



ECRO Newsletter

58

Spring 2013

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Chemical Senses: Editor-in-chief: *Prof. Wolfgang Meyerhof*

Top picture: the birth certificate of ECRO, 1971

Bottom picture: the ECRO Board in a photo taken last year. Prof Meyerhof, who was not present, has been included and overlooks from his frame on the wall.



Editorial

Dear ECRO Members, colleagues and friends, once again this issue comes late and mislabeled (spring is over already!). But this time at least I have a good reason for my poor efficiency.

Next October I have to retire and leave my lab. As a consequence, the last few months have seen me busy collecting all the crumbs left in the hopeless effort to put together my last two-three papers, cleaning and packing.

This is not going to be the last ECRO Newsletter I am editing, there is still the Autumn issue. But most likely at the end of the year I shall hand over this pleasant duty to whom has time and wish to continue.

I believe that, for a scientist who has no more direct link with the world of research (in our case with an active laboratory), it is better to stop talking about science.

The policy of my Department has been aimed in the past 30 years to prevent me for doing good research and keep my group as small as possible (1 person, myself). In fact, during all my career I have been and still I am the only scientist in my group with a position. All my help came from students, to whom I am extremely grateful.

My situation, however difficult to believe, can be summarised as follows: for 30 years I have had and still I have the best CV in the Department, but I was always denied promotion to full professor and no position was assigned to my line of research (at the end of last year, the Department was composed of 30 full professors, 15 associate professors and 33 assistant professors). As a result, all the work produced in more than 30 years, including chemicals, proteins, plasmids, and of course knowledge and expertise, will be wiped away.

Of course, in the unlikely event that during the next few months that separate me from retirement, I might find a sort of position anywhere in the world, that allows me to do research, I shall be happy to continue this service to ECRO.

While collecting news and data for this issue, I was surprised to find that olfaction is becoming very popular. Events and Festival are being organised around odours and new ways of artistic expression are being explored guided by the nose. Certainly, odours have always been the object of art expression, but this was limited to the creation of fragrances. Later, the world of food flavours received and is still receiving increasing attention.

More and more the preparation of foods is regarded as an artistic creation, sometimes at the expenses of more traditional aspects.

But there is more in the novel attitude towards odours and olfaction. People are becoming curious about smells. So far, odours have been accepted for the messages they convey, they have been the object of poetry and linked to emotions, but all this comes after the conscious perception.

Now, we ask other questions: where do these odours come from, why are they so different, what makes them so specific. We want to investigate the nature and the source of odours, not just the effects.

Unfortunately, all these legitimate and genuine questions remain largely unanswered. The persons who organise festivals and events around fragrances, food flavours or environmental odours are in the best cases psychologist. Their knowledge of chemistry is close to ground level and physiology is also unmapped land.

To talk to non-scientists we need good scientists, active in the field, not journalists, actors or entertainers.

Unfortunately we are witnessing a general phenomenon, not only in science, that puts the attention not so much on the facts, but on the presentation. All activities are regulated to some extent by the rules of advertisement. It is not so important how good is your product, what really counts is how well you can sell it. Everyone wants to convince you that his product is the best. Very often this is done not by providing experimental data, but creating associations with pleasant memories and experiences. Well, so far for advertisement. But this attitude is contaminating science as well. Several journals now reject a manuscript, before peer review, because there is not enough novelty, or because it cannot address a wide audience, and suggest to send it to a more specialised journal. This means in other words that it does not hit the news.

Then, we come across papers where fancy conclusions are produced on the basis of experimental data that, although sound and reliable, cannot support the models and theories proposed. This is the case of Luca Turin's last paper, published in Plos One and reviewed in this issue. He uses fine chemistry and accurate experiments, that would make a good and interesting paper, except for the fact that the results are forced into an unlikely theory, that no one else is ready to give credit to.

Of course there are also pieces of light entertainment and amusement, and top journals are not immune from such contamination. In the past issues we have reviewed some good example of this new literary genre.

I wish interesting and enjoyable meeting to whomever is going to the ECRO Congress in Leuven or to the ESITO meeting in Sardinia.

From the President

Dear ECRO members,

Belgium will host for the first time an ECRO meeting in the hometown of Peter Mombaerts, Leuven. A very exciting scientific meeting "flavored" with Belgian beer and chocolate will be held at the University of Leuven, 26-29 August 2013. The city is wonderful and will favor interactions among participants. The early registration deadline has passed and 229 participants from 19 countries have already registered. However, it is still possible to register online (although at a higher price) and submit an abstract for a poster presentation: visit the website address of the congress via the ECRO homepage <http://www.ecro-online.com> and join us in Leuven!

The ECRO group on Facebook, an unofficial forum started by [Masha Niv in 2012](#), will also be useful for rapid informal communications during the Leuven meeting. At present the ECRO Group has 50 members, you are welcome to join at:

*<http://www.facebook.com/groups/355987897804124/>
The planning for the XXIII ECRO meeting in 2014 already began and information about dates and location will be communicated at the Leuven meeting. For 2015 and following years the ECRO board is looking forward to suggestions from ECRO members: do not hesitate to contact us. 2016 will be the year of the XVII International Symposium on Olfaction and Taste (ISOT), organized in Japan by the Japanese Association for the Study of Taste and Smell (JAST).*

Many thanks to Paolo Pelosi for constantly taking care of ECRO Newsletters, to all members of the ECRO board for the continuous activities, and to Peter Mombaerts and his team for the excellent ongoing organization of the XXII ECRO meeting in Leuven.

I wish you a pleasant summer and hope to see you in Leuven at the end of August at ECRO 2013.

Anna Menini

Treasurers Report June 2013

For the year January-December 2012, ECRO reported 192 paid up members and during the last year ECRO was able to give a record number of grants to 23 students and young scientists amounting to 12100 Euro. We depend on funding from “The Elsie Werner-Polak Memorial Fund in memory of our niece gassed by the Nazis in 1944 at age 7”- Donors: Ernest and Ghislaine Polak. This annual donation is divided between ACHEMS and ECRO on the basis of membership numbers declared for the previous year. So if ECRO membership numbers are low, our income is also low. This year we have received 7948 Euro which will be disbursed in grants to students and young scientists. So if you have not yet done so – please renew your ECRO membership for 2013 – this will benefit young researchers next year. We have been fortunate to benefit from proceeds from the ISOT meeting in Stockholm in 2012 which has allowed ECRO to benefit by 15000 Euro – many thanks to Bill Hansson and colleagues who made ISOT a success. This will be used to help with the organisation of future ECRO congresses. So I am pleased to report that at the end of June 2013, our total assets stood at 84781 Euro. Peter Mombaerts and his team are working hard to prepare the ECRO Congress 2013 in Leuven, 26-30 August 2013.

Grants awarded 2013

Two grants were awarded for students to attend and give presentations at the ACHEMS meeting in 2013. However one student was unable to receive an entry visa to the USA, so at the end, only one grant was given. It is a reflection on the increasing difficulty in achieving student mobility.

ACHEMS 2013

Luzie Koehler

Blankenese Conference

Alissa Allen

Jennifer Stratford

SUMMER SCHOOL on HUMAN OLFACTION

Kathrin Kollndorfer

Kristopher Magee

We are currently receiving applications for grants to attend the ECRO 2013 Congress in Leuven.

See you all there!!!



Art and Olfaction

Just my Olfaction

Artists and performers are increasingly becoming interested in smell.

Nothing new! The creation of perfumes has been always regarded as the work of artists, and even chefs have been considered creative artists for a long time. The development of all the synthetic chemistry devoted to design of new fragrances and the search for defined relationships between chemical structure and odour were first prompted by the need from perfumers of chemicals with as many as possible different types of odours. On the other hand, the chemistry of dyes and the development of technical instruments for the production of sounds had their motivations in requirement from the world of art.

But there is more than just producing tools. Artists who want to communicate their emotions through the sense of smell are now exploring new ways and possibilities.

It is a completely new field with unsuspected modes of expression, that is certainly going to provide us with interesting experiences.

Here are a couple of examples.

The mission of the Institute for Art and Olfaction (<http://artandolfaction.com>) is the advancement of public and artistic engagement with scent. In January of 2013 they commissioned artist and designer Micah Hahn to create a series of prints on topics related to perfumery.

“Fascinated by the structures of scent molecules, Micah decided to focus his work on important perfume ingredients. The first three prints produced from this series thus relate to three crucial aromachemicals in 20th century perfume: Galaxolide (IFF), Aldehyde C12 (Givaudan), and Iso E Super (IFF). To complete the sensory picture, the prints were lightly scented with the corresponding aromachemicals.”

Here is not just the smell that produces an artistic emotion, but the structure of the molecule... finally, someone who is not a chemist has realised that molecular structure ARE beautiful. At least is a great leap forward to bridge chemistry (by most regarded as technical, cold, hostile) with the common

world. What is surprising is that Micah started from the bare structures of the molecules rather than from coloured space-fill models.



Sissel Tolaas: The Science of Smell

This is the title of her home page, a Scandinavian artist using odours in a most controversial way. **Sweat vs. Perfume** is the topic of an interview, in which she declares that in the future we are going to rediscover the variety of the armpit odours and replace fragrances with them. She has prepared several concoctions to reproduce the fragrances (or the stench?) produced by bacteria on persons where they are free to proliferate.

Tolaas first stepped into the world of scent in the late 80s after studying for degrees in mathematics, chemistry and visual arts in Scandinavia, Poland and Russia. It is probably this first coat of painting of scientific disciplines that enables her to call her work "science".

Here are some excerpts from an interview:

Which ingredients do you feel will embody the smell of the future?

I think bacteria on the body is a big issue. Recently products have utilized bacteria for the purpose of producing food, so we made teas from human body sweat, and it got a lot of attention.

(no doubt such smells arise a lot of attention...)

Are we going to start to smell different in the future?

Yes. Today we all smell the same and I think that's a shame. We each have a body smell as unique as our fingerprints and I think we will start to rediscover and appreciate that.

(the message: don't wash when you smell)

Will we start to find different ways to personalize our own odors?

Yes! I think that instead of saying that Chanel No. 5 is a solution, we will start to think, "I need one molecule for leisure, another for business, another for sleep, another for healthcare," and so on.

(it is not easy to replace bacterial colonies too often, I suggest to use different clothes, where different strains of bacteria have already left their products... so the message is: don't wash your clothes!)

We wonder whether Sissel Tolaas is anosmic to fatty acids and to androstenone. In such cases, she might perceive the

former as fruity and the latter as musky.

Well, in any case, it is quite original and interesting in a way. Not all of us could agree, but that's what we call new art expression.

What we cannot certainly accept is calling all this talking "SCIENCE"!



olfactory events

Still talking about art and olfaction, Maki Ueda takes a more original and interesting approach.

OLFACTOSCAPE is a space she has built where you can follow an invisible track. It is a sort of tent 3 metres in diameter. The curtain delimiting this space is "painted" with smells.

As you walk around and smell the wall, the odour changes. Some major notes start fading, while new ones are introduced, gradually modifying the overall sensation. It is like listening to a piece of music, according to the creator of this work, where themes develop as you move along the circular path.

In fact, the parallel with music is not casual. Under many aspects the olfactory sensation, produced by a large number of ingredients, interacting in a complex way with many receptor is similar in complexity and richness to a piece of music played by the instruments of an orchestra and picked-up by thousands of sensory structures in our ears.

In this version of the OLFACTOSCAPE, independent components (aromatic ingredients) of Chanel No. 5 are separately placed (sprayed) at the different locations. If you stand in the middle point of the space, you would smell the "harmony." If you walk along the curtain, you would smell the "individual tones."



The intention is thus, to deconstruct the Chanel No. 5, and to reconstruct it again.

Enter the space, close your eyes, walk and sniff like a dog. Some scents come closer to you, while others fade away.

Maki Ueda studied media arts with Prof. Masaki Fujihata at The Environmental Information Department (B.A., 1997; M.A., 1999) at Keio University, Japan. Now she teaches and gives workshops about the sense of smell and taste at The Tokyo Art University (JP), The Royal Academy of The Hague (NL), and at the Willem de Kooning Academy (NL).



An invisible sculpture at the 55th Biennale of Venezia

It was the project of Luca Vitone, an artist exhibiting at the 55th Biennale of Modern Art, who wanted to put ETERNIT at the centre of his creation.

At the beginning he wanted to convey the long history of deaths caused by the use of Eternit (a mixture of cement and asbestos), still produced for many years after the poisoning and carcinogenic effects of asbestos had been discovered. Therefore, he

conceived an artistic creation that you could tread on, a flat uniform floor of Eternit in a room, whose walls

were covered with 100 photographs from the “Voyage in Italy” of Luigi Ghirri.

He was not allowed to take

Eternit to Venezia, therefore he resolved to a much more provocative project: a room completely empty! Well, not exactly, because the visitor can perceive odours. Not the odour of Eternit, of course, it has no odour. And then, smelling asbestos might prove not quite healthy. He scented the room with the odour of rhubarb, three types of rhubarb, Swiss, Belgian and French, the three home countries of the top managers of Eternit.

The odour of rhubarb is first pleasant, then becomes pungent, annoying, irritating, unpleasant to the point that you want to go away.



The asbestos is a fine invisible dust that goes through your nose without being perceived, but slowly carries death.

The idea of the artist is that in this room absolutely empty, without any visual stimulus, the visitor inhales the smell of rhubarb, concentrates on the odour and thinks of the many people who inhaled asbestos and found their death.

Is the message clear enough? this is not the concern of the artist: explanations could come later, what he aims at is to create emotions. Is it art? Difficult to answer, but certainly it is an original and highly provocative idea.



RECENTLY PUBLISHED

Sex and death: fatal attraction

The attraction of virgin female hide beetles (*Dermestes maculatus*) to cadavers by a combination of decomposition odour and male sex pheromones

C. von Hoermann, J. Ruther and M. Ayasse

Frontiers in Zoology, DOI: 10.1186/1742-9994-9-18



Hide beetles (*Dermestes maculatus*) feed on rotting corpses and are attracted by a particular compound that develops about 9 days after death: benzyl butyrate! Esters usually smell fruity and this is no exception. Arctander reports its odour as *floral, fruity, plum-like*. Not too bad for something coming from a rotting cadaver. The appearance of this odour and of the arrival of the beetles is used by forensic scientist to evaluate the time of death. Male beetles follow the scent to find a food source, then start calling the females.

This work shows that while the odour of cadaver or the pheromone gland extract are not attractant for the female, a combination of both becomes a tremendous lure. In other words, the female is only interested in males which can provide plenty of food.

This is not the first report indicating that mixing pheromones and food odours can produce interesting and unexpected results.

For example, the group of Emmanuelle Jacquin-Joly at INRA, Versailles, France, showed that larvae of *Spodoptera littoralis* can perceive the sex pheromone and use this olfactory cue to find food (Poivet E, Rharrabe K, Monsempes C, Glaser N, Rochat D, Renou M, Marion-Poll F, Jacquin-Joly E. 2012. The use of the sex pheromone as an evolutionary solution to food source selection in caterpillars. Nat Commun. 2012;3:1047. doi: 10.1038/ncomms2050).

A comparison with human is too obvious and immediate. We have replaced cheap rotting corpses with expensive cars and houses. Can



we say that beetles are as shrewd as humans?... or perhaps that we are no better than



K. M. Ablard, P. W. Schaefer, G. Gries
**An alternative reproductive tactic:
 A parasitoid wasp gathers and guards
 a harem by pheromone-tagging virgins**
 Behavioural Processes 94, 32-40 (2013)

The small wasp *Ooencyrtus kuvanae* is a parasitoid of the gypsy moth and lays its eggs inside the eggs of the moth.

Being short-lived, the males try to use their time as efficiently as possible by mating with the maximum number of females. As adults emerge all about at the same time, competition is very high and there is a frenetic rush to get the females.

To optimise their duties, males have developed an interesting strategy. Rather than mating as many females as possible in a rush, each male marks females one after the other with its pheromone. A “tagged” female is not approached by other males and accepts only the male who left its signature on her. In this way, they quickly built a sort of harem, where

they return later to complete their job.

The nature of the pheromone is still unknown, but careful observation of the behaviour has shown that it is delivered by the antennae of males onto the antennae of females. Such behaviour of touching antennae between individuals is not unknown in insects and secretory glands have been discovered long time ago in the solitary bee *Osmia cornuta* (Felicioli et al., 1998, *Insect Soc Life* 2:137–144) emitting specific volatiles during courtship (Yin et al. 2013, CMLS, PMID 23512006).

Tagging females is much faster than mating and in this way the fittest male can rapidly reserve most of the females and pass them his genes.

Few years ago a similar phenomenon was reported in *Drosophila*. During first mating, a protein was transferred to the fly, a sort of plug that would prevent further mating (Bretman et al., 2009, *J Insect Physiol* doi:10.1016/j.jinsphys. 2009.09.010).

The case of the wasps is particularly interesting, because a pheromone seems to be involved, and unusual, because it is produced by the antennae.

A joke that fooled many



On April 1st 2003 Google announced the launch of a new smell search feature, Google Nose. It's still in beta mode, but its "aromabase" of more than 15 million "scentibytes" is sure to entertain, featuring such wondrous odors as airport terminal, used napkin and garlic breath.

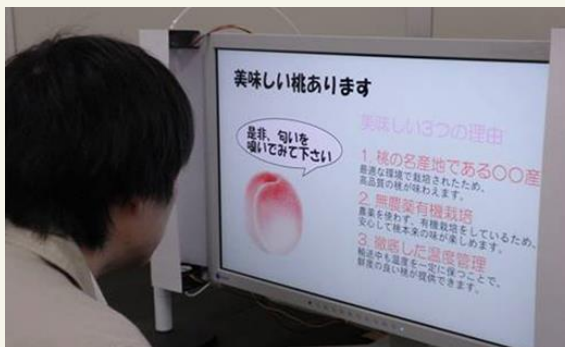
We're excited to announce our newest addition to Search: Google Nose. What do wet dogs smell like? Google Nose! How about victory? Google Nose! Try searching on Google for "wet dog" and explore other smells that people sniffed for, or visit google.com/nose to learn more. Happy smelling!



How does Google Nose work?

I have followed the instructions but I cannot smell anything, and when I click "How it works" it just takes me back to the Google Nose BETA Page. Also, how can it transmit smells to my computer? Do I need windows 8 or like a plugin for my laptop or something? How does it work?

This is real, but looks like a joke



After Smell-O-vision, now come smelly screens! Computer or television screens emanating the odour of the product being advertised. This is the last creation of Haruka Matsukura, a scientist at Tokyo University of Agriculture and Technology. Nothing magic! nothing new either. The odours are released by little pumps at the corners of the screen into air streams parallel to the screen surface. If you put your nose on the screen you feel like the odour is actually coming out of the image shown.

Do you think the image of fried chicken would be more tempting when the smell is added? May be, if you are one of those who like junk food. in any case, the smell will be even worse than the original one. To reproduce the exact flavour of a particular food is no easy task. The main problem that these approaches have to face is related to the high complexity of a natural odour. We keep extremely accurate images of familiar odours and we cannot be satisfied with poor reproductions.



Smelling burnt...

Thanks once more to Luca Turin whose creativity continues to provide material for controversial discussion. In its latest paper, published in Plos One, he reports about molecules smelling musk which become nutty and burnt after replacing hydrogen with deuterium... we definitely smell something burnt...

Despite having the entire scientific community against him and notwithstanding all the detailed criticism demolishing his previous publications, he continues to believe in his alternative model of olfactory perception.

To put such exciting debate into a historical perspective – for the sake of our younger colleagues – the first to generate a theory that odours could be perceived through vibrational modes specific to each molecule was the late Robert Wright back in 1954, based on an earlier idea of Malcom Dyson in 1928. During the late sixties and early seventies, the scientific community witnessed an interesting debate through the pages of Nature between Wright and John Amoore, who opposed his stereochemical theory. More than forty years ago, before the tools of molecular biology became routinely adopted and at a time when the chemistry of receptor proteins was at an early stage, the mechanisms of olfactory transduction were approached through theories and hypotheses to be subjected to experimental validation.

The stereochemical theory of Amoore predicted that odour was related to size and shape of the odorant molecules, more or less like the specificity of enzymes depends on stereochemical parameters of the substrates.

Nowadays, we do not talk of theories any longer, we have plenty of evidence that olfactory receptors are just part of the larger family of receptors, including those for opiod, for hormones, for glutamate, and even rhodopsin, that, although it is a transducer of light stimuli, in a way can be considered as a chemoreceptor, when we consider that it discriminates between two conformations of retinal.

But... it is hard to reject his own child. The only way around is to modify the theory and include whatever cannot be questioned, because the evidence is overwhelming.

The new theory is a fascinating product of imagination and creativity. Odours of course have to fit into receptor sites, according to their shapes... otherwise it would be



impossible to understand why two enantiomers can smell completely different (not so much to humans, but certainly to many insect species). However, once inside the cavity, they communicate their presence through specific vibrational frequencies... and here is where waves come into play.

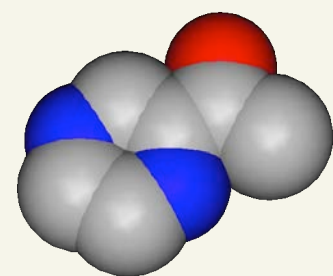
At this point, the main question is: do other types of receptors work in the same way? and what about enzymes?

If you have reached this stage and have asked yourself such deep question, it means you are close to the truth and you can perceive the tremendous novelty of this discovery! YES! the mechanism is general, it has been there under our own eyes (and noses) and we were not aware of it. Biochemistry textbooks will soon be rewritten.

We know that olfactory perception is triggered by the interaction of odorant molecules with receptor proteins. We also know that hydrogen bonds play major roles in the strength and specificity of such interactions. Therefore, it is not surprising that replacing hydrogen with deuterium (which makes much weaker hydrogen bonds) in some specific points of the odorant may affect the odour.

In a previous paper, published in the prestigious journal PNAS, Luca Turin showed that *Drosophila* flies trained to avoid 1-octanol also avoided citralva. Based on the fact that the two molecules have in

common an absorption band in their infrared spectra, the Authors conclude that olfaction depends on molecular vibrations. The fact that citronellal is very similar in odour to citralva, despite the infrared



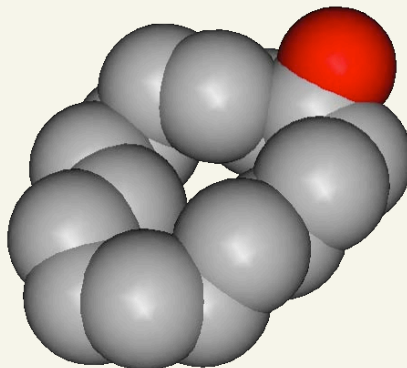
The “nutty” molecule of acetylpyrazine

a detailed critical report of that paper in the issue 82 of these ECRO Newsletters.

The recently published Plos One paper is going to convince even the most skeptic, even the very few scientists who still have some doubt about this revolutionary theory.

He takes musk-smelling molecules and replaces all the hydrogens with deuterium, very good chemistry, indeed, and a lot of work! The result is surprising: the subtle fragrance of cyclopentadecanone and other musks becomes “burn, nutty, roasted”.

He even shows that the parent molecule and its deuterated derivative can be separated on a gas-chromatographic column.



The “musk” molecule of cyclopentadecanone

Well, if they can be separated, it means they interact differently with the resin of the column. So, we can expect that their odour might be different. Why do we need vibrations to explain all this? Perhaps, it is because of different

vibrations that the two molecules have different behaviours on the column! Shall we start rewriting physical chemistry textbooks? What is also strange is that nutty notes are commonly associated with heteroaromatic compounds, such as pyrazines, thiazoles, furans of small size. Increasing the substituents on

the ring beyond two carbons is enough to lose the nutty character in

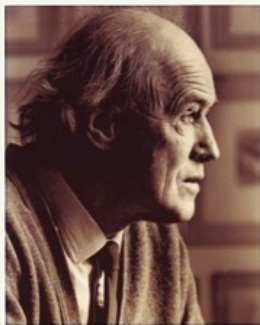
favour of green notes. How can we explain this fact? well, of course with the vibrational theory! But, according to Turin’s theory, vibration frequencies are not enough to predict the odour of a molecule. It is necessary that the molecule fits into a receptor protein (therefore there is a contribution of size and shape) and then vibrations come into play.

This “adjustment” of the theory is necessary to explain the different odours of enantiomers. So, how can a large musk-smelling molecule fit into a receptor site for small compact nutty-smelling compounds?

As in the PNAS paper, the chemistry is fine and the experiments seem to have been correctly performed, with all the necessary controls... still we are not convinced, we smell something burnt.



Smell in the literature



Roald Dahl is well known for his children stories. He wrote 19 books, two of which, *James and the Giant Peach* and *Charlie and the Chocolate Factory*, became popular movies.

He was born in 1916 in Wales and died in 1990 at Oxford. Besides his children books, he wrote nine collections of short stories in a compelling style of its own. His stories are wild, outrageous, fantastic, unpredictable...unexpected. This is the adjective that

best characterise his writing, used in two of his titles.

One of his short stories deals with a perfumer who invented the most potent aphrodisiac! Yes, it is still the fairy tale of human pheromones, but in a fiction they have full right of existing. Anyway, this is not the main interest of the story... at least for us. The title of the story is *Bitch* and the title of the collection is *Switch bitch*... you can guess the content.

What makes this story particularly interesting for us is the detailed description of the stereochemical theory of olfaction, formulated by John Amoore only few years before. In fact, *Bitch* was first published in 1974, when the stereochemical theory represented the most advanced research in olfaction and the widely accepted model, after the long debate with the other theory, the vibrational model, was finally settled... or, was it? Only last month Luca Turin produced another paper, published in Plos One, where he is desperately trying to resuscitate that old theory... or something similar.

We know that the first model of Amoore has been replaced in the course of four decades by the data of molecular biology, but at that time was perfectly acceptable for a fiction.

It was astonishing, instead, that the same model was reported as the latest scientific development in a popular science programme on the Italian television as recently as one year ago!

Here are some passages from that story, that I strongly recommend to read together with the other stories of Roald Dahl, all highly enjoyable.

He had devoted his life to the study of olfaction.

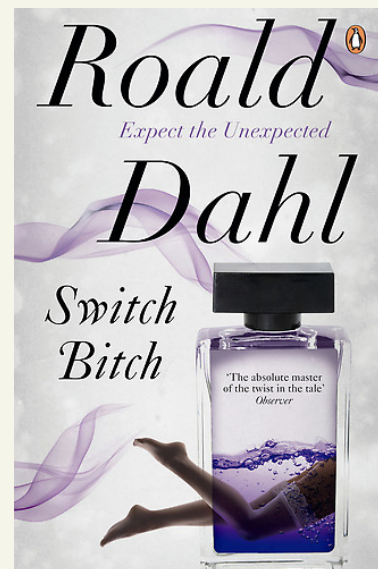
'You mean smell?' I said.

'Yes, yes!' he cried. 'Exactly! I am an expert on smells. I know more about smells that anyone else in the world!'

'Good smell or bad?' I asked, trying to slow him down.

'Good smells, lovely smells, glorious smells!' he said.

'I make them! I can make any smell you want!' He went on to tell me he was the chief perfume blender to one of the great couturiers in the city. And his nose, he said, placing a hairy finger on the tip of his hairy proboscis, probably looked just like any other nose, did it not? I wanted to tell him it had more hairs sprouting from the noseholes than wheat from the prairies and why didn't he get his barber to snip them out, but instead I confessed politely that I could see nothing unusual about it. 'Quite so,' he said. 'But in actual fact it is a smelling organ of phenomenal sensitivity. With two sniffs it can detect the presence of a single drop of macrocyclic musk in a gallon of geranium oil.'... 'Odorous molecules of a special conformation enter the dog's nostrils and stimulate his olfactory nerve-endings.



This causes urgent signals to be sent to the olfactory bulb and thence to the higher brain centres. It is all done by smell. If you sever a dog's olfactory nerve, he will lose interest in sex. This is also true of many other mammals, but it is not true of man. Smell has nothing to do with the sexual appetite of the human male. He is stimulated in this respect by sight, by tactility, and by his lively imagination. Never by smell.'

Then, he goes on, saying that he is convinced that humans had in the past a powerful odour, capable of arousing their sexual appetite. Of course, he wants to re-create such smell... well, in fact, he has already produced this concoction. But before revealing his discovery, he needs explaining how the sense of smell works and which are the *primary* odours on which our perception of odours is based.

'Then I shall tell you, otherwise I cannot answer your question. Attend closely, please. Air is sucked in through the nostrils and passes the three baffle-shaped turbinate bones in the upper part of the nose.'

'Every nerve-ending consists of an olfactory cell bearing a cluster of tiny hair-like filaments. These filaments act as receivers. "Receptors" is a better word. And when the receptors are tickled or stimulated by odorous molecules, they send signals to the brain. If, as you come downstairs in the morning, you sniff into your nostrils the odorous molecules of frying bacon, these will stimulate your receptors, the receptors will flash a signal along the olfactory nerve to the brain, and the brain will interpret it in terms of the character and intensity of the odour. And that is when you cry out, "Ah-ha, bacon for breakfast!"'

'I never eat bacon for breakfast', I said.

Difficult to conceive a more concise and at same time accurate description of how our sense of smell works, related to the knowledge available about 40 years ago. But there is more, and he ventures into details at the molecular level, to explain why we perceive all smells different from one another.

'And now you are going to ask me how on earth they can tell the difference between one odorous molecule and another, between say peppermint and camphor?'

'At the end of each receptor is an indentation, a sort of cup, except that it isn't round. This is the "receptor site"... when you sniff a certain smell, the odorous molecules of the substance which made that smell go rushing around inside your nostrils and get caught by the little cups, the receptor sites. Now the important thing to remember is this. Molecules come in all shapes and sizes. Equally, the little cups of receptor sites are also differently shaped. Thus, the molecules lodge only in the receptor sites which fit them. Pepperminty molecules go only into special pepperminty receptor sites. Camphor molecules, which have a quite different shape, will fit only into special camphor receptor sites, and so on. It's rather like those toys for small children where they have to fit variously shaped pieces into the right holes.'

'But you are surely not suggesting there are differently shaped receptor sites for every smell in the world?'

'No,' he said, 'as a matter of fact, man has only seven differently shaped sites... our sense of smell recognizes only seven "pure primary odours". All the rest are "complex odours" made up by mixing the primaries.'

Of course, we know that the picture is quite different, but what is remarkable is that this was the state of the art at that time, very accurate and updated information.

'What are the seven pure primary odours?' I asked him

'They are camphoraceous, pungent, musky, ethereal, floral, pepperminty, and putrid. Don't look so sceptical, please. This isn't my discovery. Very learned scientists have worked on it for years. And their conclusions are quite accurate, except in one respect.'

The 'exception' turns out to be the eight primary odour, that he has discovered, an odour so powerful that it can drive men to wild behaviour, as you can discover if you go on reading the story.

In Memoriam of Kunio Yamazaki Member, Monell Chemical Senses Center

Dr. Kunio Yamazaki, best known for his work on odortypes - genetically-determined body odors conferring individual identity, died with no warning from a heart attack on April 11, 2013. Local services were held in Philadelphia on April 15. A memorial celebration of his life and work will be scheduled at a later time.

Born and raised in Japan, Kunio Yamazaki received his PhD from the University of Tokyo in 1970. He was a senior researcher at the Tokyo Metropolitan Isotope Research Center before coming, in the mid 1970s, to the Memorial Sloan-Kettering Institute for Cancer Research for post-doctoral training in the laboratories of the famous President of Sloan Kettering, Lewis Thomas, and the eminent immunogeneticist Edward A Boyse. It was here that Kunio and his colleagues Boyse, Thomas and Judith Bard, made the seminal discoveries that the major histocompatibility complex (MHC) genes, best known for their role in immune regulation, also were responsible for provisioning an animal with a unique olfactory signature, called the MHC odortype.

The first publication to describe this finding (Yamazaki et al., 1976, *J. Exp. Medicine*) demonstrated that mice tend to mate with other mice that are different from themselves at the MHC loci. This discovery, which has been replicated in a number of other species by other investigators, provides a basis for maintenance of MHC diversity within a species and likely plays a central role in inbreeding avoidance. Thus the work has had implications for evolutionary biology, sociobiology and immunology. Following this paper, Kunio and collaborators, who now included Gary Beauchamp at the Monell Chemical Senses Center, proved that urinary odors could mediate discrimination between mice of different MHC types.



In 1980, Kunio was recruited to join the Monell Center where he became a full Member in 1990. Although his work was focused primarily on mechanisms and functions of MHC odortypes in mice, he also published papers on odor-based disease diagnosis, detection of an animal's age based on body odor, and human odortypes. He wrote over 100 papers, most published in high profile journals. His work spawned an entire field of research in how the MHC genes of many species impact on olfactory individuality, mate choice and conspecific recognition. At his death, he was working on studies demonstrating that immunization alters body odor and that fetal MHC odortype remnants remain circulating in the mother after the pups are born and removed from her – a sort of olfactory microchimerism.

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Kunio Yamazaki was an international scientist and scholar who lectured at meetings and universities around the world.

He maintained a special presence in Japan while he pursued his career in the United States.

In 1999 he published *Genes that Govern Olfaction* in Japan. This book received the Japanese Science and Technology Book Award, equivalent to the U. S. National Book Award for science writing.

This honor provides an elegant connection to one of Kunio's original mentors, Lewis Thomas, who had won a National Book Award for his classic series of essays, *Lives of a Cell*, that included a discussion of pheromones presaging the odortype work that would follow. More recently, in 2010, Kunio became the first recipient of the *Outstanding Achievement Award* from the Japanese Association for the Study of Taste and Smell acknowledging his foundational work on odortypes.

Kunio's many contributions to the Monell Center have been central to its success. Administratively he maintained excellent relationships between the Center and its many Japanese company and university colleagues. Scientifically, he was an active counselor of young scientists, a generous collaborator, and valued advisor. To all who knew him, he was gracious and kind, thoughtful and caring. We mourn his death as we celebrate his creative and productive life. He is survived by his beloved wife, Tomoko, and his talented and beautiful daughter, Hiroko.

Gary K. Beauchamp, April 15, 2013

Students' reports

Every year ECRO offers many students and young scientists the opportunity of attending Conferences or visit other labs for short periods, providing them with grants.

In this space, they report on their experiences, both scientific and human.

Alissa Allen from Blankenese

I would like to thank ECRO for their generous travel grant that enabled me to attend the 33rd Blankenese Conference in Blankenese Germany. I was elated to hear that I would be given the opportunity to attend and present my most recent findings during a poster presentation. The theme of the conference was Nutrient Sensing: From Brain to Gut. My research explores the influence of genetic variation in bitter taste genes on perception of bitterness in human volunteers.

Before the conference, I reviewed the list of speakers and familiarized myself with each of the lectures. Many of the presentations aligned with different aspects of my own research. I was looking forward to hearing about new findings and on-going studies in covering topics from sweet, bitter and umami receptors to activation and signaling pathways from the gut to the brain.

The conference center was situated in a beautiful wooded area in Blankenese with an amazing view of the Elbe River. It began on the 25th of May, with a presentation from Dr. Bill Hansson about drosophila and their behavior response to different compounds.



This work has helped to uncover how insects use odors to search for nutritious food, while avoiding potential toxins. Other speakers included Dr. Steven Munger, Dr. Thomas Hofmann, Dr. Veronika Somoza and Dr. Maik Behrens.

Over the course of the four days, I met a number of people with similar interests, including two students from the University of Vienna along with another student from Wageningen University in the Netherlands. We discussed current projects, previous lectures, and future potential projects. The poster session where I presented my work, was held on the second day and consisted of 23 posters, covering a wide range of topics.

Notably, very few included human subjects, while many involved *in vitro* testing and mice and feline subjects. Of particular interest to me was a poster evaluating the release of serotonin and dopamine by treating cells with capsaicin. This release of neurotransmitters is triggered by the activation of the temperature receptor hTRPV1. Coincidentally, on-going research in my lab involves measuring oral burn and bitterness perception from capsaicin. Previously, I had not considered the effects of neurotransmitters on the perception and consumption of capsaicin and other compounds that activate TRPV1, so it was great to see work about this from a different perspective.

During the poster session, I had the pleasure of speaking to several individuals who were familiar with my research. Some of the discussion around my poster has led to the inclusion of more compounds to our study, as well as ideas for future studies.

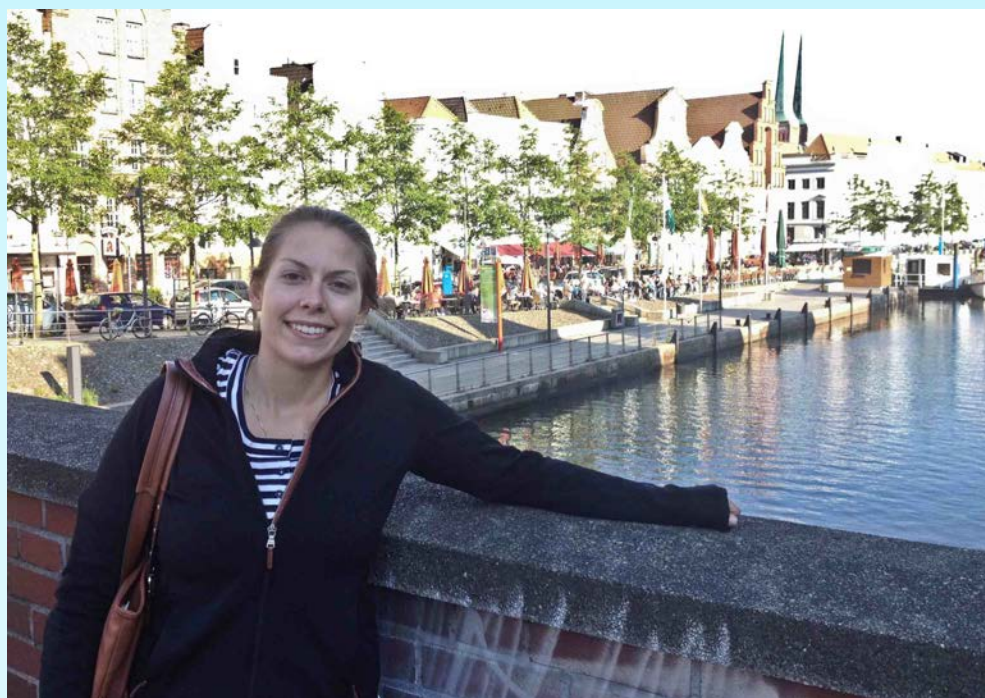
One of the long-term outcomes of attending this conference is the connections we have made with other labs, especially those specializing in different models to those I have used.

Since returning from Blankenese, there has been a lot of discussion within our lab of branching into new types of studies, such as cell-based models, and adding compounds into an existing protocol we previously did not consider.

In summary, this conference experience was immensely beneficial for my academic career. The experience has expanded my knowledge outside of my field of study and has broadened my awareness of the many pathways and signaling initiated by olfaction and gustation as well as helping me to make new connections within my field.

I would like to thank the conference committee and ECRO for helping to support me in attending this conference, as it has had a great impact on me, both as a researcher and as a student.

Alissa Allen



Jennifer Stratford from Blankenese

The 33rd Blankenese Conference, Nutrient Sensing: From Brain to Gut, was an amazing experience. The small size of the conference (~ 60 registrants) encouraged attendees from all career levels to converse across a diverse range of topics and animal models. Moreover, the cutting-edge research ideas and discourse exchanged was unparalleled. Although all of the research presented was interesting and exceptional, I found several presentations particularly compelling.

The conference began with a presentation by Bill Hanson who studies olfaction in *Drosophila*. His research found that flies are repelled by the smell of geosmin, which normally is emitted by fungi. Because the consumption of fungi is deadly for flies, the ability to detect the presence of fungi in potential food sources is essential for a fly's survival. Further, Dr. Hanson found that a single hair cell neuron on the fly's antennae is responsible for the ability to detect this by proxy fungi signal. These findings were of particular interest and importance as I approach my own research questions from a neuroethological perspective as well.

Next, Tony Sclafani presented his work on the role of the intestinal glucose co-transporters, SGLUT1 and SGLUT3, in stimulating conditioned preferences for sweeteners. Tony's research is directly related to my own as we both utilize a conditioned flavor preference paradigm to determine the neural mechanisms that underlie the post ingestive detection of sweeteners. However, I am interested in how the interplay between oral and post oral detection of sweeteners is represented/processed in the brainstem; whereas, Dr. Sclafani is interested in how the gut detects sweeteners. Tony found that the activation and transportation of glucose, via SGLUT1 and SGLUT3, is necessary for the post ingestive conditioning effects of sweeteners. Surprisingly, the caloric value of sweeteners is not essential for this effect. Sugar analogues that aren't metabolized, such as MDG and OMG, still activate SGLUT1 and SGLUT3 and have similar conditioning effects to sugars.

Together, these results are important as they provide a potential mechanism for sweetener detection in the intestine. Thus, I plan on exploring the role of SGLUT1 and SGLUT3 in my own research in the very near future.

Several other presentations complemented this research particularly well. First, Steve Munger presented work showing that sweetener detection is dependent upon glucagon signalling in T1R3- positive cells. The role of T1R3 in the intestine is interesting as T1R3 is an obligatory subunit for the taste of sweet and umami (protein) in the oral cavity. Thus, the perception of sweet taste in the mouth has parallel signalling pathways in the gut as well. Second, work on the role of the glucagon receptor, GLP1, by Christoph Beglinger provided further insight into the mechanisms that are involved in glucagon signalling.

Surprisingly, T1R3 is involved in intestinal detection of other nutrients in addition to sweeteners. In an elegant set of experiments, Soraya Shirazi - Beechey found that T1R3 and T1R2 receptors in the intestine can act as gut luminal sensors to detect amino acids (proteins). In particular, the T1R2 and T1R3 subunits are expressed in L and K cells in the intestine. Upon activation by ingested amino acids, these cells cause the release of the satiety peptide, cholecystokinin (CCK), from endocrine cells in the proximal intestine. Furthermore, Ormond McDougald found that T1R2/T1R3 receptors are also involved in adipocyte differentiation and metabolism. Together, these studies demonstrate that receptors traditionally thought to be only involved in the detection of taste stimuli in the mouth are also important for the detection of nutrients throughout the gastrointestinal tract.

Other noteworthy topics included: 1. the role of opioids (Gilles Mithieux) and the dopaminergic system (Ivan De Araujo) in the post ingestive detection of fats and sugars; 2. how the potassium channel 1.3 can act as a glucose sensor in the mitral cells of the olfactory bulb (Debra Fadool); 3. the role of canonical intestinal bitter taste receptors in the detection of nutrients (Inge De Poortere and Veronika Somoza) 4. non-traditional places for fat storage and fat storage mechanisms, such as the in the small intestine (Wolfgang Langhans); 5. chemosensory cells in the gastric mucosa (Heinz Breer); 6. protonomics in saliva (Thomas Hoffman); and 7. nutrient sensing in the pig (Eugeni Roura).

Finally, Mikai Covasa's presentation on how gut microbiota can influence intestinal signalling had the most long-term implications. Whether gut microbiota can alter the digestion of nutrients remains largely unexplored. Yet, the microenvironment of our gut is most certainly involved in the post oral detection of nutrients. Dr. Covasa's data suggest that gut microbiota in the intestine can modify the way signals are transmitted in the intestine. This research provides another potential therapeutic target in the management and treatment of obesity. Thus, it is likely that future researchers and clinicians will take into consideration the gut microbiotic composition.

In sum, I found my attendance of the 33rd Blankenese Conference was immensely beneficial. I met new people whose research complements my own. I exchanged ideas with researchers that are leaders in the brain-gut scientific field. Most importantly, I received excellent feedback on my own research as well as encouragement from the scientific community to continue to pursue my own research ideas.

I would like to thank ECRO once again for making my attendance of this conference possible.

Jennifer M Stratford, PhD

University Colorado Denver School of Medicine

Department of Cell and Developmental Biology,

Aurora, CO 80045

Martin Steffl from Dresden

I had a great opportunity to spend one month at the Smell and Taste Department, University Hospital Carl Gustav Carus Dresden, in the end of the last year. I was invited by Prof. Dr. med. Thomas Hummel to stay at the department, during November 2012, because of my interest in field of smell. We also started to cooperate on a study focused on smell last year.

My stay was divided into two parts. I spend most of my time there just at the Smell and Taste department, but because I am medical doctor, I was also interested in the clinical part of diagnostic and treatment of diseases associated with smell disorders. Especially focused on treatment of nasal polyposis. It means that I was visiting the outpatients, wards and also surgical procedures. In this point of view was very interesting to compare the system and conception in Germany and Czech Republic. Here I would like to thank PD Dr. med. Volker Gudziol, who enabled me the entrance to the other parts of the clinic and helped me a lot.

The investigating methods of smell and taste were introduced to me during my stay at the Smell and Taste Department. I was apprised with the basic psychophysical methods, like Sniffin Stick testing, gustometry, electro gustometry, as well as with those more sophisticated, like objective olfactometry and gustometry. This was for me something new, because I saw these devices just once before this stay.

These were used not only for standard investigation of patients with smell and taste disorders, but also to more or less clinical research. I was also able to help them with investigation of some of the patients after a little introduction.

I was lucky, that I could spend some time with Prof.Hummel, who is really nice person and also great scientist. He showed me a lot particularly in strategy of smell and taste disorders treatment. There were many patients coming to ask him to help them with these problems. He introduced me each patient's data, subjective problems, their other diseases, results of investigations and then the designed therapy.

There are not only Germans working in the laboratory, but also people from other countries. They are working on some research or commercial projects. Thus I could meet new people from France, like Johan or Charlotte or Emilia from Italy.

Dresden is really nice city with reach history. There are settled some of interesting museums, for example Albertinum, where I visited Gallery Neue Meister (New Masters Gallery).

I couldn't unfortunately visit the Semperoper, which is Saxon State Opera and is sad to be famous. On the other hand I joined culture in Dresden, visiting other concerts.

It is great, that here are organizations, which are supporting young scientists a students in their effort to get new knowledge's, visiting another laboratories or participating on important conferences. Thus I would like to thank ECRO for the grant, which allowed me to stay in Dresden for one month, what was really interesting for me and gave me new experiences and ideas for my future work and research.

*MU Dr. Martin Šteffl
Dept of Otorhinolaryngology
and Head and Neck Surgery,
1st Faculty of Medicine, Charles University,
Faculty Hospital Motol*

Forthcoming Meetings



The ECRO Board is pleased to be able to announce that the next ECRO meeting, ECRO XXII, will be held in Leuven, Belgium, 26-29 August 2013. The meeting will be organized by Prof. Peter Mombaerts. Please visit the [ECRO XXII congress website](#).

September 22nd - 28th, 2013
Villasimius, Italy



ESITO
European Symposium for
Insect Taste and Olfaction



Contact: esito@ice.mpg.de

1st International Workshop on Odor Spaces

4th - 7th September 2013 - Herrenhausen Palace, Hannover, Germany

Dear colleagues,

we'd like to invite you to the 1st International Workshop on "Odor spaces". The goal of this workshop is to deepen our understanding of the various interdisciplinary aspects of odor spaces: across the chemical, sensory, perceptual and physical levels. A summary of the workshop, including a list of confirmed participants is available on the website:

<http://odorspaces2013.org>

The ultimate aim of the workshop is to produce a series of reviews and opinion articles on odor spaces, to be published in a peer-reviewed open-access journal. To facilitate this, we will form focus groups during the workshop, to elaborate particular aspects of odor spaces independently and ideally draft an article outline.

We particularly encourage posters and talks related to the construction and/or analysis of olfactory related experimental or chemical databases that will be essential to making future progress on the odor space problem.

The workshop will take place on Sep 4-7th 2013 at the beautiful location of Herrenhausen Palace in Hannover, Germany. The number of participants is limited to 60. One third of the places are reserved for young investigators, PhD students and postdocs. Full board accommodation will be provided. There is a possibility that we will be able to provide a limited number of travel grants. Please indicate whether you need travel support in your application. To apply, please send an abstract (500 words max) of your presentation (post/short talk) and a statement of motivation including your contribution to the field (1 page max) to apply@odorspaces2013.org [<mailto:apply@odorspaces2013.org>](mailto:apply@odorspaces2013.org). Participants will be selected on the basis of their abstracts, their motivation to attend the meeting and their past contribution to the field. Deadline for applications is July 4th, 2013. Applicants will be notified on the success of their application until July 11th, 2013.

Kind regards,

Michael Schmuker, Freie Universitaet Berlin, Germany
Amir Madany Mamlouk, Uni Luebeck, Germany
Tim C. Pearce, Leicester University, UK

Chemical and ecological space

Nick Strausfeld (University of Arizona, USA)

Terry Acree (Cornell U, Ithaca, USA)

Moustafa Bensafi (University of Lyon, France)

Joel Mainland (Monell Chemical Senses Center, Philadelphia, PA, USA)

Michael Schmuker (Freie Universität Berlin, Germany)

Sensory space

Stuart Firestein (Columbia University, New York, USA)

Tom Bozza (Northwestern University, Evanston, IL, USA)

Brian Smith (University of Arizona, USA)

Venkatesh Murthy (Harvard University, USA)

Sigrun Korsching (University of Cologne, Germany)

Yevgeny Sirotnin (Rockefeller University, USA)

Michael Leon (UC Irvine, USA)

Johannes Reisert (Monell Chemical Senses Center, Philadelphia, PA, USA)

Detlev Schild (Georg-August-University Göttingen, Germany)

Silke Sachse (MPI Chemical Ecology, Jena, Germany)

Ron Jortner (MPI Munich, Germany)

Alexei Koulakov (Cold Spring Harbor Laboratory, USA)

Martin Strauch (University of Konstanz, Germany)

Perceptual space

Noam Sobel (Weizmann Institute, Rehovot, Israel)

Luca Turin (Fleming Biomedical Sciences Research Centre, Vari, Greece)

Christophe Laudamiel (DreamAir LLC, New York, USA)

Thomas Hummel (TU Dresden, Dresden, Germany)

Dima Rinberg (NYU Neuroscience Institute, NY, USA)

Manuel Zarzo (Technical University of Valencia, Valencia, Spain)

Amir Madany (University of Lübeck, Germany)

Artificial Olfaction and physical space

Corrado di Natale (University of Rome, Italy)

James Bower (UT San Antonio, TX, USA)

Jeff Riffell (Washington University, Seattle, USA)

Stephen Trowell (CSIRO, Black Mountain, Australia)

Barani Raman (Washington University St. Louis, USA)

Ramon Huerta (University of California San Diego, USA)

Maxim Bazhenov (Salk Institute, San Diego, USA)

Dominique Martinez (INRIA, Nancy, France)

Thomas Nowotny (University of Sussex, Brighton, United Kingdom)

Tim Pearce (University of Leicester, Leicester, United Kingdom)