The Role of Olfaction on Human Psychology

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About the Author

Linda is President of the Institute of Spiritual Healing & Aromatherapy. She is certified in holistic nursing, Healing Touch, Healing Touch Spiritual Ministry, and in aromatherapy. As creator of a certification in clinical aromatherapy program, Linda has produced a unique offering that enhances the study of clinical aromatherapy by adding the study of vibrational frequencies of the oils, emotional and spiritual aspects of healing with oils, and energetic healing techniques. When students graduate from this 300 hour course of study, they will have learned much more than the national requirements to become an aromatherapist. Linda lives in Arvada, Colorado but can be found most weekends teaching somewhere throughout the world. Her “calling” is to help restore healing in Christianity and so she takes a Christian approach to the presentation of essential oils—God’s healing pharmacy.

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Introduction

From earliest time we have relied upon our noses to tell us of danger and to help us find food. In our modern lives we don’t depend so heavily upon this sense as other animals do. But that does not lessen in any way the importance of this sense. In this ebook we will examine not only the pathway that scent information takes in the brain, but also the role of scent information in the formation of memories and in the releasing of neurotransmitters and hormones.

Olfaction is probably one of our least understood senses, but it has the most direct route affecting the central core of the brain where we live—the limbic system. Scents, memories, and emotions get connected in an intimate way. It is not too farfetched to see why those who have impairment of the olfactory sense also suffer from different neurological or emotional problems.

The importance of pheromones is also discussed along with subliminal fragrancing. In modern life we aren’t so aware of human pheromones, at least not on a conscious level. However, they play significant roles in how we conduct our social behavior.

As aromatherapists this is one area that we need to thoroughly understand. Yes, the study of essential oils is much more than fragrances, but knowing how these odorant molecules actually affect our brains and every cell of the body is crucial to our being able to assess and help the clients who come to us.
Olfaction—The Sense of Smell

Olfaction follows a certain pathway into the body allowing aromas to exert an influence on the body/mind/spirit. This pathway functions throughout the lifetime of both humans and animals. Even a newborn animal recognizes its mother by smell. This is instinctual and is part of a survival mechanism. Animals, more than humans, rely on smell to tell them of danger or where to find food. So from the moment of birth, our sense of smell grows and develops.

By comparison, humans have a much smaller number of smell receptors than say a rabbit or a dog—especially a bloodhound.

Smell is often our first response to danger—we smell smoke long before we see flames. As for food, it will often stop us from eating spoiled food. Scientists still cannot explain all the mechanisms involved in smell and how we interpret them. However, we do know quite a bit about the olfactory process. Smell is a chemical sense detected by sensory cells called chemoreceptors. So when odorant molecules stimulate these chemoreceptors in the nose, they pass on electrical impulses to the limbic system in the brain. The brain then interprets patterns in electrical activity. Isn’t it interesting that smell is also intimately linked to the parts of the brain that process emotion (amygdala) and associative learning (hippocampus)?

In the diagram to the right, the olfactory neurons (about 5 million neurons or chemoreceptors) pick up an odorant and carry the message as an electrical stimulus through tiny holes in the cribiform plate of the ethmoid bone to the olfactory bulb. The message is then carried by way of the olfactory bulb directly into the limbic brain.
Noses play an important part of survival in most animal species. We tend to think of the nasal mucosa as primarily providing a line of defense against invading bacteria. It is true that it accounts for the majority of the cells lining the nose. The olfactory epithelium is atop the nasal cavity within the nose and only accounts for a small percentage—the rest is respiratory epithelium. To put this into perspective, if we compare the 5-10 million scent-detecting olfactory cells within the olfactory epithelium of humans to those of a few other animals, it is clear that this is an extremely important sense for survival—especially in the wild. Rabbits have an estimated 100 million olfactory cells with a constant turnover of new cells every few days. The regeneration rate in humans is approximately every 30-40 days—far too slow for a rabbit to survive. The number of scent-detecting olfactory cells in dogs depends on the breed. A dachshund has about 125 million olfactory cells while the sheepdog has 220 million, roughly a million times more acute than we humans. A bloodhound has about 3 million times more acuity than we do.¹

Don’t underestimate the power of human smelling though. We can distinguish over 10,000 different chemicals. Some individuals seem to have a greater ability than others to smell. These individuals are referred to as having the “nose.” They are modern perfumers who can detect the presence of chemical compounds or identify which compounds are absent in essential oils.

**Getting Down to the Smell Genes**

In 2004, Richard Axel and Linda Buck won the Nobel Prize in medicine for their work on smell which they completed in 1991. They discovered a large gene family—1,000 genes, or 3% of the human total, that coded for olfactory receptor types. They found that every olfactory receptor cell has only one type of receptor and that each receptor type can detect a small number of related molecules and respond to some with greater intensity than to others. They identified
approximately 350 different odor receptors. What this means is that some receptor cells are extremely specialized to particular odors and that some odors can only be detected because they are picked up by several different receptors. The brain interprets the “odorant patterns” produced by activity in the different glomeruli (micro regions) of the olfactory bulb. Axel and Buck found that there are 2,000 glomeruli in the olfactory bulb which allows us to perceive a multitude of smells.² Think of it this way. Axel gave an analogy of the 26 letters in the alphabet. We can configure those few letters into an endless myriad of ways. The same is true of different olfactory receptors acting together with each arrangement providing you with a different smell. So literally, we have the ability to detect tens of thousands of different chemical smells.

Another researcher has challenged this whole idea that humans have a large number of receptors. Biophysicist Luca Turin developed his quantum vibration theory in 1996 and suggests that olfactory receptors actually sense the quantum vibrations of odorants’ atoms. He believes that it is the vibrational frequency of odorants that play a more significant role.³ He further states that humans could perceive an almost infinite number of odors with only about 10 receptors tuned to different frequencies.

As we are exposed to more odors, we learn to recognize them and associate names with certain aromas. We decide whether they are pleasant or unpleasant and these aromas will become recorded along with experiences in our memory banks. Strong emotions that accompany a particular smell are recorded right along with bodily sensations and when detected even years later will recall that sensation even if the particular memory is not.

Smell is probably our least understood sense yet it is the most powerful one in affecting the central core of the brain. Let’s take a look now and see what happens once the olfactory bulb delivers its messages to the Limbic System in the brain.
The Limbic System

The limbic system, also called the emotional brain, is one of the oldest parts of the human brain. The main functions include emotions, instinctive behavior and responses, motivational drives, learning, and memory. According to Michael Shipley, a neurobiologist, the amount of human brain tissue devoted to smell is huge. Although most of us aren’t aware of smells, they have a very privileged and intimate access to the central portions of the brain—where we live. In the diagram above, notice the olfactory bulb on the underneath side of the brain. If you follow its pathway, you will see that it leads directly to the amygdala which processes emotions, and to the hippocampus which is responsible for associative learning. Smells would not trigger memories if it wasn’t for conditioned responses. The first time you smell something you link it to an event, a person, a thing, or even a moment and your brain makes a link between smell and memory. Take a look at the pathway on the next page.
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Aroma

Inhalation

Nose

The Olfactory Pathway

Olfactory epithelium
(Where we find the olfactory neurons imbedded)

Olfactory Bulb

Amygdala

Hippocampus

Hypothalamus

Pituitary gland

Autonomic Nervous System

Mid brain

Hormones released

Sympathetic/parasympathetic activity

Motor Center
Musculoskeletal movement

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Because we encounter most odors in our childhood, we shouldn’t be surprised when fragrances bring up childhood memories. As a child, I associated the fragrance of Sweet Pea with my grandmother because it grew on her backyard fence. Likewise, the smell of ripe cherries reminds me of her since I used to climb her cherry tree gathering cherries in hopes of a pie. So no matter how old I grow, those two fragrances bring back nostalgic wonderful memories.

The limbic system comprises a number of structures: the thalamus (Greek for inner chamber—look at its shape), hypothalamus, pituitary and pineal glands, the hippocampus (Greek for sea horse—notice its shape) and the amygdala (Greek for almond—notice its shape). This whole system is responsible for survival senses like hunger and thirst, the stress response, and basic emotions like fear, pain, pleasure, joy, anger, affection, sexual arousal—along with behaviors that these emotions prompt. It also plays a part in memory. Those who sustain damage to the limbic system suffer from memory impairment.

The Amygdala

Let’s begin with the amygdala—the olfactory nerves first reach these two almond shaped structures on either side of the frontal cortex which are positioned deep within the temporal lobes, close to the hypothalamus and hippocampus. When stimulated from any of the five senses it releases emotions, particularly pleasure, pain, anger, contentment, fear, sorrow and sexual feelings. It controls the overall pattern of our behavior. However, it is the messages from the olfactory sense that reach directly to the amygdala without first going through the thalamus for relaying. That means the amygdala is hot-wired to respond by initiating the “flight or fight” response that turns on the sympathetic nervous system. Take that smell of smoke again. That alerts the amygdala which then initiates survival mechanisms and all the physical responses needed to take flight. The
scent message then goes to the hippocampus.

**The Hippocampus**

The diagram on page 9 shows the hippocampus as a curved band of gray matter located inside the temporal lobe on each side of the brain. As part of the limbic system it plays a role in learning and memory, and in spatial navigation. This structure is key to forming short-term memory and in the consolidation of that memory into a long-term form. So, immediately the smell, memory, and the emotions attached to the smell are bonded together and can easily be revived by a future hit of that smell.⁶

Like the olfactory epithelium, the hippocampus is able to produce new neurons. The hippocampus in its role of memory formation helps identify sensory information worth saving, including smells. If it is damaged, memory may be impaired as well as the ability to interpret odorants. In Alzheimer’s disease the hippocampus is one of the first regions of the brain to suffer damage. Damage can also result from oxygen deprivation, encephalitis, or temporal lobe epilepsy. In the picture to the right, smelling a lemon involves memory, both short-term and long-term. Essential oils used to awaken the hippocampus are the mind-memory stimulating rosemary and peppermint.

**The Hypothalamus**

After reaching the hippocampus, the smell information travels on to the hypothalamus which lies beneath the thalamus and above the pituitary gland at the very center of the brain. One of the most important functions of
the hypothalamus is to link the nervous system to the endocrine system by way of the pituitary gland—the master gland of the body. In other words, the hypothalamus directs the pituitary to either up-regulate or down-regulate its messages to the endocrine glands. The hypothalamus is the control center for the autonomic nervous system—sympathetic/parasympathetic systems. Think ‘automatic’ because this part of your brain is not under your conscious control. It stimulates smooth muscles, regulates heart rate, controls secretion of many glands and regulates activities like digestion, sweating, vasoconstriction, insulin production, appetite, thirst, caloric levels, stress, sexual arousal, and eye blinking. Temperature regulation is here along with controlling your endocrine functions by way of its connection to the pituitary gland.

How does the hypothalamus figure in the olfactory process? The chemistry of hormones can be deeply affected by the smell of essential oils. For example, myrrh oil has a stabilizing effect on thyroxine from the thyroid gland. Ylang ylang has a calming effect on noradrenalin in the sympathetic nervous system. Geranium, rosewood, and frankincense all affect the hypothalamus and are considered regulating oils. The hypothalamus is also responsive to olfactory stimuli, including pheromones which will be discussed next. Olfactory stimuli are important for sex and neuroendocrine function in a lot of species including humans. So through the control of the hypothalamus, the limbic region influences the entire endocrine system of hormones.

**Locus Ceruleus and the Raphe Nucleus**

Michael Shipley, a neurophysiologist demonstrated that fibers from the olfactory nerve carry impulses to two small but significant parts of the brain—the locus ceruleus and the raphe nucleus. Noradrenalin is concentrated in the locus ceruleus and serotonin in the raphe nucleus. These are very important hormones.

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Noradrenalin, also called norepinephrine, is often referred to as a “fight or flight” chemical, responsible for the body’s reaction to stressful situations. Some of its effects include increased heart rate, increased blood pressure, dilation of pupils, dilation of air passages in the lungs, and narrowing of blood vessels. It enables the body to perform well in stressful situations. Serotonin on the other hand, is primarily a contributor to feelings of well-being and happiness—a feel-good hormone, it plays a role in regulation of mood, appetite, and sleep.

Shirley and Len Price suggest that sedative aromas like marjoram, lavender, Roman chamomile, German chamomile, and neroli cause stimulation of the raphe nucleus, which then releases the neurochemical serotonin. Stimulating aromas like rosemary, lemon, basil, and peppermint will affect the locus ceruleus, which then releases noradrenalin. Price goes on to say that it is not too farfetched to think about using aromas in aromatherapy treatments just like intranasal drug delivery already in use. Research has already shown that the linalyl acetate and linalool from lavender oil has the most sedative consequence in animal tests. One group patented the use of a fragrance that included nutmeg oil to reduce stress in humans. They found that when using nutmeg oil the systolic blood pressure was reduced in stressed individuals.8

**Right Brain Recognition and Eventually—Left Brain**

After reaching the hypothalamus, the smell messages go to the thalamus, which is a relay station for the scent to be sent through the cingulated gyrus to the neocortex—the brain—specifically the right side of the brain. When it reaches the neocortex in the temporal lobe, that’s when we become conscious of the smell and we can identify it by name.
Following the Pathway

Now that we have an understanding of each of the major players in smell anatomy and physiology, let’s review it. (The diagram on page 9 will help).

Odorant molecules → picked up by olfactory epithelium → olfactory neurons hanging down through the cribiform plate of the ethmoid bone interpret the molecules as electrical-chemical stimuli → send message to the olfactory bulb → message travels to the amygdala (emotional response) → hippocampus (associative memory response) → hypothalamus (hormonal response, autonomic response, musculoskeletal response) → eventually sending the message to the right hemisphere (emotional brain). The received messages get converted into action → euphoric, relaxing, sedative or stimulating neurochemicals—whatever is appropriate.

Pheromones

Pheromones remind me of computer programs running in the background. We often aren’t aware of their presence but they are alert performing their task. Pheromones were discovered in the 1930’s by Adolph Butenandt, a German biochemist. They are subliminal smells which are airborne chemicals involuntarily expelled into the air that affect the physiology or behavior of other members of the same species. The word pheromone is Greek meaning “to carry,” and “to excite.” So pheromones carry excitement. In the animal kingdom, these are powerful signals that define status, rank, and sexual and social identification. Animals literally “mark their territory” with their smell. One way I have found that keeps rabbits from devouring my raised vegetable gardens is to spray coyote urine. I mark the territory with the bunnies’ natural predator’s scent. So far, they are leaving my lettuce and vegetables alone!
Do Humans Have Pheromones?

Of course we do. Our natural odor once served similar purposes and to some extent, still does. This is what helps newborn babies identify their mothers. It is what partners, lovers, and friends use to choose one another unconsciously. This is not something we are usually aware of, but it is what attracts us to one another. Couples going through a break-up or divorce will often say their partner “no longer smells the same.” You see, the chemical attraction between them has changed just as their emotions have changed. We each have a “smellprint” which is completely unique for us and no one else in the world has the exact same “smellprint.”

Humans have a small gland called the vomeronasal organ (VNO) located low in the nose in the septal wall which picks up pheromones. It appears as a small pit and can vary in size from a tenth of an inch to microscopic. These cells communicate sensory information somehow to the hypothalamus and limbic system. In animals this organ is extremely important in sexual reproduction encounters and can regulate puberty and ovulation. In humans, it is a known fact that when women live together, their menstrual cycles become synchronized. It is believed that it is pheromonal exchange of instructional information transmitted in human sweat, particularly axillary (armpit) secretions, signaling synchronous menstruation. Likewise, male pheromonal odors can influence the female menstrual cycle. Male pheromones tend to be muskier than female pheromones. Regular male companionship can
cause women to ovulate more readily and show more sexual arousal. It is also true that during ovulation, women tend to have a heightened smell usually peaking at mid-cycle correlating with elevated estrogen levels.

Think for a moment about some of our essential oil fragrances. Sandalwood’s scent may be due to its chemical similarity to androsterol, a male pheromone. The sex pheromones androstenone and androstenol are secreted by human apocrine glands located in the genital and axillary areas. Interestingly though, 40 to 50 percent of the U.S. population is “smell-blind” to them.9

Pheromones do have less dramatic effects on humans than in the animal kingdom. But subtle and subliminal olfactory responses to pheromones can alter human behavior, affecting us emotionally and physiologically. The perfume industry has certainly figured this one out. Perfumes that contain ingredients that mimic sexual olfactory signals like civet, musk, castoreum, or sandalwood heighten and fortify natural body odors, rather than cover them up.10

**Subliminal and Environmental Fragrancing**

We don’t have choice about many fragrances that we encounter. We are surrounded by them both in nature and in our structures—homes, offices, malls, public buildings, etc. Some are imposed upon us as background smells to encourage us to buy products in a store, or that “new car smell” that makes us want a new one when our present car works just fine. Many household products have fragrances that we have come to recognize like furniture polish, household cleaners, newly washed towels, etc. Buildings may be fragranced to manipulate the working environment, or shops and hotels to invoke a “feel-good” factor, in airports to reduce apprehension, in movie theaters to make us hungry for popcorn, or in the grocery store where “fragrant samples waffle
throughout the store “that encourage us buy products not on our shopping list. One of the hardest for me to resist is the smell of coffee. I’m learning to just drink their teas. This kind of subliminal fragrancing is referred to as psychoaromatherapy. The research shows that people can be encouraged or manipulated using this method to act a certain way. (An ethical issue for us to consider in the future?) Some are already addressing it by stating clearly that their establishment is “fragrance free.” Product manufacturers are bringing us products that are “fragrance free.” Some healthcare institutions require that their employees be “fragrance free” as well.

One study showed that the odor of orange oil diffused in a dental waiting room reduced anxiety and produced a greater feeling of calm in patients. Another study showed changes in EEG readings, suggesting increased relaxation and drowsiness in human subjects after sniffing lavender essential oil. Ingrid Martin reports that massage therapists use aromatherapy in various ways to soothe and calm clients to decrease the symptoms of disorders that are often triggered by stress. This includes asthma, irritable bowel syndrome, and fibromyalgia.

But all of these smells are the obvious ones. Some are not so obvious and are so subliminal we aren’t aware of them. However small their detection, they still can have a psycho-physiological effect on us. You don’t have to be consciously aware in order for you to have a behavioral reaction. Peter and Kate Damian report on a study done by Tyler Lorig at Washington and Lee University in Virginia. In his experiment, a synthetic musk was administered below detectable threshold levels which produced a considerable reduction in alpha brain-wave activity resulting in poorer performance of a task requiring mental concentration. Musk, remember, is a sexually stimulating pheromone hardly conducive to the tasks of mental concentration, he adds. (Perhaps that’s why so many educational institutions through the ages separated the boys and the girls into different schools!)
Does Age or Sex Have Anything to Do with Ability to Smell?

Actually they do. As we become older, our sense of smell is not what it used to be. Research has shown that our sense of smell peaks between ages 20 and 40 with a marked decline after 60. A large scale study in Wisconsin found that almost two-thirds of subjects between 80 and 97 years of age had some form of olfactory, or smell, impairment.¹⁴ I found dozens of research articles showing the decline of the ability to identify odors as we all age.¹⁵ On average, women outperformed men at all ages, nonsmokers outperformed smokers, and peak performance occurs between the third through fifth decades declining markedly after the seventh. So with these factors, is it any surprise that the elderly complain that food no longer has any taste? If you can’t smell it, you can’t taste it.

Women are thought to have a greater sense of smell than men which is quite interesting since most individuals identified as having “the nose” (perfumers) are not women—they are all men! Some researchers suggest that there is a connection between estrogen and human odor perception which could explain why women have greater smell ability than men.¹⁶ Other studies report that female infants are more attentive to scented artifacts than are male babies. In a Vanderbilt University study by George Porter, infants as young as 3 days old showed a preference difference between males and females. So from birth, women seem to have a greater olfactory aptitude sensitivity and response to odors than do men.¹⁷

The time of day also seems to play a role in olfactory sensitivity. Women’s sense of smell has greater fluctuations than do males. Female smell acuity is usually...
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sharpest in the morning hours of the day, slowly declining as the day progresses. In contrast, male olfaction is constant throughout the day and by afternoon equals that of women, after which both peak again around midnight.

What has the perfume industry figured out about the differences between how men and women smell? Men are typically attracted to complex floral and spicy fragrances while women are attracted to single-note fragrances. Males like consistency in their choices and will gravitate to one cologne and stick with it—like “Old Spice.” Women are very different in their choices and prefer to change their perfume selection frequently. Pay attention to the fragrance commercials especially around gift-giving times like Christmas. The Fragrance industry appeals primarily to women more than to men in order to lure them to their products. This includes not only perfumes but household products and personal care products as well.

Anosmia

Some people suffer from anosmia, the inability to smell. According to some authors, anosmia is always accompanied by some elements of depression. With loss of the sense of smell, people also lose the sense of taste. The world becomes dull and colorless according to Marcel Lavabre, noted aromatherapy author. Depression among the elderly may be a combination of different social and psychological causes, but if the smell of food has lost its joy, many lose their pleasure in eating and therefore their appetite may be compromised.

Research has also shown that among the elderly, the loss of smell is selective and occurs first with bad odors, whereas sensitivity to pleasant odors remains relatively normal even into the more advanced age of eighties and nineties. This clearly shows an adaptation to odors among the elderly.
Selective anosmia is referred to as smell blindness to some or many odorants whereas total anosmia is the complete loss of smell. Complete loss can be due to surgery or trauma or psychological conditions.

**Olfactory Acuity and Mental Illnesses—Is There a Connection?**

Researchers report that schizophrenics, depressives, migraine sufferers, and very-low-weight anorexics often experience olfactory deficits or dysfunctions. One group of researchers even claim that certain psychiatric disorders are so closely linked to specific olfactory deficits that smell-tests should be part of their diagnostic procedures.\(^{20}\) One study out of Japan reports that olfactory dysfunction is a biomarker for Parkinson’s disease because of the high prevalence (greater than 90%) among Parkinson’s patients.\(^ {21}\) In a recent study on Bipolar disorders, the authors found that odor acuity may be an illness-state marker of mood syndromes in bipolar disorders. Diminished odor detection sensitivity predicted mania and social avoidance, whereas more sensitive odor detection predicted more depressive symptoms but better function in bipolar disorder patients.\(^ {22}\) Another study done in Germany on anxiety disorders found that there were significant deficits concerning olfactory discrimination in patients diagnosed with anxiety disorders.\(^ {23}\)

Freud was among the first to diagnose schizophrenia as a biochemical disease. Since decreased olfaction and schizophrenia has been well established in the literature, it raises the question as to whether essential oils could be used to augment present day standard treatments by stimulating recall, affecting brain chemicals and their transmission, and neural pathways, increasing awareness and orientation. A 2009 study found that there is an olfactory threshold deficit that may be genetically mediated in those who are diagnosed with schizophrenia. This deficit was also found in close relatives leading researchers to speculate that this could be an inherited deficit.\(^ {24}\) Before the dawn of chemical pharmaceuticals, psychological illnesses were successfully treated for centuries with aromatic oils. Kurt Schnaubelt in his book on *Medical Aromatherapy*, cites statistics and ongoing exploration of aromatherapy as a vital adjunct to the medical model.\(^ {25}\) The pharmaceutical industry, which is the major source of research monies, is not
about to put funds into researching something they cannot patent and make money on. The cost of treating some of these psychiatric disorders is extremely high and Schnaulbelt suggests that aromatherapy may be an alternative that people will turn to when they cannot afford Western medical solutions.

**Olfaction and the Mind**

A holistic approach to wellness acknowledges that what affects the body, affects the mind and the emotions and spirit as well. And where exactly IS the mind? Science does not have a complete picture as yet, but is willing to acknowledge that every cell in the body has memory—which is only one function of the mind.

For thousands of years, we have split ourselves into two parts—body and mind or soul. We can thank the Greeks for this scientific approach. For them, it was a way of distinguishing between magical medicine and scientific materialism. Aromatics with their connection to the magical approach to healing were actually regarded as tools of transformation and used in magic amulets to protect from evil spirits, to bring good fortune, and to heal what ails the body and mind. They were used to help transport the mind to another dimension, to capture the attention of perspective lovers with their fragrance, and they were used to seek the illusive “elixir of life.” This is what I would call—right brain material.

The mind is manifested especially in thought, memory, perception, feeling, will, or imagination. It is all of the conscious and unconscious processes of the brain and central nervous system that direct the mental and physical behavior of the body. We can distinguish the dominant activities between the two hemispheres. We have associated the thinking, logical side of us on the left, and the intuitive, creative, imaginative side on the right. The cognitive mind provides the logic in psychology. Here we reason and think. Human consciousness is the whole of our
perception, functions of awareness, senses, and being, which is greater than the sum of its parts. The mind observes, qualifies, or modifies the instinctive and emotional behavior of the body and the psyche (right brain), including what is stimulated or experienced by smell.

It is the right side of the brain where odor recognition predominantly resides and is therefore largely independent of left-brain analysis, verbal memory, and speech. So the experience of scent is in the psyche represented by the right brain, wherein also resides the passionate, romantic, and aesthetic feelings and desires. But together, the psyche and the mind, dominate human consciousness and provide awareness, feeling and thought.

So both the left and the right brain evaluate experiences—the one, emotionally and subjectively, the other mentally and objectively. So when you smell the lavender and you experience a sense of well-being and relaxation, the mind even going into reverie, it is through your psyche, the right brain. Then the left brain cognition kicks in and identifies this scent as lavender, the right brain. Then the left brain identifies this scent as lavender, bringing with it associative emotional feelings, memories, and certain expectations along with a whole array of left-brain analyses as to the effects of lavender oil on the body and mind/spirit.

**Releasing the Neurotransmitters**

Odor stimuli in the limbic system will cause the release of neurotransmitters. The hypothalamus sends the message to the pituitary which releases **endorphins** (the body’s form of morphine) which reduces pain, stimulates sexual feelings, and produces a sense of well-being. The term “endorphin” implies a pharmacological activity. It consists of two parts: endo- and –orphin; these are short forms of the words endogenous and morphine, intended to mean “a morphine-like substance originating from within the body.” **Enkephalins** reduce pain, produce pleasant euphoric sensations, and create a feeling of well-being. These are another type of endorphine that are particularly euphoric. In the central nervous system,
serotonin is believed to play an important role as a neurotransmitter in the modulation of anger, aggression, body temperature, mood, sleep, sexuality, and appetite, as well as stimulating vomiting. Serotonin helps you to relax and calm. Noradrenalin (or epinephrine) acts as a stimulant that helps keep you awake. It is one of the catecholamine hormones, chemically related to adrenalin and crucial to help us maintain alertness, drive, and motivation. So when the limbic system turns on the sympathetic nervous system (fight or flight), noradrenalin gets you prepared for action.

Some essential oils are natural antidepressants or have sedative or tranquilizing characteristics. They can trigger the release of endorphins and enkephalins which are neurochemical analgesics and tranquilizers. Since these neurotransmitters (peptides) are released directly into the blood stream, they affect the entire system by regulating bodily processes. Every cell of the body is affected in some way by these messengers. I find this to be very exciting news. Even if the research is not there yet to “prove” the effect of essential oils on releasing these neurochemical peptides, we have the research that shows how they work in the body. So if the essential oil odorant molecules can stimulate the release of these peptides, they can be harnessed in the treatment of disorders caused by chronic stress or depression. Dr. Candace Pert discovered the opiate receptors and went on to discover how peptides affect us. She called them “molecules of emotions.” In her book Molecules of Emotion she explains that our emotions can now be understood in a biochemical, that is, a physical way as the flow and reception of peptide molecules creating mood states and prompting behaviors. Vicki Pitman comments that Dr. Pert’s work helps explain what many aromatherapists have found through client experience—“the pleasurable sensations of scenting essential oils can profoundly affect our moods, our mental functioning and the health of every cell.”

We can receive many benefits from the use of these body/mind/spirit oils.

**Scents and Sleep—Any Connection Here?**

Just because you are asleep is no sign that your nose is. We are just as responsive to smells in our sleep as we are to noises or to light. Well, that means the stimulus
has to be strong enough to awaken us. In sleep, we are on “auto-pilot” so information from all the senses is greatly diminished. But can scents during REM sleep affect dreams? One research study shows that the olfactory stimuli (hydrogen sulfide—the smell of rotten eggs, and the fragrance of roses) does affect the emotional content of dreams. The positively toned stimulus showed more positively toned dreams, whereas the negative stimulus (the rotten eggs) was followed by more negatively toned dreams. So the findings show that information processing of olfactory stimuli is present in sleep and the emotional tone of dreams can be influenced significantly depending upon the stimulus used.\textsuperscript{28} Another study by Badia, et al., showed that smell can have a psychological effect even when it is below human consciousness or when humans are asleep. That study also showed more responsiveness early in the night.\textsuperscript{29}

Research showing a connection between essential oils and the inducement of sleep is simply not there. We have testimonials to that effect, but no evidence that there is indeed a connection. Even with the lack of evidence, I for one will continue diffusing lavender or other relaxing oils at bedtime.
Footnotes

1Peter and Kate Damian. *Aromatherapy Scent and Psyche*, pp.56-58.
2http://science.howstuffworks.com/environmental/life/human-biology/smell2.htm
3See my ebook on the *Physics of Essential Oils* for an understanding of the movement of atoms.
6Elizabeth Anne Jones. *Awaken to Healing Fragrance*, p.121.
7Elizabeth Anne Jones, Ibid., p.122.
9Peter and Kate Damian, Ibid., pp.64-65.
10Marcel Lavabre. *Aromatherapy Workbook*, p. 16.
11Ingrid Martin. *Aromatherapy for Massage Practitioners*, p.27.
12Ingrid Martin. Ibid. p.28.
13Peter and Kate Damian, Ibid., p.85.
14Sharon Basaraba. “Is Your Taste Changing with Age?”
16Doty, Shaman, et al., “Smell Identification Ability: Changes with Age”.
17http://www.sciencemag.org/content/226/4681/1441.abstract
19Peter and Kate Damian, Ibid., p.101.
20Marcel Lavabre, Ibid., p.15.
23Miyamoto T., “Olfactory dysfunction in Parkinson Disease and REM sleep behavior disorder.” *Brain Nerve*, 2012 Apr; 64(4); 356-63.
29Vicki Pitman. Ibid, p.43.
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