Course 2
Growing Well: Active Aging - The Nutrition Factor

What constitutes good nutrition throughout the lifecycle? Sifting through nutritional issues at different stages, revisiting fortification, RDI's and looking at the latest in physical activity recommendations

October 25 & 26 Short Course 3
Emerging Issues: Nutrition tomorrow - what does the future hold?

What are the upcoming nutritional challenges likely to be? How is the science helping to reshape the future food supply? Understanding food and nutrition trends and the potential directions they may take us in the future.

For further information please contact: Smart foods Centre University of Wollongong, Anne McMahon, Sharyn Denmeade or Nicole Smede

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Pangborn Lives On

Report on the 4th Pangborn Sensory Science Symposium, Dijon, France, July, 2001.

By John Prescott
Sensory Science Research Centre, University of Otago,
Dunedin, New Zealand.
john.prescott@stonebow.otago.ac.nz

An external observer asked to comment on the subject matter of this year's Pangborn meeting might have suggested, after the first four invited talks and the same number of offered papers, that it was sensory psychology or psychophysics, perhaps with a smattering of chemosensory physiology. It's not the same impression that would be gained after the full four days, of course. By then, the more typical topics of collection and analysis of trained panel data, food choice, and consumer acceptability had re-asserted themselves. Still, it was an interesting phenomenon, and coupled with the dominance of molecular approaches at chemosensory meetings such as AchemS, suggests that future Pangborn meetings may increasingly provide a forum for "basic" taste and smell psychophysics.

The direction of future Pangborn meetings should be of interest to anyone in the field of sensory science. It is the only regular, broad international scientific forum for the field's applied research and as such is vital to ensure that sensory evaluation practitioners have strong scientific input into their methods.

As with previous meetings, this year's committee, led by Sylvie Issanchou of INRA in Dijon, had worked hard to ensure that the meeting represented the field's enormous breadth. If there was a theme, it was probably wine, not least because every day was punctuated by three course lunches with at least two different wines. The more than 600 attendees also served as willing guinea pigs during the opening buffet by rating blind the acceptability of several Chardonnays. The analysis of these data, together with descriptive profiles of the same wines, later formed the basis of one of the meeting's eleven afternoon workshops. Incidentally, a Californian wine was preferred overall, with the Burgundy coming last. Many there, although not Ann

Noble, wondered whether equivalent quality wines were actually being compared.

For more information about the Pangborn's program, visit www.dijon.inra.fr/aromes/pangborn/. There are plans to post the complete oral presentations on an associated website. Food Quality and Preference will publish a selection of Pangborn manuscripts in 2002 .

The next meeting will be held in July, 2003, in Boston, USA, hosted by the US Army Natick Soldier Centre. The meeting Chair is Dr Herb Meiselman. Please contact me (John Prescott) if you are interested in bidding for Pangborn to come to Australasia in 2005 ■

Upcoming Events

20 August 2001	Seminar on Smell Loss Centre for ChemoSensory Research, UNSW Australian Technology Park, Sydney, Australia Contact: m.styles@unsw.edu.au
27-30 August 2001	Combined Fine Foods, Hotel and Supermarket Australia Exhibition Darling Harbour, Sydney, Australia Contact: www.foodaustralia.com.au
30-31 August 2001	Short Course Nutrition Today: Did we get it right? What are the opportunities? Smart Foods Centre, University of Wollongong Contact: smart_foods@uow.edu.au
2-4 September 2001	Australasian Soft Drink Association Conference Marriott Resort, Surfers Paradise, Queensland, Australia Contact: Melanie McPherson asda@softdrink.org.au www.softdrink.org.au
20-21 September 2001	Short Course Growing Well: Active Aging - The Nutrition Factor Smart Foods Centre, University of Wollongong Contact: smart_foods@uow.edu.au
25 September 2001	Seminar on Air Quality Centre for ChemoSensory Research, UNSW Australian Technology Park, Sydney, Australia Contact: m.styles@unsw.edu.au
5-14 October 2001	Tasting Australia (A Food Festival) Adelaide, Australia Contact: Marina Libia +61 8 9388 8877 Libia.marina@saugov.sa.gov.au and www.tasting-australia.com.au
23 October 2001	Seminar on Barrier Technology "The price of freedom is eternal vigilence" Centre for ChemoSensory Research, UNSW Australian Technology Park, Sydney, Australia Contact: m.styles@unsw.edu.au
25 & 26 October 2001	Short Course Emerging Issues: Nutrition tomorrow - what does the future hold? Smart Foods Centre, University of Wollongong Contact: smart_foods@uow.edu.au
10-15 November 2001	Society for Neuroscience 31st Annual Meeting San Diego Convention Center San Diego, California, USA Contact: www.sfn.org
13-17 November 2001	2nd IUPAC-ISS International Symposium on Sweetners Hiroshima, Japan Contact: http://w3y.pharm.hiroshima-u.ac.jp/iss/index.html Registration: http://iupac-iss@jtbcom.co.jp
27 November 2001	Seminar on Lo-Fats and Healthy Eating Centre for ChemoSensory Research, UNSW Australian Technology Park, Sydney, Australia Contact: m.styles@unsw.edu.au
3-4 December 2001	E-Nose 2001 St Petersburg, Florida, USA Contact: www.enose-2001.com or www.techpub.com ■

NEWS

Taste Retards Success for Fat Replacers

A new report by UK consultants Frost and Sullivan, on the US fat replacement market, says it again: consumer spending on products containing fat replacers is being held back by general disappointment with the lack of taste and flavour of the products.

Makers of fat replacers are failing to realise their potential market growth, despite a progressive increase in consumer awareness and desire to include healthier foods in their diets. Consumers' sensory preferences often overide their drive to be healthy.

Fat replacer sales actually dipped in year 2000, complicated by negative publicity about gastric side effects of Olestra, which, the analysts say, also negatively effected other products' sales.

Makers of fat replacers must dispel public fears that their products are not safe and must take a long-term view of the development of new fat replacers. The report urges the industry to understand the importance of the role of fat in foods and to invest more time in understanding consumer preferences.

More information: www.foodonline.com

The report may be purchased from Bill Stringer of Frost and Sullivan, +44 1865 398651, e-mail: bill.stringer@fs-europe.com ■

NEWS

Almonds Reduce Risk of Colon Cancer

Almonds are the latest in a growing list of foods that have been shown to have a positive health benefit. Despite their fat content, almonds had a significant effect on prevention of colon cancer in an animal study (rat) at U.C. Davis, published in *Cancer Letters* in April 2001. Rats were fed diets of whole almonds, almond meal or almond oil, and control diets of cellulose or wheat bran. The rats' large intestines were then examined for markers of colon cancer. All the almond diets reduced the risk of colon cancer, irrespective of the amount of fat in the almond diets. High-fat foods such as nuts, have conventionally been associated with cancer risk. "Almonds most likely deliver a healthy package of nutrients including antioxidants and phytochemicals that may be helpful for many aspects of health; cancer is just one," said Paul A. Davis, first author of the report.

Source: www.foodonline.com
More information: www.AlmondsAreIn.com ■

Coming up in ChemoSense

Sensory Serving Strategy
Must Low-Fat = Low-Taste?
Matching Expert Panels

* Visit us at our website
http://www.chemosensory.com

NEWS

Has Your Dot.Com Investment Gone Sour?

"Some in clandestine companies combine,
Erect new stocks to trade beyond the line;
With air and empty names beguile
the town,
And raise new credits first,
then cry 'em down:
Divide the empty nothing into shares,
To set the town together by the ears.
The sham projectors and the brokers join.
And both the cully merchant undermine;
First he must be drawn in then betrayed,
And they demolish the machine they made:
So conjuring chymists, with their charm
and spell,
Some wondrous liquid wondrously exhale;
But when the gaping mob their money pay,
The cheat's dissolved, the vapour
flies away."

Daniel Defoe,
Reformation of Manners (1702) ■

E-MAIL from Tokyo

Graham Bell
Centre for ChemoSensory Research

Resilience is a word that comes to mind as I sweat it out in the oppressive heat of a Tokyo summer. You have to be *resilient* here: you are squeezed, the money, sweat and tears run out, and then you have to bounce back into shape, like a sponge. It's 37ºC and 100% humidity. Beyond the range of an air-conditioner, the timeless technology of hand-held fans come back into their own, ever resilient.

The happy memory of a superbly comfortable flight via Osaka, and its propped-up but sinking airport, fades rapidly in the heat of the Tokyo concrete jungle.

The recession is starting to bite: unemployment is still over 4% and now there are not quite so many attendants in the stores. I miss the lady who bows at the foot of the escalator.

Out at the Science City, Tsukuba, there are signs of fiscal restraint. The town looks a bit tired and there have been few new city buildings in the years since my last visit. The state-funded science departments have been shaken down and reorganised, renamed, and relocated. By Australian standards they remain impressive: my Japanese chemosensory colleagues have ad-lib access to over AUD$5 million's worth of equipment.

Young Japanese are now starting to manifest in career positions in these scientific laboratories, having had fruitful periods of education abroad, mostly in the USA. They are the new creators of their country's science output, who will provide the next wave of technology for Japan and the global markets.

Olivia Roman (4th Yr UNSW Food Sci), our Japanese colleagues and I have just done some mutually rewarding research, matching Australian and Japanese panels, and helping to develop a market for Australian sea urchin roe.

In homes, shops and restaurants, "Aussie Beef" advertisements have left a lasting impression. Clearly, our meat marketers have done a great job. The competitive (fatty)

Summer snacks and happy sales people at the Asakusa Temple market

product from Kobe and USA is pricing itself out of the market, in these tighter times. Summer has brought an abundance of fruit to the market, with rock (musk) melons going down to the unbelievably low price of AUD$40 each in the Ginza and $10 in the suburbs. Hagen Daz ice cream is making a killing and fetches $7 per single-serve tub. Australian products are not as visible or abundant as I had hoped.

No one has ever said Japan is easy. Yet, despite these torrid times, Australian products are more competitive than ever, and Japan remains a tantalising challenge for the resilient exporter, student and tourist: the kind made downunder.

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