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Odor and Taste Elimination

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Background: The National Advertising Division (NAD) is the self-regulatory body for the advertising industry in the US that adjudicates truth in advertising. In May 2022, the NAD issued a ruling that Procter and Gamble's claims that Febreze® eliminates malodor were not supported. They concluded that a purely sensory test is not sufficient to support a claim of physical or chemical odor elimination. According to the decision, the testing conducted was not a good fit for the claims. The ruling was appealed to the National Advertising Review Board (NARB) who upheld the NAD's decision. This case raised interesting questions about how and whether odor or taste elimination claims could be substantiated and, if so, what the testing protocol would require.

Scenario: You work for a company that markets home care products including air, furniture, and fabric care. Your company has developed a product for treating the malodor present on upholstery and would like to make a general claim that the malodors have been eliminated after treatment. Some of the proposed advertising includes depictions of the complete elimination of the malodorants themselves so that no malodor could be detected. Tests on upholstery samples have usually involved treating upholstery swatches with smoke, mildew or pet malodorants. For cigarette smoke mal-odorants your group usually uses an outside lab that exposes the swatches to live side-stream smoke from a smoking machine designed to mimic the behavior of smokers. Your task is to recommend and execute tests that would determine whether an odor elimination claim can be supported.

Approaches to Eliminate Odors and Tastes: An odorant is a chemical that induces an odor and a tastant is a substance that induces a taste. Correspondingly, a malodorant induces a malodor for a person when detected and is undesirable to that person. Some odors may be malodors to some people but not to others. For example, the smell of freshly cooked sweet corn, which depends on dimethyl sulfide and certain mercaptans, is highly desirable at low concentrations to some people but may be disgusting to people unaccustomed to eating sweet corn. This fact has implications for whether a hedonic or sensory intensity testing method is required. There are three ways that an odor or taste could be eliminated by a consumer product:

a) By blocking the receptor involved in smell or taste in a manner similar to the mechanism by which beta blockers operate on the heart when they compete with adrenaline, but applied to an olfactory or taste receptor,

b) By eliminating all traces of an odorant or tastant from the environment by chemical and/or physical means, and

c) By reducing the concentration of an odorant or tastant below the olfactory or taste threshold of the compound, although the odorant or tastant itself may not be eliminated.

Transduction Mechanisms in Taste and Smell: In 1988 Sir James Black was awarded the Nobel prize in Medicine for the science behind the two blockbuster drugs of the twentieth century: propranolol (a beta blocker) and cimetidine (a histamine receptor antagonist.) His Nobel lecture[2] entitled *Drugs from Emasculated Hormones: The Principle of Syntopic Antagonism* vividly entertained the idea of a two-stage process of fruitful receptor binding without subsequent transducer action and thus separated these two stages. Figures 1 and 2 illustrate the type of cellular events involving a G-protein transduction mechanism that was being considered at the time. In 1983, Black and Leff[3] had published a mathematical model that provides parameters for the two stages called *affinity* and *efficacy* and these refer to the initial receptor binding and the subsequent participation of a transducer, respectively, as shown in Figure 2. The possible common evolutionary ancestry of the mechanisms for heart stimulation, vision, taste, and smell suggested that this two-stage model may have value in modeling the chemical senses, including both smell and taste.

Developing and testing a model for smell and taste in humans poses some serious challenges because human experimentation necessarily involves chemosensory psychophysics. For models extended from pharmacology and applied in the chemical senses to be predictive it would be necessary that they preclude the need to know the precise nature of the relationship between stimulus concentration and perceived intensity. An opportunity to expand and test an extension of Black and Leff's model for single substances[3] to mixtures of sweeteners occurred when DeGraaf and Frijters[4] published experimental results on the points of subjective equality of glucose and fructose mixtures. Plots of equal sweetness of the single substances and mixtures of them are called isoboles[5]. The modeling challenge was to develop equations that included the binding constants for each substance to independent or common receptors along with binding parameters for the subsequent transduction step, if it occurred[5,6,7]. From this research it was shown for the first time that human chemical sensing involves a transducer entity, such as that shown in Figure 2. These models can also be applied in olfaction to malodorants.

Malodor Elimination Project: As you consider the alternatives open to you to determine whether or not you can substantiate the malodor elimination claim, some issues become apparent.

1. Tobacco pyrolysis and smoke generation produce literally thousands of compounds many of which may be malodorous. In order to exploit approach a), it would be necessary to discover blockers for each one of these potential malodorants because of the specialized nature of odor detection to individual compounds in humans. So, clearly this approach is not feasible.

2. The second approach, where your product guarantees the elimination of every trace of every malodorant in the

environment, even those deeply embedded in the upholstery fabric, is also impractical. It is also a fact that your analytical instruments have a detection limit and so malodorants could exist at levels you cannot measure.

3. The third approach, where you would show that the malodorants, although detectable analytically, occur at levels below the detection threshold for humans, seems the most promising. However, you would have to advise that ads that depict the complete elimination of the source of the malodor, the malodorant, could not be supported by this methodology. You would also have the daunting task of identifying all the malodorant compounds in tobacco smoke and for each one show that your product treatment reduced their concentrations below the detection limit. For this reason, you might advise that the advertising claims be limited to only certain important malodorants that are most prevalent and easily isolated.

Why Equivalence Testing is Inappropriate: The ASTM Standard Guide for Sensory Claim Substantiation contains a section on how to conduct and analyze sensory tests for equivalence claims. The Guide provides a specific small level of difference within which equivalence is established.

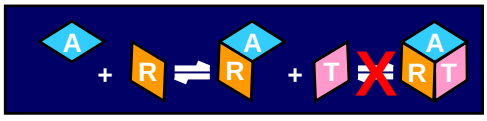

Figure 1. A is a malodorant blocker that has a high affinity for the receptor (R) but cannot interact with the transducer (T), thus preventing cell firing. The malodorant then cannot be detected.

Inherent in the idea of equivalence is that the two products involved may differ on some sensory attribute but that the difference is not of importance to the average consumer. However, this is not the same as saying that the treatments compared are exactly the same. The equivalence concept does not imply that the source of a malodor is eliminated simply because a fabric swatch treated with the malodorant plus the product is equivalent to an appropriate control. Claims other than odor elimination could be supported, such as a malodor reduction claim about a difference that is not consumer-relevant.

Conclusions: A malodor elimination claim, especially when coupled with a claim that the malodorant itself has been completely eliminated, is an extremely high bar that appears to be impossible to substantiate. More limited claims, such as those focused on particular malodorants or claims concerning a reduction in malodor intensity should be more readily substantiated. The P&G cases before the NAD and NARB highlight the importance of thinking through the issues that may arise when strong claims are made in advertising and the scientific team are required to find support for them. Counseling the business and marketing staff on the issues that may arise in a challenge is an important role that may help to develop claims that are likely to be defended successfully.

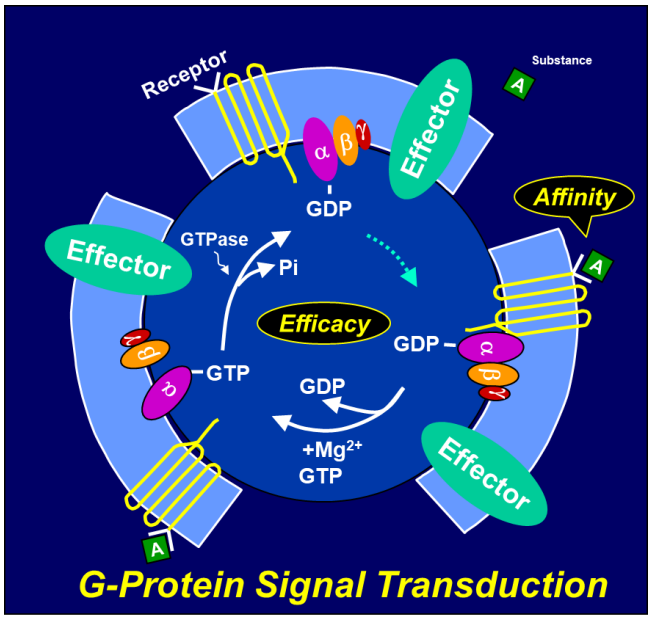

Figure 2. G-protein signal transduction in which a substance (A) such as an odorant binds to a transmembrane receptor leading to an exchange of GTP (guanisine triphosphate) for GDP (guanisine diphosphate) and subsequent activation of an effector such as adenylate cyclase. The receptor may be 7-transmembrane, rather than 5-, as occurs in the chemical senses. Also shown are the two stages labelled *affinity* when initial receptor binding occurs and *efficacy* which involves the participation of the transducer after initial receptor binding.

References and Notes

1. Febreze® is a registered trademark of the Procter and Gamble Company
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