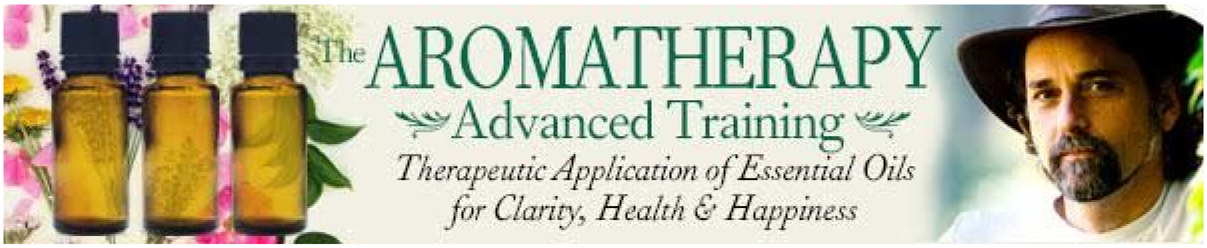

Fragrance and Consciousness
By David Crow, L.Ac.

Introduction

This paper presents a brief overview of current research into the effects of fragrance on consciousness. It specifically examines the benefits of using essential oils for treating neurological degeneration and chemo-sensory disorders, enhancing concentration, memory, and learning, assisting relaxation and reducing anxiety, relieving depression and counteracting stress. Most of these conditions can be generally classified in Chinese medicine as belonging to the category of Shen disturbances, meaning spiritual, emotional, and psychological disorders that are both a result and a cause of neurological stress, toxicity and depletion.

Olfaction

In humans, the olfactory region is an area of about 2.5 square centimeters located in each of the two nasal cavities below and between the eyes, containing approximately fifty million primary sensory receptor cells. The olfactory sense is able to distinguish an almost infinite number of chemical compounds at very low concentrations, and is over 10,000 times more sensitive than the sense of taste. Compared to sight, olfaction is more complex: humans use three classes of photoreceptors in the eyes to span the visible spectrum, but smell relies on hundreds of distinct classes of olfactory receptor neurons. Fragrances stimulate multiple areas and systems of the brain, influence the endocrine system, modulate immunological responses, and affect emotional states through their impact on the limbic system.

Like all our sense perceptions, olfaction is a three step process: chemical energy in the form of aroma molecules bonding at receptor sites in the olfactory epithelium is deconstructed and transformed into neurological energy; nerve currents are transmitted into the deeper structures of the brain; these nerve currents are then reconstructed into an internal holographic neural representation of the original information from the outside world.

The complexities and subtleties of olfaction have been the focus of intensive research for decades, and new discoveries are continually emerging. An excellent history of olfactory research and an in-depth review of current understanding can be found at http://www.leffingwell.com/olfaction.htm. Some of the most important aspects of this information are presented here in their respective sections.

Olfaction in Animals

Understanding the role of olfaction in other creatures helps us understand its primitive roots and how this complex sense relates to cognition and behavior.

The homing ability of pigeons has been thought to be due to the earth's magnetic field or infrasound. Research has confirmed that at least in some species and locations, the ability is based almost entirely on olfactory perception of the environment. (1)

Diving birds, such as petrels, use olfaction both to locate food in the sea and to identify their nesting burrows. (2)

Water turtles perceive odors in their aquatic environment. Outside the mating season, both males and females avoid each other through smelling each other's odors in the water, while during the mating season males are attracted to female scents, and females are attracted to being with other females. (3)

The well-documented courtship behavior of captive lobsters is based on the olfactory functions of the female's antennules. Removal of the antennules results in dramatic behavioral aberrations including unsuccessful couplings and mortalities. (4)

A lizard's olfactory ability to sense the odors of predator snakes is dependent on its body temperature, with perception decreasing as body temperature goes down. (5)

In order to find future hosts, many species of parasitic wasps are attracted to the fragrance of essential oils and volatile compounds released by plants infested with herbivore insects. (6)(7)

For butterflies and other flower-visiting insects, colors and scents are combined attractants. For example, Vanessa indica butterflies are more visually oriented: they prefer floral scents from Taraxacum officinale and Cirsium japonicum, but are more attracted to yellow and blue flowers, even if scentless. (8)

Bees have olfactory memories of floral scents that help them recall navigational and visual memories of nectar sources. (9)

These intriguing subjects are now the focus of intensive research and product development, as controlling, blocking, or altering olfactory functions in animals supposedly has numerous potential benefits. Mosquitoes, for example, survive primarily on floral nectars, but in order to feed her eggs the female must feast on blood, thereby spreading malaria. The ability of the female mosquito to find its meal is based on olfaction, which is the basis for mosquito repellant products. Eradication programs using pesticides have generally worsened the ecological aspects of the problem, while synthetic compounds such as DEET (N,N-diethyl-meta-toluamide), natural alternatives such as essential oils, and new molecular interventions have all failed to provide adequate protective powers against mosquitoes for the majority of people living in malarial areas. There are huge potential profits to be made in developing effective, affordable, and nontoxic mosquito repellant products.

Olfaction and Compatibility

Although humans are not as dependent on the sense of smell for survival and reproduction as other creatures are and as we once were, olfaction still operates and influences our deeper biological functions. A simple example is the synchronization of menstrual cycles when women live together, which is the result of pheromones interacting with the endocrine system via the olfactory and limbic systems.

Another example is sexual attraction based on perceived pleasantness of body odor, which is the basis of the multi-billion dollar perfume and fragrancing industries. It has long been thought, and there is now an increasing amount of supportive evidence, that there is a correlation between mate choice, odor preference, and genetics, both in animals and humans.

The Major Histo-compatibility Complex (MHC) is a diverse group of genes that help the immune system differentiate self from non-self; these genes are also involved in the production of the compounds and reactions that create an individual’s body odor. From the genetic perspective, attraction to a mate with a dissimilar MHC decreases the likelihood of interbreeding. Researchers have confirmed that there is indeed a correlation between perceived pleasantness of body odor and genetic constitutions in humans, but only when women smelled the sweat of men; men’s olfactory systems apparently do not differentiate the genetic desirability of potential mates, or have lost the ability to do so. (10)

Hyposmia and Chemo-Sensory Disorders

Olfactory dysfunction has a profound impact on the quality of life and creates many challenges to good health. As the sense of taste is predominantly experienced through olfaction, the loss of smell leads to loss of taste, which in turn causes nutritional deficiencies as a result of not enjoying food. Loss of smell also increases vulnerability to poisoning by harmful or spoiled food. There is also increased risk of injury from fires, inhalation of toxins, or exposure to gas leaks. (11)

The function of human olfaction declines with advancing age. MRI studies have confirmed that in elderly subjects the major olfactory structures in the brain are activated by fragrance stimulation, but with a lower volume and intensity than in younger subjects. (12)

Decreased olfactory function (hyposmia) is also found in neurological degeneration, such as some forms of Parkinson's and Alzheimer's diseases; it is also found in a milder form in essential tremor. In Alzheimer's both olfactory recognition and olfactory memory are affected. High rates of hyposmia are also found among oncologic hospice patients. (13)

Olfactory testing is now recognized as a valuable method for diagnosing early or pre-clinical stages of Parkinson's and Alzheimer's, as well as for the differential diagnosis of other forms of movement disorders. (14)(15)

Other olfactory disorders include anosmia, the loss of smell, and parosmia, distortion of the sense of smell or olfactory hallucinations. The causes of these disorders are numerous, but the primary causes include upper respiratory tract infections, trauma, nasal polyps, and chronic rhinosinusitis. Many prescription medications are known to cause these and other chemo-sensory disorders; nasal decongestants and over-the-counter preparations such as intranasal zinc gluconate gel marketed for the common cold are two examples. Occupational exposure to toxic substances such as heavy metals and solvent mixtures is now recognized as a cause of chemo-sensory disorders as well. (16)(17)

The Role of the Olfactory Bulb in Mood, Immunity, and Neurological Degeneration

The limbic system controls emotions, emotional responses, mood, motivation, pain and pleasure sensations, and many hormonal secretions. The olfactory bulb is part of the limbic system; it is located inside the cranium directly above the sinus cavities, and receives nerve transmissions from receptor sites in the olfactory epithelium.

One of the functions of the olfactory bulb is protection of the brain from neurotrophic agents such as viruses and toxic dust which can cause neuro-degenerative diseases; this is done through continual regeneration of cell population both within the olfactory epithelium and the deeper associated olfactory brain structures. (19)

Animal experiments have found that removal of the olfactory bulb causes immuno-depression, including decreased proliferation of lymphocytes in the spleen, inhibition of synthesis of tumor necrosis factor, and decreased macrophage activity. Bulbectomy also causes biochemical, behavioral, and morphological changes that are common with symptoms of Alzheimer's disease and major depression, including endocrine dysfunction, decreased serotonin levels, and neurotransmitter disturbances. (20)(21)

These changes are thought to be attributed to dysfunction within the neuro-anatomical areas of the cortical-hippocampal-amygdala circuit - which are also affected by major depression - rather than loss of olfaction alone, which does not produce corresponding symptoms. (22)

Based on this information, I propose that neuro-degeneration and neuro-toxicity from olfactory exposure to ubiquitous toxic compounds in the environment, including hydrocarbon pollution, synthetic aroma-chemicals, solvents, heavy metals, molds and pesticides play a much larger role in a wide variety of diseases and symptoms than generally recognized. It is plausible that conditions such as Parkinson's, Alzheimer's, and different forms of depression not only manifest as dysfunction within the olfactory bulb and related limbic structures, but are also to some degree the result of chronic toxic burden to those structures as well. If this is the case, then a number of other disorders could also be attributed fully or partially to endogenous and exogenous olfactory and neurological toxicity and degeneration, including hormonal, immunological, behavioral, and cognitive disturbances.

In the specific case of Parkinson's, the hypothesis that neuro-degeneration is the result, rather than the cause, of olfactory damage has received attention, and some researchers have proposed that the initial causative event may start in the rhinencephalon (olfactory brain) prior to manifesting as damage in the basal ganglia. The clinical experience of holistic medicine also supports this hypothesis indirectly, as many symptoms originating within and affecting the olfactory-limbic-endocrine-immune axis are resolved by removing environmental toxins, such as depression caused by chemical sensitivities. Clinical trials and empirical evidence of aromatherapy also support this hypothesis, as many hormonal, immunological, behavioral, and cognitive disturbances are benefited or cured using olfactory administration of essential oils. (23)

The modes of action of essential oils and their constituents are diverse, including immuno-modulating, anti-microbial, endocrine-balancing, detoxifying, anti-depressant, anxiolytic, anti-inflammatory, and tissue-regenerating. It is likely that through a synergistic combination of functions essential oils support a healthy cell population of the olfactory bulb and epithelium and provide neuro-protective and neuro-regenerative benefits, thereby protecting the brain from neurotrophic toxins and reducing or reversing the progression of neuro-degenerative diseases.

Essential Oils for Olfactory Dysfunctions and Neurological Degeneration

Conditions of neuro-toxicity and neuro-degeneration cause symptoms of dysfunction in olfactory and limbic structures. Conversely, activation of the olfactory and limbic structures using inhalation of essential oil vapors has been found to reduce neuro-toxicity and neuro-degeneration and their symptoms. This is not surprising, as essential oil vapors are first inhaled directly into and then travel through the affected olfactory and neurological structures; in other words, essential oil inhalation is the most direct way to administer pure botanical substances to the central nervous system. By blocking nasal absorption of essential oils with procain, it has been confirmed that their effects are via stimulation of the olfactory system and not via absorption by the lungs. (24)

In my clinical practice I have treated numerous cases of olfactory dysfunction, both as a primary complaint as well as an iatrogenic symptom. I have seen several cases of hyposmia and complete anosmia benefited to various degrees through the long-term repeated inhalation of a variety of pure botanical essential oil vapors. Other than systemic steroids, allopathic medicine has little to offer for most of these conditions. (18)

The therapeutic effects of essential oils in these cases could be attributed to a combination of anti-microbial, decongestant, tissue-regenerating, mucous membrane balancing, and nerve-stimulating functions of the oils. These functions have great potential not only for treating the symptoms of chemo-sensory disorders, but for reaching into the olfactory bulb and related limbic structures to treat conditions of neurological degeneration as well.

One example of the potential of this type of treatment is the use of mellisa (lemon balm) oil for stimulating the brain’s acetylcholine receptors. Acetylcholine (ACh) is the primary neurotransmitter involved in brain activity related to cognitive functions, and deficits in

ACh levels and activity are among the primary neurological factors in the development of Alzheimer's disease. Mellisa has been found to improve cognitive performance and mood and may therefore be a valuable adjunct in the treatment of Alzheimer's disease. (25)

Besides improving memory and cognitive function, mellisa oil is also well-known as a mild sedative which has been found to be a safe and effective treatment for agitation in people with severe dementia. It also has antioxidant properties that may provide protection against the free radical damage that is believed to be a causative factor in Alzheimer's. (26)

Essential Oils for Concentration, Memory and Learning
Numerous essential oils have a historical and empirical reputation for improving concentration, memory, and learning, which is now being confirmed and clarified by clinical trials. Enhancing these cognitive abilities is a complex and multi-system process utilizing a diverse range of olfactory, psychological and neurological functions including subjective enjoyment of a fragrance, adrenal modulation, enhancement of alertness, stimulation of certain neurological centers with sedation of others, and other variables.

One example of the multi-system benefits of aromatherapy for cognition can be found in the case of the common oils lavender and rosemary. When tested for EEG activity, alertness and mood, lavender oil increases beta waves with corresponding relaxation, less depression, and faster and more accurate computation abilities. Rosemary oil decreases frontal alpha and beta power with corresponding alertness, lowered anxiety and increased relaxation, and faster but not more accurate computation abilities. (27)

As a practitioner who routinely uses a wide range of essential oils for therapeutic, meditative, and cognition-enhancing purposes, I have come to regard aromatherapy as a form of neurological training that utilizes botanical intelligence to enhance human consciousness, vitality, and immunity. In a way, this is no different than refining and improving our sense of taste by eating a healthy diet and exploring the range of herbal flavors, increasing our visual acuity by developing artistic appreciation and visualization skills, enhancing our auditory capacity through learning to play music, or developing our sensitivity to body sensations through yoga and meditation. All of these forms of learning bring long-term enhancement of synaptic connections in their respective neurological centers; in the case of aromatherapy this is within the olfactory cortex and other related structures. (28)

The olfactory sense offers unique and interesting benefits for increasing memory through increased neural networking. Fragrance association, for example, has been found to enhance memorization and recall. It has been found that if an ambient fragrance is present in a room during memorization, the memory of the information is stronger if the same fragrance is present again at a later date. (29)

Empirical and documented evidence such as this corroborates my personal experience and validates my opinion that aromatherapy is an underutilized modality which, if applied at a larger social level such as in public schools, has tremendous potential for addressing the epidemic of cognitive disorders such as ADHD, autism and other learning and behavioral disorders.

The memory-enhancing benefits of aromatherapy can be further increased by using specific fragrances that strengthen concentration, enhance attentional processing, reduce mental tension, and improve productivity. For example, jasmine has marked excitatory effects on vigilance (the ability to sustain attention), while lavender has marked sedative effects which benefit those who are hyperactive and stressed. Mellisa oil produces a significant increase in the speed of mathematical processing with no reduction in accuracy, while increasing calmness and reducing negative moods associated with stress. (30)(31)

Essential Oils for Relaxation and Stress

Difficulties of concentration, memory, and learning are intimately connected to mental stress and physical tension, which in turn are major factors affecting productivity and wellbeing both in schools and in the workplace.

One of the mechanisms through which essential oils reduce stress is modulation of the sympathetic nervous system. Inhalation of rose and patchouli oils causes a forty percent decrease in relative sympathetic activity in normal adult subjects as measured in blood pressure fluctuations and plasma catecholamine levels, while inhalation of only rose oil causes a thirty percent decrease in adrenaline concentration. Inhalation of grapefruit oil fragrance, on the other hand, results in 1.5- to 2.5-fold increase in relative sympathetic activity; grapefruit oil is known empirically in aromatherapy as an oil that enhances mental alertness. (32)

In another study, jasmine and lavender fragrances at lowest perceivable concentrations had sedative effects on autonomic nerve activity and mood, in the form of significantly decreases heart rate and production of calm and vigorous mood states. (33)

Mental fatigue is an acute and chronic problem for those who spend long hours working or studying using computers. Sedative fragrances such as lavender and sandalwood have been found to be beneficial to concentration and mental stability, leading to improvement in productivity. Lavender, orange, and rose simultaneously improve reaction times and increase mental relaxation. Chamomile and jasmine increase mental stimulation, and jasmine, ylang ylang, rose, and peppermint improve productivity and help relieve the perception of the workload. The optimum effects of these fragrances are achieved if the exposure occurs at three minute intervals. (34)(35)

Relaxing fragrances have important therapeutic applications in the stress-filled world of allopathic medicine. When diffused in dental waiting rooms, the ambient scent of orange oil was found to have a significant relaxant effect. Female subjects were especially responsive, who reported lower levels of anxiety, more positive moods, and a higher level of calmness. This and other studies confirm not only the anxiolytic benefits of certain essential oils, but the higher olfactory capacity of women over men. (36)

In 1991 Sloan-Kettering Cancer Center in New York announced that heliotropin, the compound that gives vanilla its sweet scent, was the most relaxing and pleasant of five fragrances tested for the reduction of anxiety during a difficult medical procedure. Further testing revealed that patients exposed to heliotropin while undergoing MRI experienced 63 percent less overall anxiety than those not given a fragrance. As a result, many hospitals now offer a novel variety of “integrative” medicine in the form of aromatherapy to calm the mind while the body is exposed to a powerful electromagnetic field and radio waves. (37)(38)

Studying the motility of over-caffeinated agitated mice is probably an accurate model for understanding the stresses of the modern workplace. Lavender oil, especially the Mont Blanc variety, produces the most soporific effect on both normal and agitated mice, while lavender, sandalwood and neroli oils have the greatest effect decreasing the motility of normal mice. (39)

Neroli (Citrus auranti blossom oil) is commonly used in aromatherapy as an alternative treatment for insomnia, anxiety and epilepsy; its anxiolytic, sedative, and anti-convulsant properties have been confirmed. Paradoxically, in the above study, neroli had stimulating effects on caffeine-agitated rodents, indicating that the oil alone works as a sedative and in conjunction with caffeine works as a stimulant. (40)(41)

Another research method which has interesting parallels in modern society is the “forced swimming test” (FST), which is commonly used to measure the effects of antidepressant drugs. Inhalation of stimulant oils such as ginger, thyme, peppermint, and cypress result in a predictable decrease in the immobility of mice, while inhalation of lavender and hyssop oils increases their immobility, even after injection with caffeine. These studies are receiving more attention in the field of industrial and corporate psychology, which seeks new ways of decreasing immobility and increasing motility of workers. (42)

From the standpoint of mental health and social wellbeing in the modern workplace, it would be beneficial to plant an abundance of roses, lavender, chamomile, mellisa, hyssop, sandalwood and citruses in and around office buildings. It would also be helpful to develop and market a botanical perfume based on the essential oil of angelica root, which has been confirmed as having a wide range of pronounced anxiolytic effects. Of perhaps even more interest and relevance to our culture is the discovery that this oil decreases aggressive behavior and increases social interaction among rodents. “Thus,” conclude the scientists conducting this fascinating research, “our findings suggest the potential usefulness of angelica essential oil against various types of anxiety-related disorders and social failure,” thereby offering an alternative to addictive and toxic antidepressants such as Paxil, which is marketed to counteract “social shyness syndrome.” (43)

For those suffering from immune weakness caused by stress and chronic fatigue, inhalation of labdanum, oak moss, or tuberose fragrance restores immune functions suppressed by glucocorticoid released from the adrenal glands due to stimulation by corticotropin-releasing factor derived from the stress-stimulated hypothalamus. (44)

Essential Oils for Depression

Depression is one of the most common reasons for using complementary and alternative therapies. Aromatherapy is used extensively for depression, indicating empirical benefits, but only a limited number of studies have been performed to determine its efficacy. Clinically, many of the oils mentioned previously in different therapeutic categories (neurological rejuvenation, mental stimulation, relaxation, anxiolytic) are known to have positive effects on different aspects of depression, which frequently manifests with other symptoms such as anxiety. It is often difficult to separate depression from pain, tension, chronic illness, insomnia, and fatigue; likewise, studies have found that essential oils have different levels of effects on different aspects of the condition.

A study on the effect of aromatherapy on pain, depression, and feelings of satisfaction in life of arthritis patients found that receiving massage with lavender, marjoram, eucalyptus, rosemary, and peppermint oils significantly decreased both the pain and the depression levels. (45)

In another study, lavender was found to have beneficial effects on both insomnia and depression in female college students. (46)

Another study found that the fragrance of hiba oil, a species of cypress, was an effective, non-invasive means for the treatment of depression and anxiety in chronic hemodialysis patients. (47)

Conclusion

Essential oils have historical and empirical evidence supporting their use for a wide range of emotional, cognitive, and neurological symptoms described by Chinese medicine as Shen disorders. An increasing number of studies now validate their effectiveness, pointing to important new ways of balancing and regenerating the olfactory-limbic-endocrine-immunological axis and its relationship to consciousness, mood, and stress. There is tremendous potential for essential oils to be utilized in innovative ways for the epidemic of Shen disturbances, not only in complementary, alternative, and integrative medicine, but as a major part of public health programs as well.

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