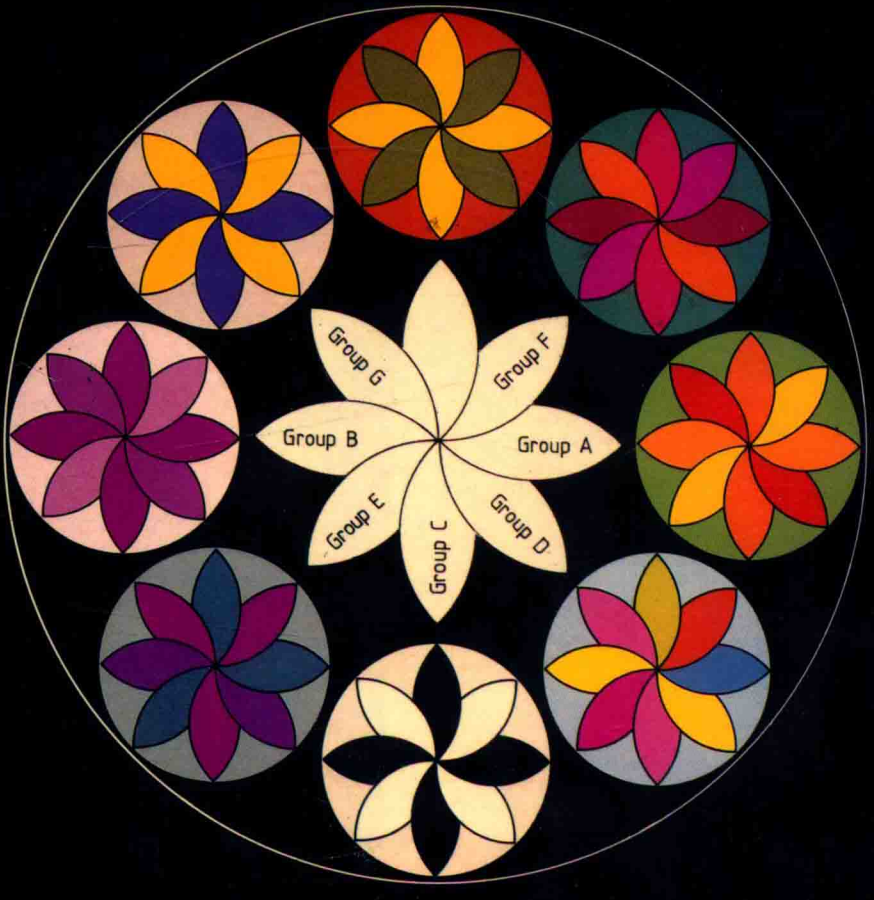
PERFUMERY

The psychology and biology of fragrance

EDITED BY

Steve Van Toller and George H. Dodd



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Preface

THE SENSE OF SMELL

The nose is normally mistakenly assumed to be the organ of smell reception. It is not. The primary function of the nose is to regulate the temperature and humidity of inspired air, thereby protecting the delicate linings of the lungs. This is achieved by the breathed air passing through narrow passageways formed by three nasal turbinates in each nostril. The turbinates are covered by spongy vascular cells which can expand or contract to open or close the nasal pathways.

The olfactory receptors, innervated by the 1st cranial nerve, are located at the top of the nose. There are about 50 million smell receptors in the human olfactory epithelia, the total size of which, in humans, is about that of a small postage stamp, with half being at the top of the left and half at the top of the right nostril. The receptive surfaces of olfactory cells are ciliated and extend into a covering layer of mucus. There is a constant turnover of olfactory cells. Their average active life has been estimated to be about 28 days.

A major neurological feature of the sense of smell is the large number of receptor cells that converge upon a relatively small number of secondary cells, located in the olfactory bulbs which lie on the under surface of the brain. This convergence indicates that the sense has evolved in terms of sensitivity. It has been calculated that as few as seven or eight molecules striking an olfactory cell will produce a nerve impulse with about forty nerve cells needing to be stimulated before a smell sensation is reported. There have been numerous theories of olfaction, but all have failed to explain how we detect smells. A detailed account of olfactory processes can be found in the first chapter of *Ageing and the Sense of Smell* (Van Toller, Dodd and Billing, 1985).

In addition to smell receptors, the nose of humans contains another system, a touch system, which is often mistakenly assumed to be part of the sense of smell. This second system is the trigeminal system and it is part of the extensive 5th cranial nerve. Somatosensory or touch nerves detect pungent substances, such as ammonia, carbon dioxide and acetic acid. The

chemosensory system is best illustrated by the protecting head-averting reflex when a pungent substance, such as household ammonia, is inhaled.

THE PERFUME INDUSTRY

Perfumers have a low public profile. Whereas most people meet physicians, plumbers or bank managers, they will probably never meet a perfumer. Indeed, few of the enthusiastic readers of fashion magazines could name a perfumer. Perfumers learn their craft by joining manufacturing companies as apprentices. Perfumery is not encountered as a university course of study and, at present, there is very little communication between the perfume industry and the academic world. It is for this reason that we intend to have courses at the University of Warwick, designed to introduce people in the perfume industry to the sense of smell.

Human interest in pleasant smells is ancient. Aristotle noted the aesthetic aspect of the smell sense by pointing out that it could be pleasurable even when the source neither protected nor nourished. In addition, Aristotle argued that pleasant smells could contribute to the well-being of humans. Later, the Roman poet Lucretius wrote that pleasant smell particles were smooth and round whilst unpleasant smell particles were barbed and prickly and invaded the senses by intrusive actions.

The study of perfumery is a multidisciplinary activity which overlaps the molecular sciences – chemistry, plant biochemistry, biotechnology, with the humanistic fields – literature, advertising, fashion and aesthetics. The immensely successful and growing perfume industry has not, apparently, hitherto felt the need to examine the psychological phenomena underlying the effects of fragrance.

If we turn to consider the related pharmaceutical industry we find that it has evolved much more rapidly this century. Up until the end of the last century, there were many similarities between the activities of pharmacy and perfumery. Both chiefly used plant extracts and pharmacists formulated simple perfumes. Advances in biochemistry during this century have revolutionized our understanding of the ways in which drugs work. Unlike the perfumery field we find that academic study of pharmacology works in close conjunction with the pharmaceutical industry. It is not unusual to find a pharmacology department in a university taking the initiative and organizing a meeting on new areas of drug action.

THE PSYCHOLOGY OF PERFUMERY

Although an important book on the psychology of perfumery was published

in 1951 (Jellinek, 1951), until the conference held at the University of Warwick in 1986 there has previously never been a joint meeting of the industrial and academic disciplines relating to the sense of smell. Each year brings the launchings of many new perfumes; the respective national perfumery societies hold meetings; conferences on the sense of smell take place. These events involve the exchange of important knowledge relating to perfumes but the information remains largely isolated.

The Warwick Olfaction Research Group is unusual in that it is led by two people, one of whom is a practising perfumer with an understanding of what it means to be asked to create a perfume, and the other a psychologist with an expertise in the area of emotion. Our interaction (Dodd and Van Toller, 1983) was a potent stimulus to hold the First International Conference on the Psychology of Perfumery. The main purpose of the meeting was to see if there was a framework that would knit the area together into a coherent set of ideas and also to give new perspectives to the study of perfumes. We invited speakers from all areas of the discipline. Thus, the meeting brought together people from the fragrance industry, academics and aromatherapists into a forum for debate. Besides the scientific basis of smell and perfumery, other important topics, including the important one of educating the general public about olfaction and perfume, were discussed. Hopefully, the meeting brought fresh perspectives to current issues in perfumery. Following our meeting, Annette Green of the Fragrance Foundation in New York, coined the word 'Aromacology' to identify this new area.

PLAN OF THE BOOK

Anyone interested in the sense of smell must have some knowledge of the abnormalities of the sense and this important aspect is discussed by Douek in the foreword. The book is divided into five sections, each having an important bearing on any discussion concerning perfume and fragrances.

Part I relates to biological underpinnings. Stoddart, bringing a zoological perspective to the problem, presents *Homo sapiens* as the scented ape and suggests certain biosocial reasons for the use of perfumes in the female of the species. Dodd, a biochemist and perfumer, discusses the aromatic molecules and analyses their chemical, physiological and aesthetic roles in human behaviour. He also questions the basic tenets of the aromatherapists. Gower and his colleagues review and present new, fascinating findings about the role of the odorous steroids produced by the apocrine glands, which are located in certain areas of the skin.

Part II deals with the important developmental and social aspects of fragrances. Engen reviews earlier studies on how babies react to odours and points to the paramount importance of the learning processes in human

reaction to an odour. Baron has carried out a number of experiments on how a perfume wearer is perceived. He concludes that perfume can be used as a tactic of impression management, so long as a series of cautions is taken into account.

Part III is concerned with the electrical activity of the brain during odour perception. Torii and his colleagues present a series of studies that involve the measurement of the DC voltage activity of the brain during the smelling of odours. They report both psychological and electrical changes of the brain in response to odours. Van Toller discusses the similarities between emotion and the sense of smell before reporting two new techniques involving AC electrical activity of the brain.

Part IV concerns two authors from widely differing backgrounds who are, nevertheless, both interested in the role of fragrances in inducing mood and relaxation states. King, who is a psychiatrist, uses odours to help reduce stress in his patients. He analyses the precise role of the sea-shore or woodland fragrances used in his therapy techniques. Tisserand presents an historical and a contemporary account relating to the use of aromatic essential oils in aromatherapy.

The fifth and final section contains four chapters by authors who all deal with the perfume consumer. Mensing and Beck describe their personality test using a coloured rosette, which has a value for indicating the type of perfume the testee is likely to favour. Byrne-Quinn works in the fragrance industry and her job is to understand how a product's odour is perceived by customers of Quest International. She reports that it is possible to classify consumers into odour-perception types. Le Norcy, in the penultimate chapter, takes us to the perfume counter and discusses problems relating to the sale of perfume and the training of the perfume sales assistant. As Le Norcy points out, the selling of a perfume involves a complex interaction between the consumer and the representative of the perfume house. The final chapter, by Green, discusses the important role played by the Fragrance Foundation in educating public awareness of fragrance and perfume. The industry is moving away from the 'mysterious' to a more enlightened position, concerned with educating the public about the forgotten sense of smell.

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Finally, the Second International Conference on the Psychology of Perfumery will be held at the University of Warwick in July, 1991.

Foreword
Abnormalities of smell

E. DOUEK

When studying perception, it is always interesting to consider the abnormal. Observing what happens when things go wrong offers a new insight into forms which otherwise may be taken for granted. Deafness clearly defines the place that hearing has in human development, together with the function that sound has in communication and the elaboration of language and, more subtly, whether the higher concepts of human understanding that seem to depend on language can be found if hearing and language are absent.

The sense of smell, and therefore of taste and flavour, also invokes a system of communication. This sense has not been developed in humans to the point of a language or transduced to writing, it has therefore been more difficult to describe and define. Nevertheless, we are aware of its presence and uncertain role, and we therefore experience a certain unease when considering its possible influence. Newspapers abound with entertaining pieces on animal pheromones and their possible presence in humans. Behind it all is our sexual anxiety: is there a means of enhancing our attractiveness, and our influence, surreptitiously? Put very crudely in reproductive terms, 'can I aspire to the greatest choice in selecting the genes with which to mingle my own in the creation of my descendants?' Or in terms of power, 'could I become so irresistible that people will do what I want them to?'

The possible ways to a wide sexual choice and economic social power are documented in practically every history or novel ever written and humanity does not cease to reflect upon them, from beauty and techniques for its enhancement to intelligence and how it can be trained. Smell retains a mysterious element because its place is uncertain anyway, and because it offers tantalizing possibilities of a pathway which shortcuts beauty, intelligence, training and money. In this way, it lies closer to magic and its potions than to other aspects of human endeavour. More recently, it has been brought into psychological terminology – 'bonding' between mother and

baby, 'territorial marking', aggression, and so on. We should not forget that knowledge of psychology is often felt to represent the exercise of an 'underhand' power as it gives a technique for understanding, predicting and therefore countering other people's behaviour.

What, then, can abnormalities of smell teach us? The main problem that we come across is a decrease in the ability to smell. When it is total, it is referred to as anosmia but unfortunately the term is often extended to refer to any type of loss, even when it is partial. Clinically this is a serious mistake as the prognoses are totally different. Patients suffering from anosmia rarely get better, but when there is a diminution only, a high proportion have a chance of improvement, especially with treatment.

The causes of total anosmia fall into two main categories. The first is head injury and is probably the most common. In my experience road traffic accidents produce most cases and these are often associated with other neurological deficits, but from time to time we see other injuries such as those sustained in muggings or people who have slipped and fallen. The obvious injury is a blow to the forehead or face but not infrequently the patient has fallen on the back of the head producing a 'contre-coup' effect with the brain displaced from back to front. This displacement may tear the fine nerve fibres as they pass to the olfactory bulb.

The second main cause of anosmia seems to be a viral infection – *seems* because we have not isolated a specific virus on the one hand, and there is on the other a tendency to attribute all diseases of unknown aetiology to 'viruses'. In some ways, it is similar to possession by demons in medieval times and we could make a case for the virus as a 'demon'. However, in favour of an infective cause is the fact that patients describe an influenza-like illness with some fever, malaise and nasal obstruction during which the sense of smell disappears. At first they are not alarmed as they expect not to be able to smell properly in the circumstances. It is only when the illness improves and the nasal obstruction is cleared that they realize that olfaction does not return. There is one typical and specific system in such cases. Patients perceive from time to time a fleeting whiff of smell, but it is very brief and the sensation they experience although olfactory is the same whatever the actual smell. It is a single, non-discriminating response and invariably carries a bad prognosis. I have never seen anyone recover.

Complete anosmia results in serious problems. There is always an element of depression and this can often become severe and intractable. Patients will describe the world as dull and colourless, and it is difficult to decide whether this is simply a common feature of clinical depression or whether it is the direct, real effect of the loss of so many sensations. Perhaps there is no real dividing line between the one and the other?

To many patients the inability to taste food has been the major loss. A few who have managed to overcome their despondency have tried to devise

foodstuffs which produce some interest despite loss of flavour, but this has never been properly exploited. It is worth discussing in some detail possible further development. First, we should consider what residual experiences survive:

1. Taste for salt, sweet, sour and bitter.
2. Perception of burning such as that obtained from chilli, pepper or curry powder.
3. Perception of texture such as identifying differences between thick and thin sauces and recognition of what textures and surfaces are agreeable.
4. Vision, so that attractive preparations can arouse interest.
5. Audition, identifying the difference between crackly and soft sounds.

This, then, allows the possibility of elaborate permutations, and although there is no way in which the loss of flavour can be replaced, it does offer some chance of a greater interest in food. I should add, in this context, that there is a small group of patients who have lost the sense of smell completely, yet do not complain. All I can say is that perhaps these had in common a certain familiarity with repetitive and uninteresting food even before their injury.

I have two patients who appear never to have had a sense of smell. They are probably congenital anosmiaics; they were certainly not bothered by it, only curious about their missing sense.

When patients have a partial loss of smell which we should properly call hyposmia, or when the sense of smell comes and goes, the prognosis is totally different. Generally speaking, it is good because it suggests that the olfactory organ is normal and there is present some obstruction such as mucus or swelling. Surgery is sometimes helpful, but the main form of treatment is topical, intranasal steroids. Quite remarkable successes have been achieved by a combination of both with resulting exhilaration in the patient. One somewhat sophisticated woman of scientific bent described the wonderful sensation of the return of smell as being like 'making love again after a long interval'. This rather imaginative declaration from an articulate woman has certain implications regarding the emotional levels at which olfaction operates. One can only with difficulty imagine such a statement made when someone recovers the ability to see or hear. Certainly I have never come across this association following a successful operation for deafness.

A relatively common abnormality is the illusion or hallucination of smell. The term parosmia has been broadly associated with this symptom. In the most common category it is associated with loss of smell, often after head injury. The sensation consists almost invariably of a bad smell which is usually difficult to describe, but similar to that of drains or faecal matter. These poor people are not only deprived of their sense of smell, but have to experience these unpleasant sensations as well.

A second group of patients is more difficult to define. They have no loss of

smell, but they do have frequent experiences of a bad smell. This tends to be faint and not dramatic, but causes a good deal of concern. The personalities of these people have characteristics in common: they are shy and withdrawn and a subgroup feels that the unpleasant odour emanates from themselves. Here there are obvious associated problems and in rare cases the olfactory hallucination is associated with paranoid feelings. These generally do not develop into anything more florid. It is said that Louis IX, King of France, suffered from this complaint, and his skills in countering real or imagined plots gave him a reputation for cunning. The countermeasures he took could easily be looked upon as those of a paranoiac, but there is no doubt that as a king in those unstable times he was rather successful.

A third group of patients suffers from hallucinations of smell. In those cases there is an association with temporal lobe epilepsy and the olfactory sensation may be part of the aura which precedes the fit or, in rare cases, may represent the fit itself. The smell then is most often one of burning, but in view of these cases it is best to consider this possibility whenever a patient complains of parosmia.

Very occasionally we find people who complain of hyperosmia, or say that they are so susceptible to smells that it is indeed a disease. There are never any clinical findings and it is difficult to find an explanation. By analogy, it is not possible to see too well or to hear too well although excessive sensitivity to light occurs, and people with a cochlear type of hearing loss do suffer from over-sensitivity to loud sounds and distortion. The meaning of hyperosmia remains obscure.

Occasionally we see a patient where an olfactory sensation produces a sense of *déjà vu* or of true recall. This does not necessarily imply serious neurological disease and in some ways it may be a not unpleasant aspect of life. There is Marcel Proust's experience of how the smell/taste of a Madeleine biscuit dipped into tea began his recall, years later, of the summers of childhood spent at his aunt's house in the country, and ultimately inspired the writing of his great seven-part novel.

Abnormalities of smell are common and the sensations experienced often bizarre. Patients will describe them in detail and may become obsessed with the strange nature of the sensations they experience. In practice, these descriptions do not help much with diagnosis. In the end, we find that we must exclude serious lesions, such as intracranial tumours, but that after this we have to divide cases into those that will get better and those that will not. We are still looking for a clinical electro-physiological test to investigate the neuronal patterns, and we are always searching for better means of quantifying the abnormalities complained of.

Contents