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ChemoSense

Editorial

By Graham Bell
g.bell@e-nose.info

The career of Gordon Shepherd and his contribution to neurobiology, in general, and chemosensory science, in particular, has been remarkable. His wisdom, insatiable curiosity and insight is now shared with us in this edition of ChemoSense. A few reading these pages may never have heard of him, but very many will know him as a guiding light in the field and many will have studied textbooks written by him as students and used his research papers as the genesis for whole careers in research. We congratulate Gordon on achievements and influence "wider than the sky". We wish him many more years of work, with us, in this amazing and diverse field of chemosensory science, whose examples have crucial implications for how nervous

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Q & A: ChemoSense talks to Gordon Shepherd

Your contribution to Neuroscience in general has been prodigious, yet the olfactory system has occupied a special place in your interests. Why is this?

I went to study with Charles Phillips in 1959 to learn intracellular recording from cortical neurons and work out how a principal neuron is controlled by local interneurons, what we now call microcircuits. After much discussion we decided that the olfactory bulb offered better advantages as a model system for this purpose. So from the start my primary interest has been synaptic organization of brain circuits, and has continued to be the main focus of my lab (my main NIH grant since 1967 has been entitled "Basic Mechanisms of Cortical Integration"). I started to learn about smell on a fellowship with David Ottoson in Sweden and a sabbatical with David Moulton at the Monell Center, both of them pre-eminent pioneers in olfactory physiology.

Gordon Shepherd

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INSIDE:

Perceived Complexity

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Editorial continued

systems support life, and how animals have evolved.

We also applaud in this issue the work of Wendy Parr, New Zealand's leading wine sensory scientist and prolific writer for ChemoSense over our 12 years of publication.

Here she explores the notion of perceived complexity in wine and again helps to bring clarity to an economically important and perplexing topic.

Wine will feature in the forthcoming meeting of AACSS, the Australasian Association for ChemoSensory Science meeting in December, being held in the beautiful wine region of Yarra Valley, near Melbourne, in December. We look forward to welcoming many local and overseas contributors to the scientific program ■

Q & A: ChemoSense talks to Gordon Shepherd continued

What, for you, have been the salient points in the development of chemosensory science during the span of your career?

The most important development has been bringing chemosensory science into the mainstream of biological and neurobiological science. When I came into the field it consisted of perfume organic chemists, psychophysicists who had been trained in college psychology departments, and insect physiologists, all excellent in their fields but focussed on what seemed special about the chemosenses that set them apart from the other senses. I remember an organic chemist telling me that it would never be possible to do reliable physiology of olfactory responses because the stimuli would always contain impurities. I believe I was one of the first to have been trained in a medical school (along with my friend Al Farbman in dental school) and at NIH, and to be doing research in a medical school (Jim Schwob and I think he was the second). The first decade of AChemS widened the base, and it received a big push by Buck and Axel in 1991, all of which showed how the chemosensory sciences need to be in the mainstream and have access to the funding levels of large labs with sophisticated instrumentation in medical schools and research institutes.

I once heard you talk on the need for some new chemosensory vocabulary to meet emerging molecular aspects of olfactory science. Did it happen and if so, what are some examples?

As the molecular revolution began in the 1980s I became convinced that we were moving from a chemosensory science to a molecular sensory science, which would benefit from appropriate terminology. It seemed to me that characterizing olfaction as a molecular sense situated it better in mainstream molecular biology. Similarly, we thought of glomerular activity maps as molecular images rather than chemical responses. The molecular modelling carried out by Michael Singer, Doron Lancet and subsequently many others indicated that what appeared to be encoded were the determinants of odor molecules, and that these could be single atoms, an astonishing level of molecular discrimination. We suggested referring to these as odotopes, to emphasize the difference from immune epitopes, which usually consist of much larger peptides. Eventually the field will evolve whatever terminology is useful.

Competition for chemosensory science funding has always been intense. Has it become any easier, or more difficult, from your vantage-point and what might be the cause/s of change?

Competition has become much more difficult. This of course is happening in most fields. In our field it means that much valuable research on the frontier of both chemosensory science and neuroscience is simply lost. There is of course a balance between investigators entirely focused on olfaction or taste, and investigators like myself using the olfactory system to develop new technologies such as 2DG, high-field fMRI, and realistic neural circuit modeling to understand principles of microcircuit organization underlying sensory perception. It appears that the chemosensory field may not be able to support being competitive in many of

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AACSS 12th Scientific Meeting
Yarra Valley, December 2-4, 2010

The 12th Scientific Meeting of the Australasian Association for ChemoSensory Science (AACSS) will be held from December 2-4, 2010 in the beautiful Yarra Valley wine region near Melbourne. The meeting will commence Thursday December 2nd in the evening, and conclude Saturday December 4th with lunch. This leaves the weekend free to visit the many nearby wineries if desired. The conference venue is the Balgownie Estate Vineyard Resort and Spa: www.balgownieestate.com.au/yarra-valley/

We have assembled a very exciting line up of international speakers and in particular are privileged to announce that a plenary speaker at the meeting will be renowned chemical senses researcher Professor Richard Doty, author of many seminal books in the chemical senses and inventor of the UPSIT smell identification test.

Plenary speakers:

Professor Richard Doty, Director, University of Pennsylvania Smell and Taste Center

Neurodegenerative Diseases and Olfaction

Associate Professor Giovanni Galizia, University of Konstanz

Olfactory information coding in the insect antennal lobe

Assistant Professor Helen Treloar, Yale University

Axon guidance in the mammalian olfactory system

This is a great opportunity to hear from and talk to these outstanding researchers in a beautiful and relaxed setting, so take advantage of it!

Information regarding the program and invited speakers, registration, abstract submission and accommodation is available on the AACSS website, www.aacss.org

The deadline for registration and abstract submission is 15th October, 2010

Any queries regarding the meeting can be directed to Coral Warr, coral.warr@monash.edu

Q & A: ChemoSense talks to Gordon Shepherd
continued

these areas of mainstream neuroscience. This is already having an adverse effect on the field, in that investigators unable to obtain support through chemosensory funding channels are turning to other fields.

Would you like to see anything done differently to improve the quality of research in the chemical senses?

Freedom and continuity are two essential keys to success in science. Freedom is being increasingly narrowed by the competition for funds. Study sections are literally afraid to give investigators freedom to do innovative research, because they want to see the results first, and therefore demand virtually a completed study before being willing to give a fundable score. As has often been said, if you know what you'll be doing a year from now it won't be science. The other key is continuity, supporting a productive grant through more than one cycle. The current mentality is the same as the stock market - a focus on the past year's publications, like the focus on last quarter's profits. That's not how to build a quality business for the long term, and not how to build quality in research for the long term.

Has the arrival of electronic publication made a difference to working in neuroscience?

Yes and no. During my term with the Journal of Neuroscience, the e-journal, with its links and supplementary material, became the journal of record. As e-journals replace hard-copy journals, the information they contain is in principle more easily accessed by being on the web, but in practice it is increasingly submerged in the ocean of data. The hope lies in developing search tools and databases that make the data more easily accessible. That's why I've been devoting increasing effort in recent years to neuroinformatics through our website "SenseLab" and participation in national efforts such as the Neuroscience Information Framework (NIF) and the International Neuroinformatics Coordinating Facility (incf). There's a lot of resistance among neuroscientists to sharing data in these new databases, but sharing sequence data has been essential to the growth of molecular biology and we need to do the same for neuroscience and the chemosenses.

Ethics approvals to conduct research are a prerequisite for every scientist where once it was not. How have these changes impacted on you?

My background is experimental physiology, so I was trained in the careful use of animals in my research, and have transmitted those principles to everyone who comes into the lab. The use of animals is critical for the advancement of biological, veterinary, and medical science, and we must continue to hold ourselves to high standards in that effort. It is important for every principal investigator to take extra care in being sure that ethical principles are being followed by everyone in the laboratory.

The multidisciplinary nature of chemosensory science is one of its great strengths. Is enough done to include potential contributors?

From the start of my studies we have carried out multidisciplinary projects. My thesis studies involved correlations between our unit recordings and the histological layers of the olfactory bulb. This led to the study with Wil Rall applying the new computational modeling that predicted dendrodendritic synapses revealed by electronmicroscopy. Similarly, our introduction of activity mapping in the glomerular layer with Frank Sharp and John Kauer involved careful correlation between the 2DG patterns and the histological layers of the olfactory bulb and subsequently extension by functional imaging. Much of my recent work has been done in correlation with anatomical studies by Charlie Greer. The problem in proposing multidisciplinary research for funding is that it always risks being rejected by study sections because the more fields represented, the more the potential criticism of limited pilot data, but you can't cover everything adequately in the brief encompass of the application. So we proceed with our main research aims, and assemble multidisciplinary collaborations when the opportunities arise.

Would you like to see research centres dedicated to the chemical senses (such as The Monell Institute) arise elsewhere? Is there a future for such centres? Might we soon see one in China?

I have great affection and admiration for the Monell Institute. I was a visiting scientist there in its first year when Morley Kare set it up in 1971, and had the benefit of Tom Getchell and John Kauer coming afterwards from there as my first postdoctoral fellows. It has been a constant core of excellence for the field in the past four decades. Its financial

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base is unfortunately at risk because of current economic woes. I think it is in all our interests that it survives and prospers. The private sector could do much more in committing itself to the support of an institution from which it derives much reflected glory. I could imagine other kinds of institutes focused on other aspects related to the chemosenses. However, by far the greatest benefit for the chemical senses will come from individual research grants to principal investigators in the fertile multidisciplinary environments of mainstream research in academic institutions around the world.

We have seen the discovery of olfactory receptors and great advances in understanding of chemical senses at the molecular level. What remains the most pressing question, in your opinion?

After the initial burst of excitement by all of us about the receptors, interest appears to be turning increasingly to understanding how the information contained in the odor molecules is processed by the circuits at successive stages in the olfactory pathway. That is still the overriding question in olfaction, as it is in all the sensory systems. Our evidence has suggested that, starting at the receptor level, determinants of the odor molecules are encoded by interactions within a binding pocket in the receptor; this information in the ensemble of olfactory sensory neurons is then represented by spatial activity patterns in the glomerular level, which we call the molecular image. The image is processed at successive stages through the mitral-granule cell interactions and the olfactory cortex to the orbito-frontal cortex, as the basis for the perception of smell. The nature of the processing at each of these stages is to my mind the most interesting question in olfaction, in parallel with similar questions at each stage in the processing of other sensory modalities. The more we recognize similarities between the systems, the more we can understand the common principles of neural processing that are fine tuned for each system. Binding pocket interactions, image formation in the glomerular layer, lateral inhibition in the granule layer, content addressable memory in the olfactory cortex, are examples of these common principles. These processing steps also have their temporal dimensions. The concepts of Lew Haberly and Don Wilson of memory formation in olfactory cortex draw closely on analogies with image processing in vision. Their work indicates the potential for olfactory processing to be integrated into general principles of the neural basis of sensory perception.

Will we see another Nobel Prize come out of chemosensory science?

I've noted above the distinction between mainstream science and chemosensory science. It's interesting in this connection to point out that the Nobel Prize did not in fact come out of chemosensory science; it was awarded to a laboratory initially not engaged in chemosensory science but rather in mainstream science in the molecular biology of membrane receptors. So it was an example of how much the chemosensory field has benefited from mainstream science, as I noted above. The same can be said of our studies of synaptic organization, dendrodendritic interactions, and glomerular activity patterns. Conversely, these studies show how the olfactory field contains problems of deep general biological interest. In the future, the mechanisms that turn on or off neurogenesis of the olfactory receptors could give critical insight into brain neurogenesis; the cells of the rostral migratory stream are of even more interest from that point of view. In these respects the olfactory system can continue to serve as a model for critical biological mechanisms in the mammalian brain.

Looking back on your time as a scientist, where did your inspiration come from, and what kept the flame of excitement alive for you?

My initial interest in going into brain studies was stimulated by reading Norbert Wiener's book on cybernetics around 1955, just as I was going off to medical school. That led to a summer doing brain research and running a computer in Wiener's old laboratory at MIT in 1956. Hearing a lecture by Phillips in 1958 on his new recordings from cortical neurons was my inspiration for joining him to start my career on the cortex. Turning to work on the olfactory bulb, I got excited about using it as a model to study dendrites and axon collaterals in a cortical structure. After that, we've applied a succession of different methods to the olfactory bulb that have kept the innovative juices flowing. In that respect, the succession of graduate students such as Lew Haberly, Tom Woolf, Michael Singer and Janna Nawroth; postdoctoral fellows such as Tom Getchell, John Kauer, Bill Stewart, Charlie Greer, Kensaku Mori, Martha

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Nowycky, Doron Lancet, Patty Pedersen, Ben Strowbridge, Stuart Firestein, Frank Zufall, Chiquito Crasto, Fuqiang Xu, Wei Chen, Zhishang Zhou, Xavier Grosmaitre, Andrew Davison, and David Willhite and many others; and collaborators such as Frank Sharp, Michael Hines, Matthias Laska and Peter Mombaerts, have kept the fires burning every day in the lab. It may be a small piece of the brain, but like the brain, as Emily Dickenson wrote, it's "wider than the sky".

Where should young and aspiring scientists look for inspiration?

Innovation in science involves a combination of methods, people, and ideas. A young person can be inspired by one or more of these. For me it was initially the idea of cortical circuits, the method of microelectrode recording, and an exciting person in Charles Phillips. After that it was the idea of olfactory bulb dendrites, computational methods, and an exciting person in Wilfrid Rall. The work continued with the concept of glomerular maps, the 2DG method, and an exciting collaborator in Frank Sharp, and more recently with glomerular maps, high resolution fMRI, and the Yale imaging center. And there are many more examples. Every successful lab has them. I've tried to provide an environment for these kinds of innovation, so that the members of the lab become a source of inspiration for each other. With a new idea, a new method, and a productive relation with your colleagues, there's no limit to what you can do (some funding helps, too).

Do you have any plans you'd like to mention?

There's still so much to do it's difficult to decide on priorities. I'm presently incorporating recent experimental data into scaled up circuit models to get at that overriding question of how information is processed in this system. A new focus is on retronasal smell, its role in flavor, and the role of flavor in nutrition. If smell is the main component of flavor, and flavor is a major sense in humans, it leads naturally to the hypothesis that smell must have played a much more important role in human evolution than commonly believed. The fact that this idea is counterintuitive and against the dominant view makes it all the more interesting. It shows that whatever their age, scientists can continue to be aspiring and looking for inspiration!

Questions for this article were written by Graham Bell, Editor, *ChemoSense* ■

Gordon M. Shepherd *was born in Ames, Iowa, in 1933, and was educated at Iowa State College, Harvard Medical School, and Oxford University. He pursued posdoctoral training at the National Institutes of Health and the Karolinska Institute, before joining the faculty at Yale Medical School in 1967, where he is currently Professor of Neurobiology. He has served as Deputy Provost for Biomedical Science at Yale, and as Editor-in-Chief of the Journal of Neurophysology and the Journal of Neuroscience. His research has been on the integrative properties of dendrites, dendritic spines, and synaptic microcircuits, using the olfactory bulb as a model system. His contributions include electrophysiological analysis and computational prediction with Wilfrid Rall of dendrodendritic synaptic interactions for feedback and lateral inhibition in the olfactory bulb; discovery of the represention of odors by spatial activity patterns in the olfactory glomerular layer; and databases and neuroinformatics tools supporting research in neuroscience. Among his books are The Synaptic Organization of the Brain (5th ed), Neurobiology (3rd ed), Foundations of the Neuron Doctrine, Creating Modern Neuroscience, and Handbook of Brain Microcircuits. His current research is on scaled up models of olfactory bulb circuits, and the role of retronasal smell in human evolution* ■

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WineSense:

Making sense of wine: Exploring the nature of perceived complexity

Wendy V. Parr

AGLS Faculty, Lincoln University,
Christchurch, New Zealand

Fine wine provides us with pleasure. Perhaps less obvious to many is that fine wine also challenges us to think (Aron, 1999). In other words, wine is a food product capable of evoking cerebral (cognitive) as well as sensorial responses. This is particularly so in the case of fine or high quality exemplars of the product (e.g., Charters and Pettigrew, 2007).

The concept of complexity

From a scientific perspective, exactly what makes a wine "fine" or of high quality is not clear. An attribute that is frequently applied to those wines deemed of superior quality or that encourage thought is "complex". Quality and complexity have become often-used but vague variables that give a wine a distinction and a status (Aron, 1999). Sensory perception of a wine, and the ensuing individual and social mental representation of the wine, are "fed" or reinforced by these somewhat vague factors. Recently, the notion of perceived quality in wine has come under serious investigation (Charters & Pettigrew, 2007). The work described in the present article is aimed at tackling the second of these "vague variables" (Aron, 1999) by elucidating the important dimensions of the concept of 'complexity' in wine.

So, what do we mean when we sample a wine and say that the wine has complexity? What are we expecting when we are told that one wine is "complex" and another is relatively "simple"? That is, what does a complex wine have that a less-complex wine does not have? And what is the relation between perceived complexity in a wine and perceived wine aging potential? We do not as yet have clear answers to these questions, but such questions are being explored in a new programme of research involving collaboration between sensory scientists at Lincoln University in New Zealand, and at two French universities.

First, it is important to make explicit that our research concerns perceived complexity rather than actual or objective complexity, even though our research programme involves both sensory and chemical data. When actual complexity in wine is discussed, with wine considered "an especially complex" stimulus (e.g., Thorngate, 1997, p. 271), the definition of complex typically relates to concrete attributes such as the quantity and diversity of the product's constituent chemical compounds. In contrast, perceived complexity makes explicit that there is an organism or perceiver in the equation and lends itself to a more psychological definition, an example of which was provided by Melcher and Schooler (1996) in their wine recognition study. Melcher & Schooler defined complex stimuli as "things that are difficult to capture in words" (1996, p. 232) such as the aroma of fine perfume or difficult-to-describe visual stimuli (e.g., human faces).

Background literature

Although we currently have few sound data concerning perceived complexity in wine, we can make some general comments about the concept. A generalisation that is relatively safe to make is that a judgement of complex is a positive judgment for a wine in that complexity in wine is typically conceived of as a desirable attribute (e.g., Kennedy, 2009, p. 72). Similarly, complexity has been linked positively with higher quality wine (Charters & Pettigrew, 2007) and

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with high typicality of a wine varietal, at least in Sauvignon blanc (Parr, Green, White & Sherlock, 2007). Recently, the attribute 'complex' was shown to be an important organising term when wine consumers and wine professionals categorised hierarchically the specific characteristics of Sauvignon wine (Urdapilleta, Parr, Dacremont, & Green, manuscript under review).

We can also hypothesise from published research indirectly linked to wine complexity that certain factors and psychological processes may be associated with perception of complexity in wine. For example, fundamental literature on odour complexity (Lawless, 1997; Dalton, 2000) suggests familiarity of a wine (i.e., prior experience) and the number of perceived distinct components in a mixture (e.g., Jinks & Laing, 2001) may be relevant variables. From a theoretical perspective, published research investigating cognitive processes involved in human olfaction raises several empirically testable hypotheses. For example, it has been suggested that "complex" may be a single percept, while being a multi-dimensional term. Jinks and Laing (2001) argued on the basis of both physiological and psychological evidence that integration of aromas in a multi-component mixture (i.e., a wine or a perfume) may give rise to a single percept described by the single word "complex". Similarly, Lawless (1997) argued that multiple odours may be recognised as a whole pattern, with the individual features not being accessible to consciousness. In keeping with this idea, Charters and Pettigrew (2007) comment that wine quality can be considered a "higher level abstraction" (p. 998), rather than a concrete attribute of a wine, and therefore involves an overall assessment of a wine. With this in mind, we employed a range of global (overall assessment) and analytical techniques and tasks in our initial investigations of perceived complexity to provide both conceptual data (interview techniques) and organoleptic data (wine sensory evaluation tasks).

Related to the argument that wine complexity, like wine quality, may be a higher-level abstraction is the notion that complexity in wine can be an ambiguous concept (i.e., hard to make concrete in some contexts). A result of ambiguity is that individuals are likely to allocate different meanings to the term complex based on their prior experiences and in different contexts. To examine these notions, our current research programme includes investigation of perceived complexity as a function of domain-specific expertise (i.e., wine expertise), and in the context of aging ability of wine. Wine aging ability was considered a relevant contextual factor to examine on the basis that aging ability was one of seven dimensions of wine quality reported by Jover, Montes, and Fuentes (2004), and a link between perceived quality and perceived complexity in wine was identified by Charters & Pettigrew (2007).

Current research

Two empirical projects are underway.

REPRESENTATION OF COMPLEXITY IN WINE: INFLUENCE OF EXPERTISE AND CONTEXT (AGING ABILITY)

Sensory scientist Wendy Parr and Oenologist Sue Blackmore of Lincoln University, together with Viticulture and Oenology student Tim Pelquest-Hunt, are working with Professor Isabel Urdapilleta and Ph. D. student Marion Mouret of the University of Paris VIII on the project. The main objective of this study was to investigate

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what is meant by perceived 'complexity', and how one's concept of complexity in wine is influenced by domain-specific expertise. That is, we aim to elucidate the important underlying dimensions essential to the concept "complex" as applied to wine as a function of wine-related expertise. A second aim was to investigate the representation of "complex" as applied to (i) red wine and (ii) white wine in a specific context, namely vin de garde (i.e., ability of a wine to age well).

A recent experiment involved 39 wine professionals and 30 wine consumers from New Zealand and Australia taking part in a structured interview. Using a technique of free association and hierarchical evocation (see Viaud, 2002 for a description of the method), participants were asked to produce the first words or phrases that came to mind when asked about complexity in wine. Subsequent interview questions resulted in participants organising their own thoughts. In two further conditions, each participant was asked about complexity in relation to "red wine with aging potential" and "white wine with aging potential".

The interview responses formed the data which are currently being analysed at the University of Paris VIII in France. Analysis is by a textual data-analysis method known as ALCESTE (Reinert, 1986; 2001), used previously to investigate oenologists' descriptions of wines that had undergone different oak treatments (Sauvageot, Urdapilleta, & Peyron, 2006). The goal of this analysis is to quantify a text so as to extract the most significant structures by modelling the distribution of words in a description and identifying the language patterns that are most frequently used by the participants. An important assumption on which the methodology is based is that words evoked or induced by questioning each person within a group (wine 'expert' or wine consumer) are assumed to reflect part of each individual's memorised linguistic system and hence the contents and organisation of their mental representation of the concept of interest, namely complexity in wine (Dubois & Giboreau, 2006). The textual analysis allows consideration of the shared mode of thinking within and between the groups, the shared thinking giving rise to social representations of the concept or product.

Preliminary results show that wine professionals and wine consumers conceptualised complexity in wine in different ways. Wine consumers' focus when asked about perceived complexity was on intrinsic factors relating to their experiences of consuming wine (e.g., smelling; tasting flavours) and was personalised and subjective (e.g., about their own enjoyment and pleasure associated with a wine). On the other hand, wine professionals' conceptualisations of complexity were very much dominated by extrinsic factors such as oenological processing operations aimed at increasing complexity (e.g., lees stirring; malo-lactic fermentation; judicious use of oak barrels) and terroir variables (e.g., vineyard soil type). When asked about the concept of complexity in relation to either white or red wine with aging potential, wine expertise was again a significant factor in influencing between-group differences. These data, that already give some indication as to how wine consumers and wine professionals *think* differentially about wine complexity and about wines with aging potential, will be reported in full in scientific media once the data analyses are complete.

PERCEIVED COMPLEXITY IN SAUVIGNON BLANC WINE

This collaborative project includes Pascal Schlich, INRA Research Director of LIRIS (Laboratoire d'interface recherché-industrie-sensométrie) and Ph. D. student and Oenologist Marcela Medel of the University of Burgundy in France and their colleagues, and wine scientist Wendy Parr of Lincoln

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University and wine-maker Julia O'Connell of Pernod Ricard New Zealand. The major aim is to elucidate the components or dimensions of perceived complexity in white wine, employing New Zealand Sauvignon blanc as the wine varietal for investigation. The project involves both sensory and chemical data. Prior work at the University of Burgundy has involved investigation of perceived complexity, primarily employing red wine.

In a recent experiment, thirteen Sauvignon wines from Marlborough, New Zealand, were evaluated organoleptically by both New Zealand and French participants, the wines being freighted to France so that both sensory experiments could be conducted within a three-month temporal parameter. Nine of the wines formed part of a new-product development project within a large wine company where the wines reflect a range of viticultural (e.g., vineyard site and aspect) and oenological-processing (e.g., natural yeast fermentation) factors aimed at increasing complexity in the resulting wines. The other four wines in the stimulus set were commercially available Sauvignon wines from the same vintage (2009). A total of 117 people evaluated the wines, the participant groups consisting of New Zealand wine professionals, French wine professionals (oenologists), French wine connoisseurs, and French wine consumers. Participants undertook several sensory evaluation tasks that involved smelling and tasting the thirteen wines prior to making both global judgments (overall assessment tasks such as sorting/classification) and analytical judgments (e.g., intensity ratings of a range of specific wine characteristics). Of particular importance was employment of a new methodology, recently developed at the University of Burgundy (Medel, Viala, Meillon, Urbano, & Schlich, 2009). The methodology involves an illustrated questionnaire to which participants responded by rating each wine on seven assumed components of wine complexity, along with an overall judgment of complexity. The sensory data are currently in the process of being analysed at the University of Burgundy and will be reported at a later date. Chemical analyses of the wines employed in the sensory component of the project will allow the sensory and chemical data to be associated by multivariate analyses.

In conclusion, empirical projects are currently underway aimed at elucidating the key components of perceived complexity in wine from conceptual (mental representation), organoleptic (sensory), and chemical composition perspectives ■

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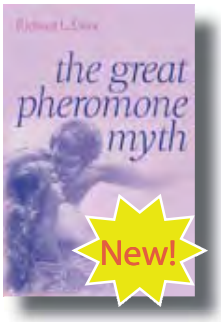
The Great Pheromone Myth

Richard L. Doty, Ph.D., University of Pennsylvania



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Mammalian pheromones, audiomones, visuomones, and snarks — Dr. Doty argues that they all belong in the same category: objects of imagination. For more than 50 years, researchers — including many prominent scientists — have identified pheromones as the triggers for a wide range of mammalian behaviors and endocrine responses. In this provocative book, renowned olfaction expert Richard L. Doty, Ph.D., rejects this idea and states bluntly that, in contrast to insects, mammals do not have pheromones.

Doty systematically debunks the claims and conclusions of studies that purport to reveal the existence of mammalian pheromones. He demonstrates that there is no generally accepted scientific definition of what constitutes a mammalian pheromone and that attempts to divide stimuli and complex behaviors into pheromonal and nonpheromonal categories have primarily failed. Doty's controversial assertion belies a continued fascination with the pheromone concept, numerous claims of its chemical isolation, and what he sees as the wasted expenditure of hundreds of millions of dollars by industry and government.

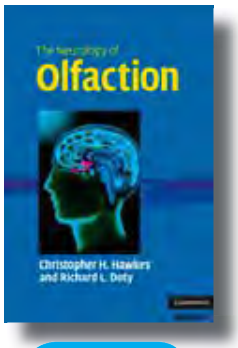
The Great Pheromone Myth directly challenges ideas about the role chemicals play in mammalian behavior and reproductive processes. It is a must-have reference for biologists, psychologists, neuroscientists, and readers interested in animal behavior, ecology, and evolution.

"Simply delightful reading. In a concise but totally convincing manner, Richard Doty sweeps away the pervasive mythology of pheromones." — Floyd E. Bloom, Scripps Research Institute

"The field of mammalian pheromones is a bit sloppy and human pheromones a complete mess. This book will make a major contribution to the field by either galvanizing people to prove Doty wrong or applying brakes to a field that may be fast moving down the wrong track."— Donald A. Wilson, author of *Learning to Smell: Olfactory Perception from Neurobiology to Behavior*

The Neurology of Olfaction

Christopher H. Hawkes, Neuroscience Centre, Barts & The London School of Medicine & Dentistry, London
Richard L. Doty, University of Pennsylvania School of Medicine



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Testing the sense of smell is often omitted or trivialized during neurological examination. This comprehensive review addresses this shortcoming by emphasizing the significance of this important sensory modality. The Neurology of Olfaction describes the anatomy and physiology of human olfaction and how it may be measured. The book covers neurologic disorders in depth and a comprehensive chapter is devoted to neurodegenerative disorders, particularly Alzheimer's disease and Parkinson's disease, where loss of smell is frequent and may be an early preclinical feature that could predict the onset of disease in asymptomatic subjects. Finally, the authors describe methods of treatment for anosmia, evaluate its medicolegal importance, and give guidance for those unfortunate enough to have lost their sense of smell.

Written by two experts in the field, this book provides information useful to physicians for assessing and managing chemosensory disorders and summarizes the current scientific knowledge of human olfaction.

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14-19 September 2010	**XXth ECRO** European Chemoreception Research Organisation Congress Avignon, France www.ecro-online.info
22-24 September 2010	**NOSE2010** International Conference on Environmental Odour Monitoring and Control Florence, Italy www.aidic.it/NOSE2010
13-15 October 2010	**National Association for Clean Air (NACA)** Polokwane, South Africa. bev@naca.org.za
13-17 November 2010	**Society for Neuroscience** San Diego, California, USA www.sfn.org
December 2010 (dates TBA)	**AACSS Annual Scientific Meeting** Australasian Association for ChemoSensory Science Melbourne, Victoria, Australia www.aacss.org
31 January – 3 February 2011	**Australian Neuroscience Society Annual Conference** Auckland, New Zealand www.ans.org.au
13-17 April 2011	**33rd AChemS** Tradewinds Resort, St Pete Beach Florida USA www.achems.org
3-5 May 2011	**ISOEN 2011** New York, USA www.olfactionsociety.org
4-8 July 2011	**20th International Clean Air and Environment Conference** Christchurch, New Zealand www.casanz.org.au
10-14 July 2011	**9th Pangborn Sensory Science Symposium** Bangkok, Thailand www.pangborn2011.com

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Production Team
Editor: Graham Bell, g.bell@atp.com.au
Advertising: Brian Crowley, crowbrin@hotmail.com
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