**סמינר כימיה פיסיקלית ואנליטית**

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נושא:

The nose knows:

(status of the vibrational theory of olfaction)

Literature seminar

ההרצאה תתקיים בחדר סמינרים הפקולטי

**The nose knows (the status of the vibrational theory of olfaction)**

Odor molecules are drawn into your nose and captured by a layer of mucus, then transported to an area at the top of your nasal cavity known as the olfactory epithelium. The epithelium consists of neuron packages with particular receptor sites that detect molecules and send signals to the brain. Although we know that smell is caused by odor molecules being captured by receptor sites, which causes those neurons to fire. However, because we cannot directly observe the receptors, we must rely on indirect evidence to understand how they function.

According to the shape model, specific odor molecules fit the receptor as a key fits into a lock, according to the first theory of how receptors work. However, a few molecules with similar shapes have distinct odors. [1] As a result, another model based on odor vibration has emerged. According to the vibrational theory of olfaction, the smell receptor can distinguish between different molecules based on how they vibrate. Each chemical bond has a natural resonant frequency at which it vibrates. [2] More specifically, at the active sites of odorant receptors, an electron transfer across odorants occurs, serving as a sensitive measure of odorant vibrational frequencies and ultimately leading to olfactory perception. [3] According to one study, humans could distinguish between hydrogen and deuterium isotopomers of the cyclopentadecanone molecules (found in musk). Giving credibility to the theory. [4] At the same time, an opponent of the vibration theory claims that the previous report is incorrect due to a contaminating impurity they claim is responsible for the smell difference.[5] Furthermore, they demonstrated that the human recognizing receptor, OR5AN1, cannot distinguish isotopomers of these compounds (cyclopentadecanone). The mouse recognizing receptor and other human olifactory receptors responded similarly to undeuterated and deuterated odor molecules. Furthermore, their theoretical analysis shows that the proposed electron transfer mechanism of odorant vibrational frequencies is suppressed by non-odorant molecular vibrational modes' quantum effects. [5][6]

[1]. Turin, Luca. "A spectroscopic mechanism for primary olfactory reception." *Chemical senses* 21.6 (1996): 773-791.‏

[2]. Franco, Maria Isabel, et al. "Molecular vibration-sensing component in Drosophila melanogaster olfaction." Proceedings of the National Academy of Sciences 108.9 (2011): 3797-3802.‏

[3]. Solov'yov, Ilia A., Po-Yao Chang, and Klaus Schulten. "Vibrationally assisted electron transfer mechanism of olfaction: myth or reality?" Physical Chemistry Chemical Physics 14.40 (2012): 13861-13871.‏

[4] Turin, Luca, et al. "Plausibility of the vibrational theory of olfaction." Proceedings of the National Academy of Sciences 112.25 (2015): E3154-E3154.‏

[5] Block, Eric, et al. "Reply to Turin et al.: Vibrational theory of olfaction is implausible." Proceedings of the National Academy of Sciences 112.25 (2015): E3155-E3155.‏

[6]. Hoehn, Ross D., et al. "Status of the vibrational theory of olfaction." Frontiers in Physics 6 (2018): 25.‏