Chemical Senses- Smell and Olfaction

MIOARA DECUSARA[1], AURELIANA CARAIANE[2]*, LUANA ANDREEA MACOVEI[3], MARIANA ILIE[1], SERGIU CIPRIAN FOCSANEANU[4], ANTONELA MAGDALENA COVACI[1], MAGDALENA RUSU NEGRAIA[1], GHEORGHE RAFTU[5]

[1]Dunarea de Jos University of Galati, Center of Medical-Pharmaceutical Research, 47 Domneasca Str., 800008, Galati, Romania.

[2]Ovidius University of Medicine and Pharmacy, 124 Mamaia Blvd., 900527, Constanta, Romania

[3]Grigore T. Popa University of Medicine and Pharmacy, 16 Universitatii Str., 700115, Iasi, Romania

[4]Gh.Asachi Technical University of Iasi Faculty of Materials Engineering, Dimitrie Mangeron Str.,700050, Iasi, Romania

[5]Counselling and Career Guidance Center, University Ovidius of Constanta, No. 124, Mamaia Blvd., 900527, Constanta, Romania

The mucosa of most of the nasal cavity has no olfactory function. The olfactory receptors are found in the nasal mucosa in a reduced region - the olfactory area, represented by the walls of a narrow niche formed by the upper nasal cornet, the upper septum and the roof of the nasal cavity (the cryobriform lamina of the etmoid). The smell is very similar to taste, being described by some as 'taste at a distance'. Olfactive recipients adapt quickly. It is common that an unpleasant smell, at first very difficult to bear, becomes quickly inacceptable. Generally, the olfactory potential of some chemical compounds belonging to a homologous series grow progressively from the lower compounds of the series to the upper ones. The division of odors by category is a very difficult problem. In case of olfaction there are no fundamental qualities that can be compared with taste sensations: sweet, sour, bitter salty . The large number of perceptible odors asks a question to which the answer has not yet been found, namely: What is the mechanism behind the olfactory differentiation? .What can we distinguish between two odors?

Key words: odors, olfaction, olfactory discrimination, chemical senses

The smell and the taste are part of the chemical senses. The smell occurs in the detection and selection of fodder, the olfactory recognition of the offspring, the sexual attraction of the partners, the orientation of the animals[1-3].

The olfactory epithelium differs both macroscopically and microscopically from the rest of the nasal epithelium. It has a yellowish or yellowish brown color. Jacobson's vomero-nasal organ is a short, well-developed tubular formation in the inferiour vertebrats. It has a vestigial appearance in children, but although it may persist throughout life, it is usually absent in adults. the vomero-nasal organ is not precisely known; its structure and innervation suggest it would be an additional olfactory organ.The olfactory epithelium is made up of three types of cells: supporting, basal and nerve cells.The basal cells have the shape of convex cones and rise very little above the chorion. They appear to be transformed into supporting cells in the event of their destruction. The terminal olfactory organs differ from those of other senses in that the pericharion of the primary neuron is located at the periphery, being stimulated directly without the intervention of a specialized receptor cell.Bipolar nerve cells are the main bodies of the organ of olfactory sense. Bipolar neurons represent both the receptor and the protoneuron of the pathway[4-6]. Their length originate from the opposite poles of the fusiform cellular body, namely the dentrites of the superficial surface, and the axons from the deep one.

Dentrite is a cylindrical extension of oblong, straight form, and is relatively thick. It spreads to the epithelial surface, penetrates through the gap between the supporting cells and forms the olfactory vesicle. It contains 6-8 beads, from which a protoplasmic protrusion protrudes in the form of a cil. The bipolar cell axis is directed centrally and after crossing the larynx, it joins with the axons of neighboring cells, forming about 20 nerve threads - the olfactory or nerves tab olfactory. They penetrate into the cranial cavity through the holes of the cut blade and end in olfactory lobes (bulbs) in the form of fine arbors that synapse with the mitral cell dentures [7].

The synapses form small spherical formations called olfactory glomeruli. The mitral cell axons form the olfactory tracts. Most of their fibers continue in the olfactory side strips, which impulse to the cortical centers. The olfactory nerve fibers are amyelinic, but they have neurilem.

The olfactory mucous membrane contains tubulo-alveolar glands (Bowman's glands) that secrete a serous fluid that moisturizes the epithelial surface, constituting a solvent for smells.

Although the primary neuron of the optic pathway is located in the retina, the stimulus is received through cones and sticks; painful sensations are received by the free nerve endings, the pericorium of the pain fibers being located in the spinal nodules of the posterior branches.

Stimulating the sense of smell is the mucus that acts as a solvent and determines odor identification. Mucus is able to capture all odors because it is permanently renewed, making it possible for all odors to be equally captured. It is estimated that only the part of the mucus on the surface of the sinus contains approximately 40 million olfactory receptors. The olfactory cells also communicate with the other senses and together they can transmit information to the brain.

The dentric terminals of the olfactory cells, the olfactory brushes, are covered with only a thin layer of liquid. The olfactory nerve thecas continue with the subarachnoidian space.

The physiology of the olfactory sense: in many animals, the smell is highly developed, with much of the brain having an olfactory function. In the life of these macrosomatic animals, the smell is of major importance, warning the animal of an enemy's approach, guiding him to its food and initiating sexual reflexes.Stimulus suitable for receptors as well as for gustative ones is the chemical one[8].

The diffusion is a relatively slow process and it is of minor importance in the contacting of smells with olfactory

**email:drcaraiane@yahoo.com*

terminations. During a conscious apnea, even if the nose is filled with smelly air , the smell is not perceived.

During exhalation, the smells of food released during mastication or swallowing enter the nose through the cones and rise up to the olfactory area. The olfactory paints are covered by the liquid secreted by Bowman's glands. The fragrant particles must first dissolve to stimulate these sensory organs.

This again emphasizes the resemblance between the sense of smell and the taste. To stimulate the receptors, the odorous particles must dissolve even in the substance of the olfactory bristles. It can be considered that the odorous substances must be oily, both in fat and water, and those that have a higher degree of solubility in both environments produce the most acute olfactory sensations.

Among the most effective olfactory stimulants are: mercaptan, butyric acid, iodoform, peppermint oil and artificial mosquito. Although missing for a certain smell, the olfactory sense is preserved for the others; the phenomenon is not due to the fatigue of the olfactory mechanism, but is an example of sensory adaptation. The adaptation period varies for different odors. The olfactory adaptation starts from the moment the substance smells, the threshold gradually increasing, until the insensitivity to the odor is reached.

Exposure in advance to a certain smell increases the minimum concentration in which it is perceived for a long time afterwards. Elsberg has shown that the ointment ratios for mint, canfor, double their normal value if the individual has previously smelled these substances , and that the etheric sensitivity of a person who spent more time in an operating room is subnormal for several hours.

The brain perceives and interprets the odors differently from other types of senses. The encounter of an older smell, felt many years ago, can awaken memories of that period; it is explained by the fact that some of the olfactory nerves are releasing their ramifications directly to the brain, the place where your presence and memory are felt.The link between the chemical composition and the olfactory stimulus.

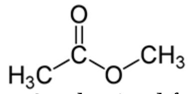
The olfactory potential of some chemical compounds belonging to a homologous series increases progressively from the inferior compounds of the series to the higher. The smell of monoatomic alcohols increases in intensity in the following order: methyl, ethyl, propyl, amyl, butyl, the relative olfactory potential of the methyl alcohol to the amyl is in the ratio of 1 to 10,000.

The compounds resemble the chemical and physical properties tend to have odors with some common characteristics. For example, the sulfur, selenium and tellurium, belonging to the sixth group of Mendeleev's periodic table, combined with methyl or ethyl hydrogen, have unpleasant odors. The members of group VII - chlorine, bromine, iodine - have related odors; the smell of chlorine and iodoform, chlorine and iodoform compounds, are together in the smell of bromoform, in which the odor of the chloroform and the unpleasant iodoform can be revealed.

The chemical substances such as ethyl, propyl and butyl acetate, have an acetic odor, while amyl and butyl acetate have an acetic odor, while amyl acetate does not have it; however, the odor of the lower compound of the series is linked to the odor of the upper one by the two intermediate compounds. Thus: ethyl acetate-odor acetate; acetic acid-poor smell of pineapple acetate; weak acetic butyric acid acetate with pineapple flavor; amyl acetate has no acetic smell, strong pineapple flavor.

Ethyl acetate is an organic compound of formula CH_3-COO-CH_2-CH_3. This colorless liquid has a distinctive sweet smell. Chemical Formula:$C_4H_8O_2$

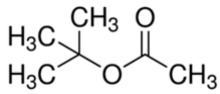
Propyl Acetate $CH_3COOC_3H_7$- Acetic smell with Low Pineapple Flavor.



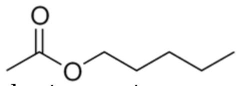
It is used as a solvent. Synthesized from propanol and HCOOH over TiO_2 at 150 ºC; from propanol, HCOOH and HCl gas.

Butyl acetate - is an acetic acid esther of the structural formula CH_3-$COOC_4$-H_9. It is obtained by esterification of acetic acid with butyl alcohol. As a matter of fact, it is a colorless or pale yellow, flammable liquid with a pleasant scent, slightly soluble in water but soluble in organic solvents.

Industrial use in synthesis processes in the chemical industry, solvent. Chemical formula $C_6H_{12}O_2$ / CH_3COO (CH_2) $3CH_3$.



The substance is dangerous for aquatic organisms. Avoid product spreading in water, in sewage systems. Vapors are lighter than air and may form explosive mixtures with it. If symptoms of intoxication occur, the doctor's advice will be sought. In case of loss of consciousness, nothing will be given orally. Amyl acetate has acetic smell, strong pineapple flavor; is an acetic acid ester of formula CH_3-COO-C_5H_{11}. It is obtained by esterification of acetic acid with amyl alcohol. Appearance is a yellowish, flammable, pleasant, water-insoluble liquid, soluble in organic solvents.



We can not do the interesting examples of chemico-olfactory correlations, but only broadly appreciation of chemical composition and smell can be made, because chemically similar compounds can have very special odors and others with little similarities (hydrocyanic acid and nitrobenzene, garlic and certain arsenic compounds, natural and artificial musk) can have very similar odors. The smell of aromatic substances is attributed to a radical of the benzene nucleus. The type of odor is due to the groups: hydroxyl, aldehyde, ketone, ester, nitro and nitrile, called osmophore groups. But the odor does not depend on which particular group is present, but on its position in the benzene nucleus.

A common fictitious property of many scents is the high degree of infrared absorption. The significance of this fact, first observed by Faraday, is unknown. The most common method for the study of olfactory sense is olfactometria. The number of different odors is huge and one can not even try a rational classification based on chemical composition or physical properties. The first classification of odors was made by Swedish botanist Linnaeus (1750).

The next one, proposed by Zwaardemaker, consists of nine categories, which is more a development of the one proposed by Linnaeus. It is based on purely subjective, not very scientific value

- Etheric smells: fruit, beeswax, ethers.
- Aromatic or resinous smells: camphor, bitter almonds, lavender, cloves.
- Delicate or balsamic smells : flowers, natural or artificial fragrances.
- Ambrogenic smells: musk, amber.
- Garlic-like smells: garlic, onion and sulfur and selenium compounds.
- Burning smells: burned feathers, tobacco, roasted coffee and roasted meat.
- Goat-like smells: caproic acid, fermented cheese and sweat.

- Regecting smells: Hyociamus and several plants of the Beladon family; the scent of scabbards

- Smells that cause nausea: excrement, meat saqu, herbal substances in putrefaction.

Potential for action picked up in the olfactory paths: Gerard and Young recorded the currents of action of fossil olfactory bulbs. In this isolated brain part a spontaneous rhythm discharge takes place at a frequency of about 4 per second. The discharge is considered to represent the automatic activity of the olfactory bulb nerve cells, as it seems that the possibility of it being due to the irritation of the formations traumatic. The problem of olfactory discrimination.

If there were a limited number of fundamental olfactory sensations, as there are fundamental taste sensations, the problem would not be difficult, but it remains unsolved. For sight, we assume there are three types of receptors, each sensitive to a particular series of wavelengths and each sending impulses along specific nerve fibers to the brain.

The *local* theory is able to explain the differentiation of the tone of the sounds, and the four distinct functional types of the taste buds, each with its specific nervous fiber. It explains the perception of basic sensations of taste. One can not conceive, however, that every smell of the huge number of odors perceived has a specific type of nerve fiber receptor. In addition, new and distinct odors are created.

Given the lack of facts, theories that explain the mechanism by which a smell causes impulses in an olfactory nerve fiber are almost entirely speculative. Kistiakowsky proposed a catalysis theory of olfaction, similar to that described for taste.

Probably the odor itself inhibits one or more of the enzymatic systems.

This would lead to differences in the combination of stimulating compounds and even a small change in their concentration could produce an olfactory sensation [9].

The difficulty lies in defining a fundamental olfactory sensation and in the fact that we have to assume the existence of a large number of receptors because the nerve impulses themselves do not possess differentiation characteristics that could use the brain as indicators. But if there were additionally areas with different properties chemical or chemical distribution on the olfactive membrane, which would allow a penetration or elective absorption of the odorous substances to or on the receptors, a certain form of excitation could be established which could be interpreted by the cerebral cortex as a smell in a certain way; or different yones may have specific affinities for different chemical groups. Such a mechanism would not require a huge number of different types of receptors. It can be deduced that the intensity of the olfactory sensation is related to the frequency of pulses sent to the olfactory centers [10,11]. Strong smells tend to cover the weakest. If two odors are of the same intensity, a mixture of them is perceived or both are identified, but if one is much stronger than the other one is perceived by itself. On the other hand, certain pairs of odors in relatively close concentrations are antagonistic, and when they are smelled concurrently are both diminished.Thus, the iodoform is antagonistic to Peru balm, bitter almond musk, and ammonia with acetic acid. Other pairs of neutralized odors are: cedar wood and rubber, beeswax and Tolu balm, essence of benzene and rubber, canophora and Colonia water. Although in some cases the neutralizing effect is of a chemical or physical nature, sometimes there seems to be a true physiological antagonism, as the phenomenon is also observed when mixing is avoided, applying the two smelling substances on each nostril.

Odor loss may occur following a severe head injury or a sinus infection affecting the olfactory receptors. Also, the term *anosmia* is also used in people who feel some odors, usually unpleasant, although they do not exist [12].

Olfactory defects: Loss of olfactory sense or anosmia is common in a passing form, as a result of inflammation of the nasal mucosa or due to local application of cocaine or adrenaline. A complete and permanent anosmia is rare in such normal individuals and is usually due to olfactory bulb or olfactory nerves, but olfactory or bilateral olfactory deficiencies are commonly associated with lesions of the olfactory lobes[13-15]. Albinoes are also anosmic, suggesting that the pigment in the supporting cells of the olfactory epithelium is missing. Quite often there is the impossibility of perceiving certain odors. Some people do not perceive the smell of acidic anhydride, others the smell of vanillin, methyl alcohol, etc. Even a strong repelling odor, like an stale egg, may not be perceived.

Conclusions

The chemical sense is restricted to areas that are eternally damp. The receiving organs of this sensation in the mouth and nose are distinguished from tasteful and olfactory terminations and seem not to be the same as those serving the pain of chemical sensation, the pain being abolished first.

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