

as certain surfactants in cleaning products. Of course, fragrance is also used to mask biological malodors such as those produced in the scalp and underarm area.

Fragrance materials themselves have benefits outside their use in fragrance. For example, extensive research suggests that some fragrance chemicals, particularly monoterpenes, have effective anticancer and other pharmacological properties. Similarly, the antimicrobial activity and insect repellency of essential oils and certain fragrance chemicals has become an established fact as a result of extensive studies in this area.

## The Importance of the Sense of Smell

The ability to detect chemicals in the environment is so basic and so important that every organism from single-celled amoebae to human beings is endowed with an exquisitely tuned chemical awareness. Humans have not one sensory system, but three, to detect aroma chemicals: our sense of taste in the oral cavity, our sense of smell in the nasal cavity and chemical feel (chemesthesis) with receptors all over the body.<sup>3</sup>

All species use their chemical senses for a most basic and fundamentally important behavior: approaching and being attracted to pleasant and potentially safe aromas, as well as avoiding and being repelled by unpleasant and potentially harmful ones.<sup>4</sup> It is an instinctive behavior that causes humans to be cautious or to avoid unpleasant or irritating aromas. In contrast, we approach and seek pleasant aromas. For example, consumers choose to linger longer near a store counter with a pleasant aroma.<sup>5</sup> Strong evidence that consumers seek pleasant fragrance is that the majority of consumers choose to buy a fragranced version of a product over an unfragranced version in product categories offering consumers a choice. For example, in the US laundry market in 2001, fragrance-free fabric softener sales represented approximately four percent of total dollar sales, while fragrance-free laundry detergent sales represented approximately seven percent of total dollar sales (from Nielsen 2001 FDM).

In humans, the sense of smell is unique in having strong neural connectivity to older, emotional parts of the brain, thus reinforcing the strong emotional reaction we instinctively have to aromas. The

emotional underpinning of fragrance is what makes aromas a strong attractant or repellant. There is great survival value in this instinct. Many unpleasant and irritating odors are associated with harmful, diseased or decayed sources, and thus our natural inclination to avoid unpleasant odors has obvious survival value. However, not all malodorous substances are harmful; thus, since ancient times, perfumes have been used to mask safe but unpleasant odors.

## Positive Influence of Fragrances on Humans

***Fragrance and mood effects:*** As stated before, fragrance is emotional. There is an anatomical basis for this in the projection of the sense of smell to the limbic system of the brain.<sup>6</sup> This region of the brain is associated with emotions and memories. Thus, whether fragrance is used as cologne or in a laundry detergent, it evokes a hedonic response of pleasure-displeasure and emotional responses such as happiness and relaxation.

It is commonly recognized that aromatic materials differ in the type of emotional feeling that is evoked. For example, Oscar Wilde wrote in 1891:

He saw that there was no mood of the mind that had not its counterpart in the sensuous life...wondering what there was in frankincense that made one mystical, and in ambergris that stirred one's passions, and in violets that woke the memory of dead romances and in musk that troubled the brain.<sup>1</sup>

The burgeoning field of aromatherapy is established around creating formulas of aromatic natural materials that offer a range of differing mood and health effects. There is as yet little solid scientific evidence for the field's health effects and mechanism of action. However, there is good evidence of the mood effects elicited by fragrance materials, whether natural or synthetic.<sup>7,8</sup> A general characterization of this research is that pleasant odors tend to improve mood. Moods such as relaxing, happy and energizing are commonly evoked by pleasant-smelling fragrances. Unpleasant odors evoke moods of apathy, irritation, stress and depression. Citrus notes are stimulating and happy, powdery and soft floral notes are relaxing and happy,

musk notes and some floral notes are sensual, fruity notes are happy and stimulating. An example of the mood profiles of several fragrant materials is shown in **Figure 1**.

The mood changes induced by fragrance can have positive effects in real life situations. Studies have shown that the use of fragrance can improve mood in both women and men at mid-life. Feelings of tension, depression, and confusion were significantly alleviated by pleasant fragrance in female subjects.<sup>9</sup> Certain fragrances even reduce the stress of unpleasant medical procedures; in one study, administration of heliotropin scent during MRI scans was shown to reduce anxiety levels by 47 percent among the 70 percent of all

patients who experienced heliotropin as pleasant (10).

Fragrance also has the ability to alter our emotions through the recollection of old memories and associations. Marcel Proust, the French author made famous at the turn of the 20<sup>th</sup> century, is well known for his descriptions of vivid memories triggered by a familiar smell. In fact, today this phenomenon is termed

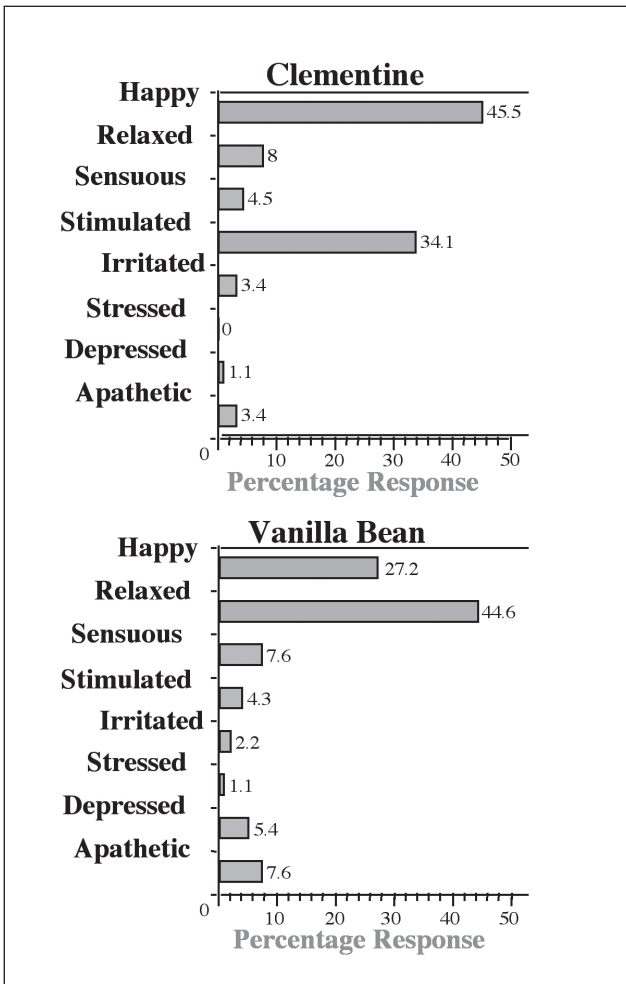


Figure 1. Mood profiles of Clementine and vanilla bean