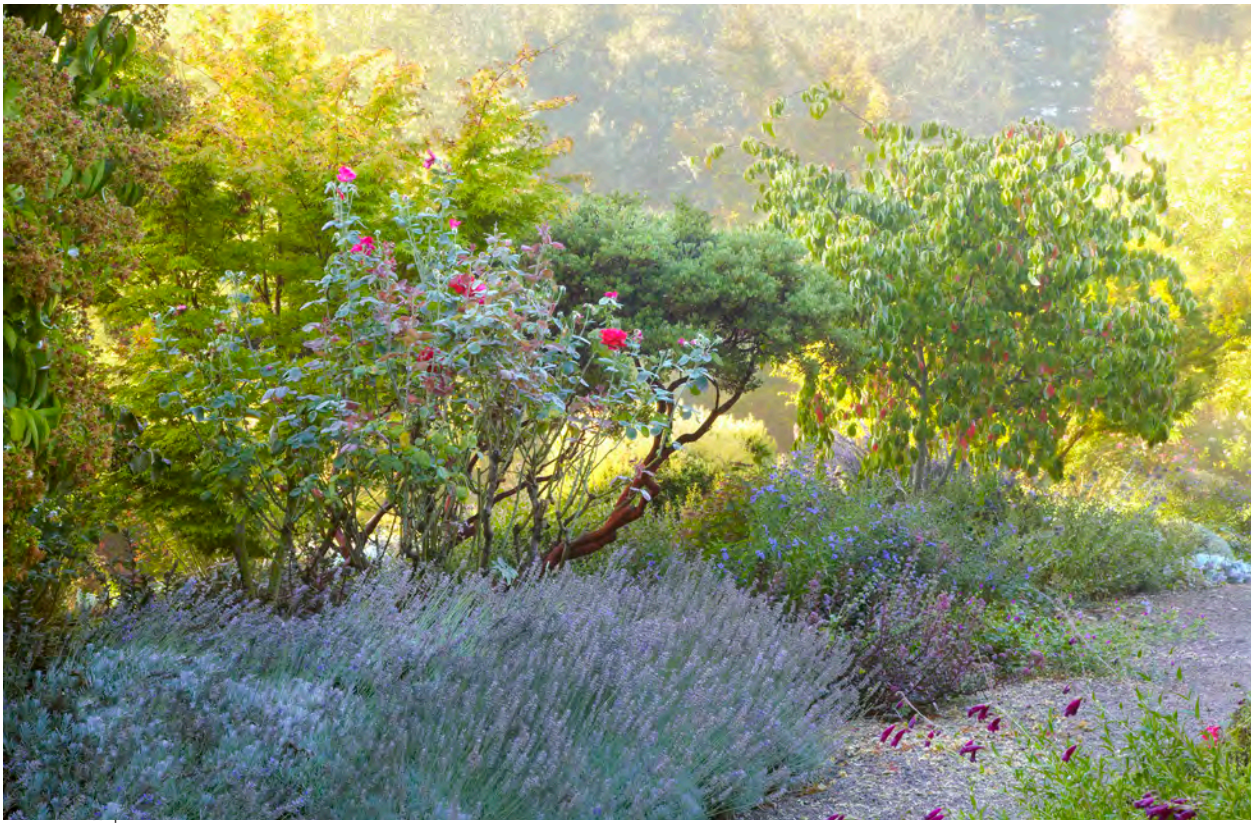
a tradition of scent in the garden

We cannot see or hear scent, making it seemingly less tangible than our senses of sight, touch, taste, or hearing. Step into a fragrance garden and it is almost magical how layers of aromas greet your nose completely unannounced. This delightful mix changes with amazing frequency walking through the garden. Some aromas dance across your senses while others are deep and exotic. There are familiar scents, while others leave you at a loss for words.

▶ A gate marks the official entry to the author's garden, but heady fragrances announce its presence long before one arrives.

▼ Some of the best paths to follow are fragrant.



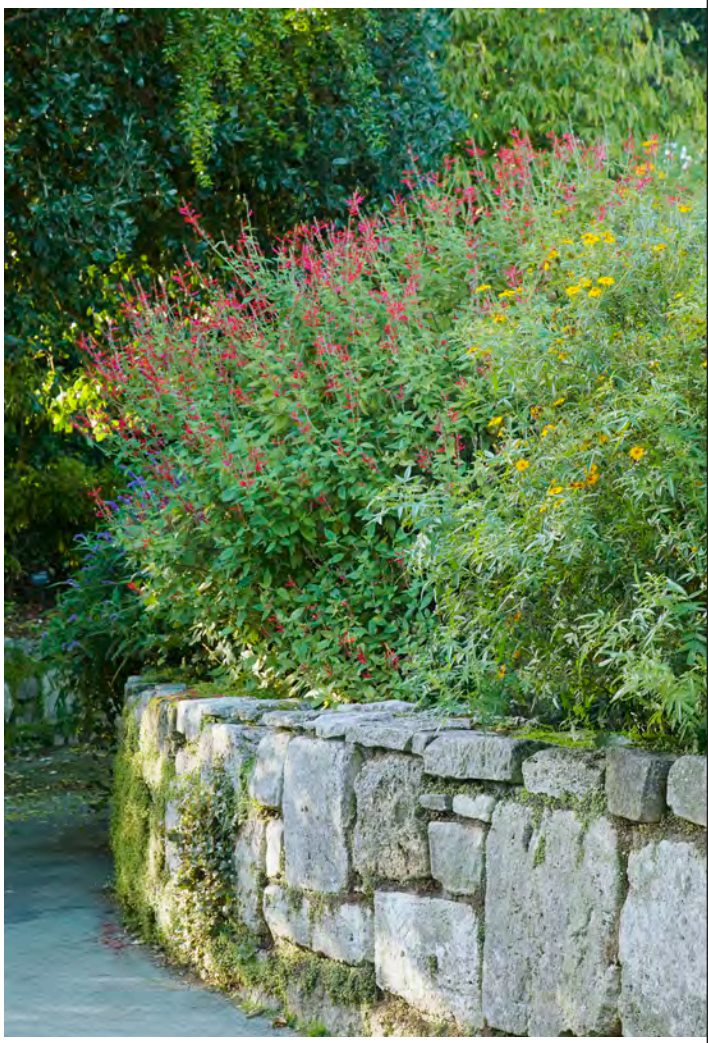
We respond to these intriguing smells with sensual delight, but while fragrant plants are enticing us, they are also hard at work, modifying our mood and frame of mind every time we inhale. Plant scientists are discovering what gardeners have always known: the fragrant garden reduces stress. Heady plant aromas make us laugh and smile more, and leave us with a sense of contentment. It's not all about the human experience, either. Scent is also important in attracting pollinators, deterring predators, and even allowing plants to communicate with each other.

what is fragrance?

A bloom in full splendor, a cup of hot herbal tea, a favorite cologne, or the earth after a summer rain—a multitude of smells enrich our lives daily. The impact is profound. Scent enhances life experiences, such as tasting and sensuality. It is also the stuff of which dreams and memories are made. It embodies poetry, mythology, imagination.

Nature's potpourri may seem enchanted, but fragrance is based on an assortment of invisible but very real aromatic compounds. They fit together like a puzzle to make up essential oils. These tiny oils easily float through the air, and can be released simply by pressing on a fragrant leaf.

Aromatic flowers, leaves, stems, fruit, roots, and bark typically concentrate essential oils in special cells. Different plant families have characteristic places where they store the oils. For example, most members of the mint family make and keep scent in fine, glandular hairs that cover their leaves. The carrot family prefers to hold aromatic essential oils in tubes in their seeds, or sometimes in their stems and roots. You can see this in plants like angelica, coriander, dill, and fennel.



▶ The pungent aromas of Mexican marigold and sages are brought to nose level.

How we perceive aroma

Each time you inhale, tiny, aromatic molecules hitchhike a ride. Smell a rose or basil leaf, and the compounds you breathe are first greeted high in the nose by the olfactory epithelium: two small receptors that are about the size of dimes. These receptors use tiny cilia filaments to catch and identify molecules, seemingly by their shape. The information is sent to olfactory bulbs located at the base of the brain, which interpret it and send a report to the limbic system. That is where different scents are interpreted and sent to the brain, to analyze and coordinate with other senses. The limbic system also ties our sense of smell to emotions and memory. It distinguishes between aromas that draw us in and odors that fend us off. It determines when there is an emergency, such as smelling something burning. All of this happens in less than a second, making our perception and reaction to a scent instantaneous. You immediately identify the aroma as rose or basil, and think either bouquet or pesto.

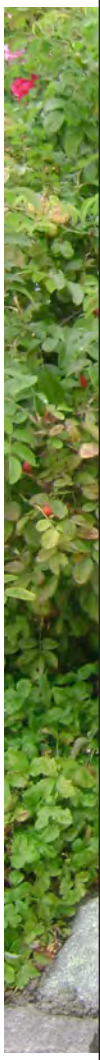
Your reaction to aroma is largely based on past experiences with the scent, how a particular scent acts on your brain, and probably genetic make-up. If you are like most people, you prefer familiar fragrances that spark good memories. Sometimes past association gets in the way of fully appreciating aroma. When students at Warwick University in England took a test while smelling a certain scent and were later told they had performed poorly, they felt depressed the next time they encountered the same aroma.

Many people are attracted to lemon's clean, sharp scent, but it can also be associated with furniture polish or lemon-scented dishwashing soap. Lemon grass, citronella, and lemon-scented eucalyptus can be reminiscent of pungent insect repellent.

Putting a name to fragrance

Describing the many scents produced by plants has long fascinated botanists and perfumers. One of the first classifications of scent was by Theophrastus, a Greek botanist and herbalist from the fourth century BC. In his treatise, *Concerning Odours*, he designated aromas as simply good or evil, and categorized them as sweet, pungent, heavy, powerful, or faint. In the eighteenth century, Carl Linnaeus, who founded the system of botany we use today, divided these categories. Good scents smelled fragrant, aromatic, or like ambrosia, while bad scents were garlic, goat-like, or foul. In the next century, Eugene Rimmel identified eighteen plant-based aromas in his classic *Book of Perfumes*, defining them poetically as spicy, rose-like, anise, balsamic, and jasmine. The nineteenth-century Frenchman, G. W. Septimus Piesse, took a new approach to aroma by corresponding scents with musical "notes." Perfumers and aromatherapists still talk of high, middle, and base notes when they describe essential oils. Base notes, such as vetiver and spikenard, smell heavy. They fix scent and make the blend last longer. Middle notes—think of rose geranium or marjoram—are considered the heart of an aromatic blend, carrying and tying the mix together. Top notes like rose and lemon dance over the top of the other aromas.

Classification of plant fragrance was expanded by botanist Anton Kerner von Marilaun, a professor at the University of



▲ Eighteenth-century Swedish botanist Carl Linnaeus created an early system of dividing scents.

Vienna, Austria, and curator of its botanical garden in 1860. He placed damask rose in a rosy, sweet-floral, almost fruity group. Violet-like orris root is paired with violets. The aromatic group lumps together the intense fragrances of clematis, heliotrope, honeysuckle, sweet pea, and Mexican orange blossom shrub. Heavy aromas that are more cloying, such as daffodil, daphne, lily, and mock orange, are in their own category. Citrus includes the obvious choices of lemon, lemon balm, lemon verbena, lemon eucalyptus, and lemon thyme. Animal scents are represented by spikenard and musk rose. Leaves are compared to mint, garlic, turpentine (such as rosemary or pine), or camphor (such as bay, sage, thyme, or wormwood). Wood-like scents are aromatic, such as cedar, or carry the turpentine scent of pine and fir.

Modern scientists organize scents according to the similarity of their aromatic compounds. If you have a good sense of smell, you will detect a common, aromatic thread. An example is the terpene group, with the diverse, green, earthy scents found in lavender and citrus. The benzoloid group includes the spicy clove of pinks and the cherry-cinnamon scent of hyacinth, as well as the cherry-vanilla fragrance of heliotrope. Scented geranium, rose, and even valerian are in the paraffinoid group.

Essential oils are the key

It is possible to capture the garden's fragrances in a bottle by extracting essential oils from plants. The most common method is by steam distillation. The tiny aromatic molecules that comprise essential oils move readily into hot steam in the same way they

fill the garden with fragrance on a hot day. A steam distiller extracts the essential oils, cools the steam back into water, and separates out the pure essential oil. Most essential oils that can handle this kind of high heat are found in leaves and seeds.

The leaves of basil, bay laurel, clary sage, juniper, lemon grass, lemon verbena, marjoram, patchouli, peppermint, rockrose, rose geranium, rosemary, sage, and thyme are distilled for flavoring products including alcoholic drinks, gum, candy, and tobacco. They are also distilled to scent body care and other products. Other, less-known plant leaves, such as anise hyssop, can be distilled (I've done it myself with my steam distiller), but they are rarely commercially available due to low demand.

Aromatic flowers are a different story. Many of the essential oils responsible for flowers' fragrance are fragile and altered by the high heat of distillation. Heat changes the aromas of clematis, daffodil, daphne, gardenia, hyacinth, freesia, lilac, lily-of-the-valley, and sweet pea flowers. Most of these floral essential oils are produced synthetically in a lab and labeled as fragrance oils. The best way to think about synthetic essential oils is to compare them to cloying, cheap cologne that sticks to the back of the nose. Synthetics are commonly used in perfume, cologne, and scented body care and household products, including many labeled as aromatherapy. However, they never smell like the real thing. Some of the chemicals used to create them have questionable health effects. Aromatherapists like myself use only plant-derived essential oils.

A few flowers, such as chamomile, lavender, orange blossom, and rose, are steam distilled. Some floral essential oils are also extracted without heat using chemicals or a carbon dioxide process. These expensive oils mostly go into high-end perfume. Jasmine and tuberose are available only as "absolutes," which means their essential oil is extracted with solvents, then the chemicals are removed to leave just the essential oil. It is an investment, but you can purchase a steam distiller to produce essential oils from your fragrance garden. It requires a vast amount of plant material, which is more than most gardens can supply. However, small amounts of plant material will give you a quantity of scented water, called hydrosol, as a by-product of distillation. This aromatic water is dilute enough for use in sprays, to splash on the skin, or for use in cooking.

Pure essential oil is so concentrated that it smells much stronger in a bottle than the plant itself. In fact, it is so strong that it should be used with care. Although many people think problems with essential oils are due to extenders that are added to some inexpensive brands, even pure essential oils have the potential of being toxic. After all, one of their primary roles in plants is to deter predatory insects and animals from eating them. Undiluted essential oils such as oregano, thyme, and the citruses can burn skin. Essential oils also absorb into your skin and reach the bloodstream, and even small

▶ Tabletop distillers are a good way to capture fragrant hydrosols and a bit of essential oil from your garden.

amounts can tax the liver and kidneys. Some essential oils, such as camphor, are also rough on the nervous system. For safety's sake, do not use essential oil directly on your skin without diluting it, and do not ingest oils. It does little good, since ingesting pure essential oils causes them to be absorbed mostly in the throat. Better to add oils to lotion, cream, or salve so they can penetrate into and benefit underlying tissue. Cats and dogs do not process ingested essential oils well, so can be easily poisoned by them.

why plant aromas vary

With seventeen hundred known aromatic compounds from more than ninety plant families, there are a lot of possibilities for making one plant smell different from the next. Some essential oils, such as orange, have a simple chemistry based on a few specific aromatic compounds that give them a straightforward smell. Orange is pleasant enough, but compare it to the deeply complex rose, which contains around two hundred seventy-five scent molecules. That complexity is why the captivating fragrance of rose finds its way into the imagination, poetry, and perfume.

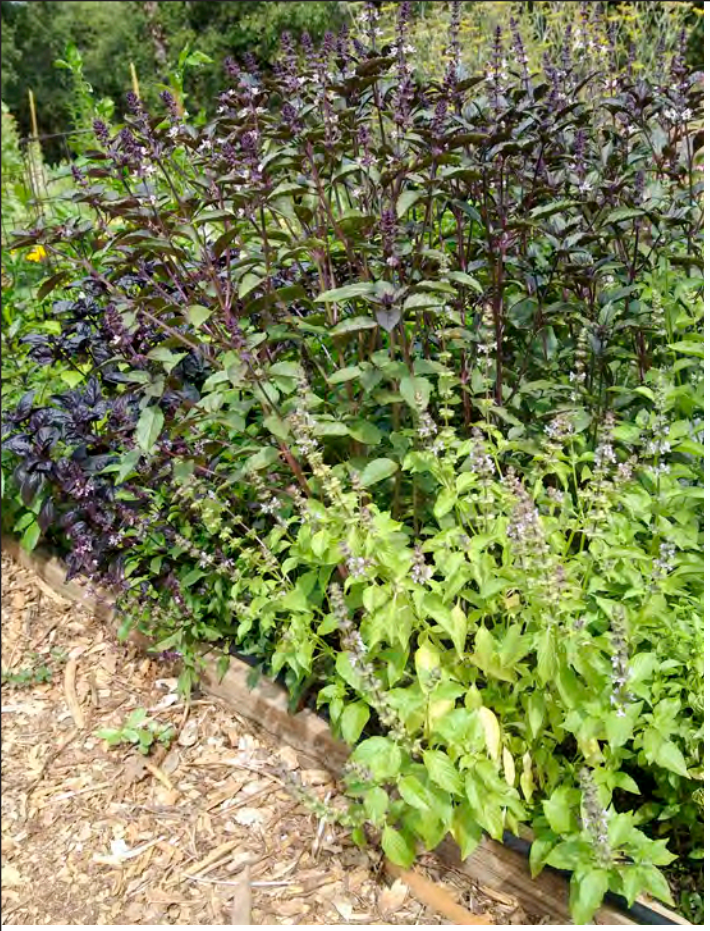
When several plants share some of the same compounds—such as lemon verbena, lemon thyme, lemon eucalyptus, and lemon grass—they smell similar. Yet, you can distinguish these plants from each other because their other aromatic molecules give each a unique essence.

Chemotypes

Occasionally, plants in the same species look identical to the botanist, but do not smell exactly the same. This occurs when they are growing in different regions and adapt their chemistry for better survival. A chemist refers to these variations as chemotypes, because the two plants contain different percentages of their aromatic molecules. The mint family readily develops chemotypes, with at least eight chemotypes of thyme alone. So thyme growing in the mountains of southern France smells softer because it is higher in linalool, a compound that is abundant in lavender, while its seaside counterpart contains more thymol, which gives thyme its characteristic aroma. The chemotypes of rosemary include the harsh camphor, a gentler verbenone, and eucalyptus-like cineol. Korean mint, related to anise hyssop, can have the scent of either cloves or patchouli. Other plants containing aromatic chemotypes include basil, bee balm, curry plant, lavender, myrtle, sage, scented geranium, and camphor and eucalyptus trees.

how plants use scent

As much as we enjoy the fragrances of the garden, plants produce all their wonderful scents not for our enjoyment, but for their own gain. The same essential oils that create aroma are sophisticated survival tools to help aromatic plants control their environment. Since plants are stuck in one place, they use scent to reach out and lure pollinators for reproduction, to fend off predators, and to



thwart competitive plants. In many cases, natural selection has favored the survival of plants with higher concentrations of scent.

DIFFERENT ROLES FOR FRAGRANT PLANTS

Aromatic flowers and leaves play different roles. Flowers broadcast copious amounts of fragrance for a just a few weeks a year, attracting pollinating creatures. Leaves generally keep their scent to themselves since they have no need for pollination; strong aroma could distract pollinators and waste precious energy. As a result, we must rub or crush a leaf to release its scent. That aroma is more pungent and "green" than floral, since it serves to keep away destructive insects and infection. Sharp-smelling leaves, such as rosemary, thyme, eucalyptus, and tea tree, are also some of the most antiseptic—not only for plants, but also for people.

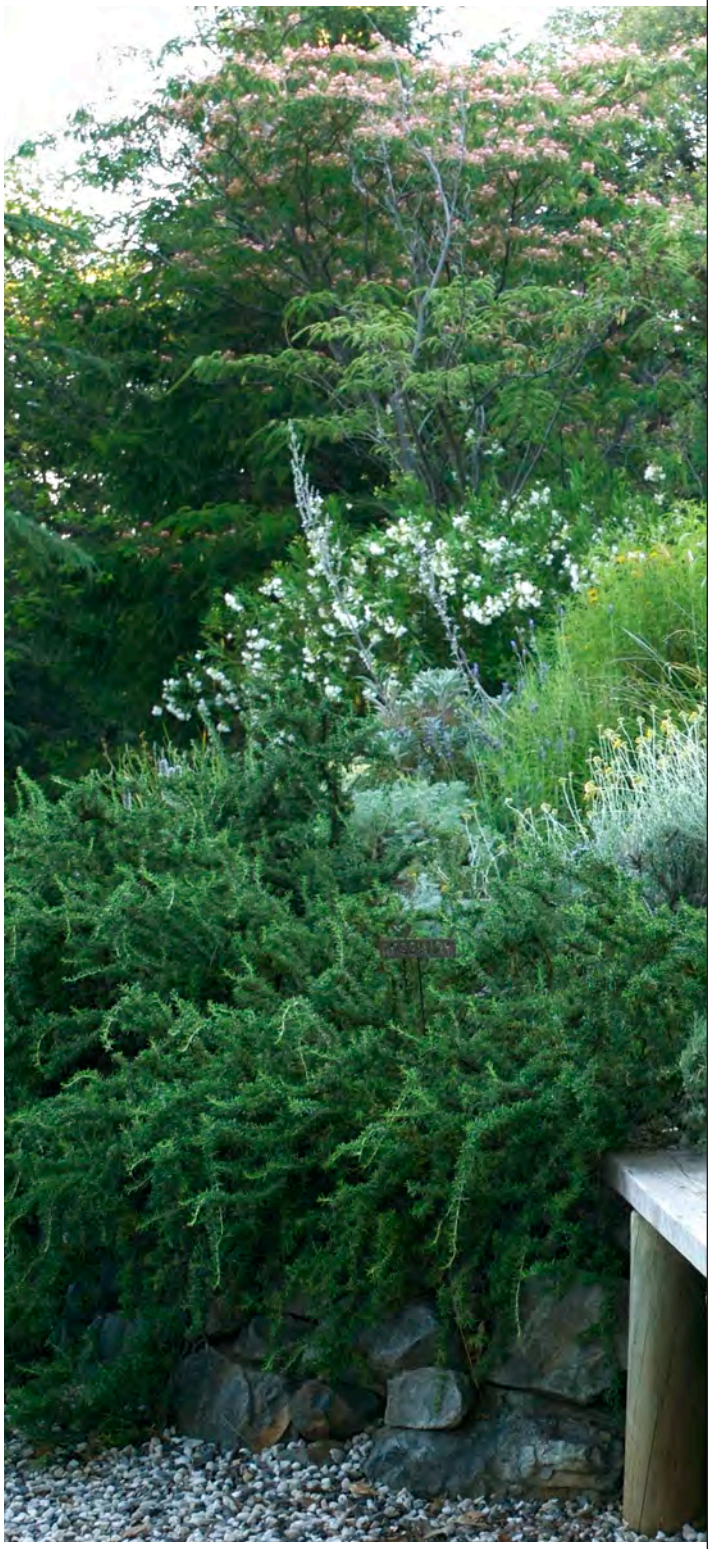
Plants use scent to keep potential predators from eating them—predators that include us. We consume aromatic herbs only in tiny amounts, because their scent and flavor are so potent. Animals do not find fragrant plants such as rosemary, sage, and thyme tasty. My fragrance garden does not have to be fenced, even though deer frequent it. The aromas that are exuded into the soil from the roots of rue, wormwood, and yarrow deter neighboring plants from getting too close.

▲ Lemon, cinnamon, and purple basils each have slightly different scents.

◀ Geraniums offer a potpourri of scent and leaf textures.

When Cornell University researchers artificially increased the scent of certain flowers, bees were unimpressed, but destructive ants were deterred by the strong scent. Flowers do not always benefit from pumped-up fragrance. Sigma Xi, the Scientific Research Society, reported that flowers with increased scent put out the welcome mat to beetles—however, honeybees were repelled, although seemingly not by the stronger fragrance, but by the abundance of beetles!

It is amazing to consider, but plants can smell. Their sense of smell is based on hormones rather than via a nose and brain neurons. They detect pheromones from their fruit to know when it is ripe. They also put out distress signals when injured or attacked. Wild tobacco that is infested by caterpillars releases a leaf scent to alert parasitic wasps that eat the caterpillars. The University of Florida and United States Department of Agriculture (USDA) found that citrus trees infected by the deadly greening disease produce a scent that attracts parasites that spread the disease, but also a wasp that is their natural enemy. Lemon tree roots exude essential oils if attacked underground. Wounded sagebrush increases its potent scent more than six times to notify other sagebrush in the area. Even tobacco plants growing downwind from the sagebrush get the message to increase their defenses—and suffer less insect damage as a result.



▶ A rich-smelling garden can offer multiple benefits.

The aromatic compounds that give pine trees their well-known smell also play a significant role in reducing ground temperatures in boreal forests. The compounds react with oxygen to become aerosol vapor, rising and encouraging clouds to form in the forest canopy. The vapor-filled clouds reflect the sun's heat to cool the air below. Some scientists say that the loss of aromatic trees worldwide may be helping to warm the planet and contributing to global warming.

ATTRACTING POLLINATORS

A fragrance garden offers far more than pretty smells; it also draws an array of pollinators. Insects are nature's aromatherapists. Many of them rely on a keen sense of smell to locate the nectar and pollen that flowers advertise through fragrance. Insects and flowers have developed a mutual dependency and adapted accordingly.

Plant researchers have long said that pollinators find color more attractive than scent. However, it turns out that olfactory cues help pollinators choose the best flowers. When many flowers go into bloom at the same time, those that are most highly scented win the battle for pollinators. The Centre for Research on Ecology and Forestry Applications found that flowers in early spring in Barcelona, Spain, had much stronger, herby scents that bees love. In the summer, when far fewer flowers are competing with each other, the fragrance was less intense. This competition to attract pollinators may be why plants developed so many different scents.

Bees, butterflies, and hummingbirds demand a high-energy diet to sustain themselves and their brood. Pollen is rich in protein and flower nectar is primarily sugar water, but it does contain some amino acids, vitamins, and minerals. Most pollinators fly, enabling them to distribute pollen over a wide area. This promotes genetic diversity for the plants they visit. It's a big job: each flower requires about fifteen visits before it is fully fertilized. To ensure fertilization, flowers may rely on more than one type of pollinator.

Species that have strong daytime scents are pollinated mostly by bees and butterflies. Those that release fragrance at night are typically pollinated by moths and bats. Plants that are pollinated by bees and flies smell sweet, while those pollinated by beetles have strong musty, spicy, or fruity odors. Plants that rely on wind pollination, such as lemon grass, juniper, and wormwood, have no need to be fragrant or flashy, so they have small, greenish flowers without sepals or petals.

Different plant species have developed ways to recruit pollinators and keep them faithful, as well as ways to keep away creatures that will rob the plants of pollen and nectar. Plants often play tricks to smell or look especially attractive to an insect. Some clever flowers, especially those catering to butterflies, smell like pheromones that insects use to attract the opposite sex. Flowers signal that they are prime for pollination by increasing their scent when their potential pollinators are active. Once pollinated, they gradually lose both scent and attractiveness.

▶ A bee visits a dittany of Crete flower.

Honeybees and wild bees

Most flowers are pollinated by bees, which have specialized, furry legs to hold pollen. Honeybees are attracted to yellow, blue, and purple flowers, although they are more partial to strong, sweet scents that indicate the presence of pollen and nectar. Fragrance helps them find the correct plants. Similar to people, bees recognize aromas faster and remember them much longer than they do visual cues, according to research reported in *Functional Ecology*. We humans cannot see them, but low ultraviolet light nectar-guides on angelica, bee balm, lamb's ears, and sweet pea attract bees and help them quickly locate their target. Yarrow and tansy have a similar zone across their floral discs.

Wild bees have always been a vital part of the ecosystem. The job of plant survival fell on their wings before beekeepers kept European honeybees. Native bees prefer to pick up pollen and nectar from the native plants in their area, but they visit domesticated plants as well. Many wild bees are small with short tongues, so they prefer packed clusters of tiny flowers, such as chamomile. Ground-nesting bees are among the first to emerge to visit violets and other early spring bloomers.

Like honeybees, bumblebees form colonies with a queen, although there are fewer than fifty in a nest. Watching bumblebees maneuver into large clary sage flowers can be quite entertaining. They will also visit anise hyssop, bay laurel, clematis, honeysuckle, lamb's ears, phlox, rockrose, and wisteria. Sometimes they will pollinate smaller lavender, rosemary, and thyme flowers.

Relying on bees for pollination has become an increasing problem for many plants. The seasonal behavior of some species has been changing and natural foraging areas moving. Wild bees are beginning to emerge

at different times in the year when flowering plants are not abundant. The spread of infectious colony collapse disorder has also caused a sharp drop in European honeybees. The Intergovernmental Panel on Climate Change's 2014 report warned that bees and other pollinators faced the risk of extinction because of global warming. In 2013, the European Union announced plans to restrict the use of some pesticides in the hope of slowing the decline of bee populations.

Butterfly and moth pollinators

Butterflies are particularly active during sunny days, visiting a variety of flowers. They seek out long flowers and extract the nectar with long proboscises. They have excellent vision and, unlike bees, can see red flowers. They also go for bright orange, yellow, pink, and sometimes blue. However, butterflies do not have a keen sense of smell. They rely on taste receptors on their feet to identify a host plant. Highly perched on long, thin legs, they are not able to pick up or carry as much pollen as a bee, but they still do their fair share. Flat-topped flower clusters, such as those on yarrow plants, make the easiest landing pads for large butterflies. Protective plants such as fennel and violets are used for laying eggs.

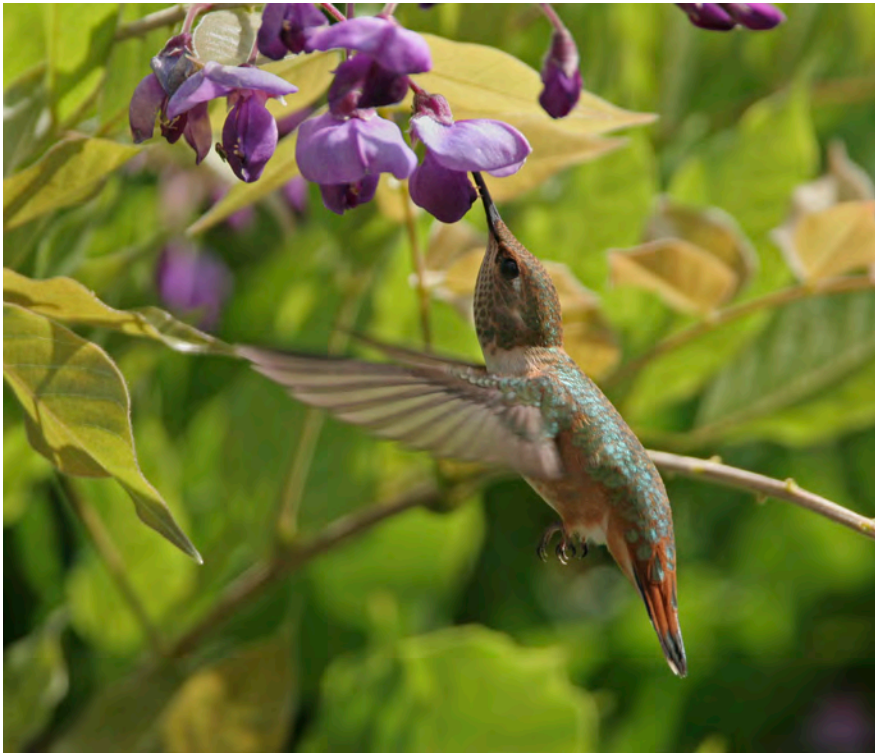
The western tiger swallowtail butterflies visit my garden to pollinate the bay laurel, dill, fennel, native honeysuckle, lavender, mint, lilac, mock orange, phlox, and wallflower. Skipper butterflies are tiny enough to pollinate the small flowers of catnip, lavender, and oregano. Phlox and rue attract the beautiful giant swallowtails, and mint and mock orange lure wood nymph butterflies. Painted ladies and sulfurs are a few of the butterflies that also feast on the nectar of phlox. Milbert's tortoiseshell butterfly visits lilacs and wallflowers and sara orangetips pollinate violets, while Baltimore butterflies flock to wallflowers.

Moths, on the other hand, are extremely sensitive to odors. They pick up honeysuckle's fragrance from half a mile away. Most are nocturnal, so the flowers they pollinate wait until dusk to emit strong scents that will carry in the night air without the sun's heat to evaporate the aroma—think flowering tobacco, gardenia, Easter lily, and night-blooming jasmine. Moths and long-tongued bees that can reach into the tubular flowers of primrose and phlox help with pollination.

Other pollinators

Other pollinators visit the fragrance garden. Hummingbirds are so sensitive to scent that they were taught to differentiate between smells at the Centro di Studio per la Faunistica ed Ecologia Tropicali del C.N.R in Santa Teresa, Brazil. For example, they could tell the difference between jasmine and lavender.

Hummingbirds are drawn to the deep red flowers of bee balm, flowering tobacco, and pineapple sage. They also go for orange, yellow, and deep pink blooms, as well as many purple and some blue-purple flowers, such as anise hyssop, hummingbird sage, Spanish sage, and wisteria. Tubular, nodding flowers with long styles and filaments—such as honeysuckle, red-flowering sage, bee balm, and some lilies—accommodate the hummingbirds' long beaks, which collect pollen as the birds drink. These flowers do not need a landing area, because hummingbirds prefer to hover while feeding.



▲ Pollination of an unusual blue-flowering spearmint.

◀ Hummingbirds serve as important pollinators.

Roman chamomile is pollinated by flies, as well as by little beetles. Small wasps pollinate German chamomile and tansy. Flies gravitate toward the white and cream-colored flowers of angelica, daphne, fennel, lily-of-the-valley, peppermint, rockrose, sweet woodruff, thyme, wallflowers, tansy, and some green flowers. Flies with short tongues prefer simple, bowl-shaped flowers. Hover flies visit so many wild plants that they have been considered the next important group of pollinators after wild bees. Some even have a proboscis, to siphon nectar out of long, narrow flowers. Pollinating flies can mimic bees, but look closely and you will see only one pair of wings instead of two, as well as larger eyes, shorter antennae, and skinnier legs than bees. The larvae of nearly half the pollinating flies are laid on the plant. This helps with pest control, because the larvae prey on other insects.

How to attract plenty of pollinators, but not too many beetles, is an ongoing floral dilemma. Beetles are clumsy in flight, so require an easy entrance to the flowers. They are also messy pollinators, often chewing the plant and leaving droppings. Flowers such as Mexican marigold and rockrose have adapted ways to provide enough food for hungry, pollinating beetles, while avoiding being destroyed in the process.

Millions of years ago, when the first flowering plants began to bloom, some wasps made a switch from hunting prey to gathering pollen for their brood. Wasps are generally less efficient pollinators than bees (which descended from wasps) and lack the body hairs to trap pollen, so are unable to carry it from flower to flower. Even so, some hard-working wasps bring their young nectar and pollen.

Using aroma to deter bad bugs

The fragrant garden is fairly pest-free. Most insects in my garden are pollinators, rather than their destructive relatives. The aroma creates a built-in defense against predators that cannot pick up the scent they want through the aromatic shield. Insects rely on their acute sense of smell to locate plants to eat, with many of them flying miles to track down a meal. Night-flying moths that lay caterpillar and cutworm eggs on garden plants purposely fly upwind to detect plants.

My first garden a few decades ago was in a tightly populated beach community that still had old victory garden plots from World War II, when everyone was encouraged to grow food. My neighborhood replanted them. My refurbished victory garden held only a few vegetables that were surrounded by forty-some aromatic herbs. It was the only garden for blocks without predatory bugs—that is, my garden and the one directly on the other side of the fence. My first garden tours were to show curious neighbors the benefits of having an aromatic garden.

If your garden is invaded, peppermint, thyme, and wormwood are star players against garden pests. They remove white flies from the greenhouse. Along with basil and dill, they deter the dreaded tomato hornworm. Wormwood can almost single-handedly defend the entire garden, discouraging carrot fly, squash bug, and maggot. Along with southernwood, it also

works against the cabbage looper. Peppermint deters both the ants that climb my roses and the aphids they deposit on the shrubs. Other plants to battle aphids include basil, camphor, cilantro, eucalyptus, fennel, and tansy. Use French marigold, rosemary, and rue for beetles, and tansy for Japanese and cucumber beetles and squash bugs. Catnip, cilantro, and tansy are specific for potato beetles. To deter spider mites, try cilantro, cumin, and oregano. Fennel and rosemary can be ground into a powder to sprinkle anywhere there are slugs or snails.

A plant's essential oils protect it in other ways besides just odors and aromas. Essential oils also destroy bacterial, fungal, and viral infections responsible for plant diseases. These antibiotic oils are the same ones used in aromatherapy to fight infections and heal wounds in both people and animals. Some particularly potent examples are the highly antibacterial and antifungal lavender, oregano, and rosemary. It's effective to use these aromatic plants in any combination to make a spray for infected plants or to create a powder to sprinkle around a plant's base. Simply planting them in your garden can deter pests from vegetables. French marigold roots exude an aromatic substance that repels destructive nematodes in the soil, helping prevent injury to garden plant roots.

Of course, the best way to keep your garden free of harmful bugs is to have healthy plants. Preventive health care works the same in your garden as it does for people, making the plants more resistant to disease and pests. Insects generally avoid strong plants and go after the ones that are ailing. If you see problems in the garden, look first at the infested or infected plant itself for health problems. Pamper those plants with bug spray, compost "tea" (compost steeped in water), and sufficient water to make them more resilient.

▲ The odor of caraway thyme (*Thymus herba-barona*) helps keep insect pests at bay.

make your own plant pest repellent

A simple, all-purpose insect spray for plants. This employs the naturally repellent qualities of plant aromas.

Approximately 1 cup fresh peppermint, thyme, and wormwood leaves

2 whole, unpeeled garlic cloves

2 cups water

blender

spray bottle

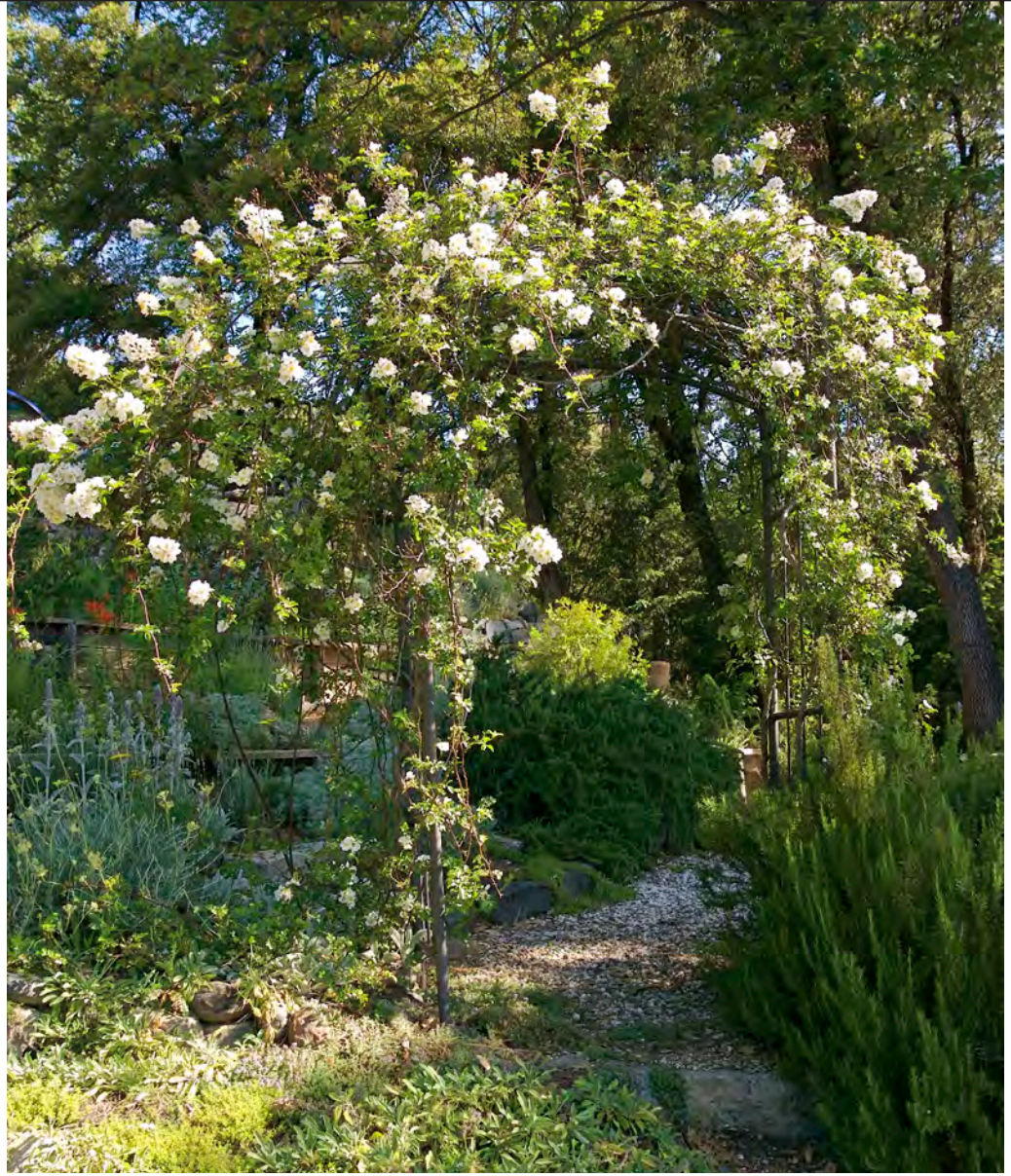
1. Place the leaves, garlic cloves, and water in a blender.
2. Blend contents into a slurry.
3. Let mixture sit overnight, then strain.
4. Use the resulting herb-scented solution as is, or add liquid castile soap or dishwashing liquid (for better adherence) and vinegar.
5. To use, pour liquid into spray bottle and apply directly onto infested plants. Dilute with water if too thick.
6. Store repellent in refrigerator, where it should keep about a week. Mark your bug spray well! When labels have fallen off, my family has eaten all sorts of herbal concoctions.

optional

1 teaspoon liquid castile soap or dishwashing liquid

2 tablespoons regular strength vinegar (any kind)

▶ Thyme is a natural pest repellent.



▲ A rose arbor brings cheer to visitors.

aromatherapy from the garden

At one time, it was taken for granted that spending time in a garden was healing to body, mind, and spirit. It is no wonder that gardeners love being in their gardens! They will be the first to tell you that a fragrant garden changes one's mood. Never hesitate to take an extra "dose" of garden whenever you need an emotional lift. Like many gardeners, I also bring the aromas of my healing garden into the house with fragrant

bouquets, and plants such as jasmine, lilies, violets, and daphne growing outside my windows.

Scientists have been investigating the field of aromacology to discover how scent impacts us. What they found is that aromas spark areas in the brain that control emotions. One reason we respond so quickly to liking or disliking a scent is because it gains direct access to our mind. One of the ways in which fragrance alters moods is to modify brain activity. Changes are observed in brainwaves and neurotransmitters, such as serotonin and dopamine, which play important roles in regulating our emotions, anxiety, cognition, sleep regulation, and appetite. Scent also communicates with hormonal regulators in the body, especially the adrenal, hypothalamus, and pituitary glands that act as control centers to manage everyday functions.

PLANTS CAN CHANGE YOUR MOOD

Aromas impact our emotions in different ways. Calming scents help our bodies deal with stress and depression. Other aromas stimulate the mind to keep us awake or to help us work more efficiently. Most scents stir the memory, but some do a better job than others. Generally, fragrances that we find pleasant make us feel good and assist us in functioning better emotionally.

Medical science is looking into the many ways people have traditionally used fragrant plants. It's helping scientists uncover the untapped potential of aromas. Researchers are studying plants with rich aromatherapy lore, hoping to put our sense of smell to work helping us heal (as well as prevent) at least some emotional and physical diseases. As a result, we now have a selection of aromatic plants with therapeutic uses that are backed by both science and history. Aromatherapists add a number of additional fragrant plants to their pharmacy—plants that have not been scientifically investigated but have many traditional uses.

The Fragrance Research Fund, a nonprofit coalition of fragrance industry companies, began collaborating with Yale University's psychophysiology department in 1982 to investigate ways in which aroma affects personality and behavior. One program followed more than two thousand subjects over twenty years. A long list of disorders is being researched, including fatigue, migraine headaches, pain, food cravings, insomnia, depression, anxiety, schizophrenia, sexual dysfunction, and memory loss. Fragrance is certainly not as potent as its pharmaceutical counterparts, but it is non-addicting, seems to have no side effects, and can be used safely with drugs. The typical prescription for aromatherapy is simply to take a sniff every few minutes.

Relaxing, stress-relieving scents

Chamomile, lavender, lemon, marjoram, orange blossom, and other citrus scents have been shown to enhance relaxation, encourage sleep, reduce depression and anxiety, and lower the body's response to pain. It takes just a few whiffs of any one of these scents to calm the body physically and mentally. Spikenard and valerian increase the calming, meditative theta brain waves and

▲ Plant clove pinks to boost relaxation and happiness.

deeply relaxing delta waves, while decreasing the more stimulating beta waves. Most lemon-scented plants, such as lemon grass, and lemon itself, help the nervous system overcome stress, nervous exhaustion, and especially sleep disorders. The eleventh-century Islamic healer Avicenna recommended lemon balm to lift a bad mood.

A relaxed, happiness response is produced in the brain by clove-like scents. This may be one reason why clove-scented roses, clove pink, wallflower, and especially stocks became such well-loved garden flowers. Basil also has clove buried in its scent. The aromatic compound eugenol gives these plants their clove-like scent. University of Arizona psychologist Gary Schwartz, PhD, has had hundreds of people participate in studies on scent. He showed how clove produces relaxation and reduces stress, mental fatigue, and nervousness, as well as memory loss. The scent does this by moderating brain neurotransmitters and reducing adrenal cortisol levels that rise when we are stressed.

Herb-like scents that are identified by perfumers as "green odors" help protect the body from the negative impact of stress. The green scents of fennel, oregano, and marjoram appear to improve feelings of general well-being by adjusting neurotransmitter activity. Many green scents, such as German chamomile, gardenia, lemon grass, rose, and sweet flag have been shown to be calming because they enhance a brain chemical called GABA that encourages relaxation and sleep, sometimes more than sleeping pills. They are thought to work through the hypothalamus and pituitary glands, which

signal regulatory processes throughout the body to keep it in balance. Ruhr University researchers in Germany say that aromatherapy sprays may offer a new class of GABA modulators and "a scientific basis for aromatherapy." Sniffing jasmine may be comparable to taking sedative drugs.

Even cosmetic companies are creating aromatherapy perfumes and body care products. Research at Shiseido, the world's third-largest cosmetic company, says that stress adversely affects the complexion, but an aromatherapy facial can relax brain waves to the same extent as meditation.

Multiple research studies indicate that the scents of rose, patchouli, and orange blossom encourage relaxation and help with long-term pain and physical and emotional stress, as well as problems from the resulting high levels of cortisol and adrenaline. Orange blossom, lavender, and rosemary lower cortisol levels. Rose and patchouli seem to moderate adrenaline output and slow sympathetic nerve activity. Rose-scented geranium and lavender balance emotions by producing either relaxation or alertness. It is suspected that all of these scents help regulate the brain's neurotransmitters.

Nurses in a 2014 study from Australia's Griffith University found that the high stress and anxiety of working in the emergency room decreased after an aromatherapy spray containing lavender, lime, patchouli, rose, ylang ylang, and bergamot was misted over them and briefly massaged into their shoulders. They experienced an "immediate and dramatic" difference. Stress indicators, such as blood pressure and cortisol levels, dropped when volunteers in a 2012 study at Eulji University's College of Nursing in Korea repeatedly inhaled a blend of lavender, marjoram, orange blossom, and ylang ylang over twenty-four hours.

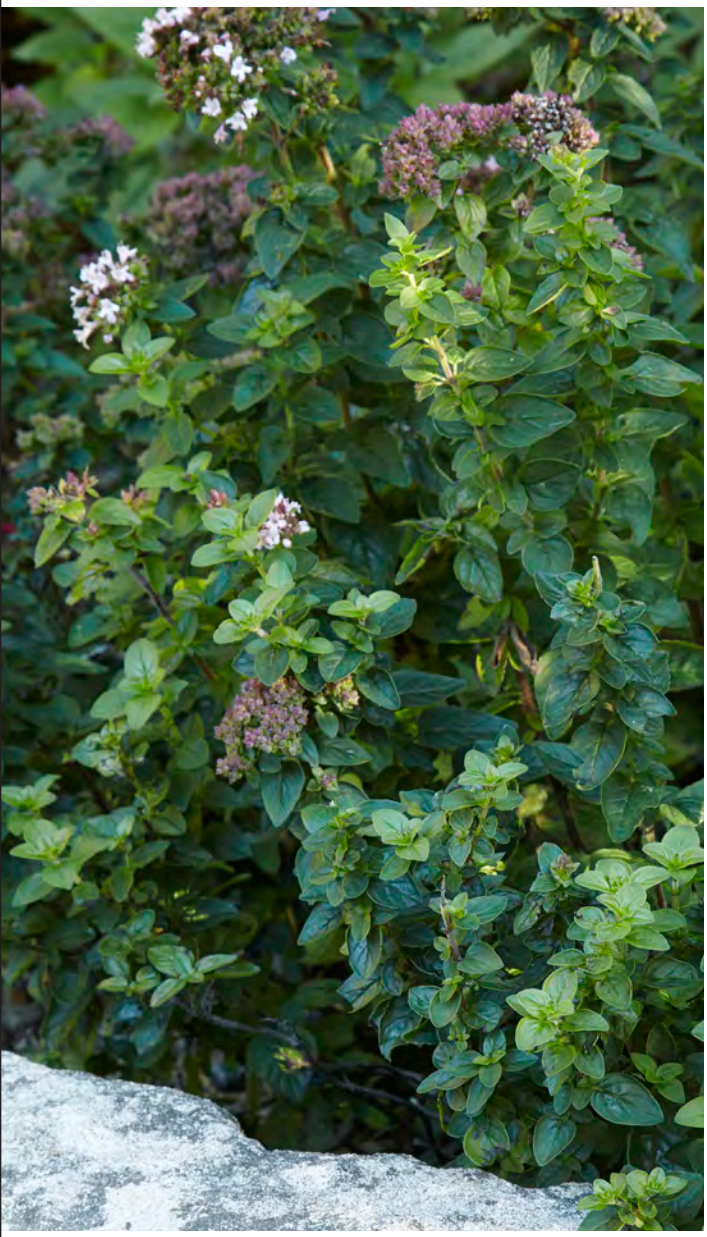
The relaxing and comforting scents of India's vetiver and daphne (which the Chinese called the sleeping scent) have yet to be examined by science, but both have long historical use. Research may also find potential in primrose, orris root, and violets, which English herbalists once commonly used to treat nervous disorders such as anxiety and insomnia. Even dill seeds were tucked into potpourri pillows to encourage fussy babies to sleep.

Antidepressant, feel-good scents

According to Dr. Jeanette Haviland-Jones of Rutgers University, fragrant flowers have an immediate positive effect on our emotional well-being, with the ability to "trigger satisfaction, happiness, emotional bonds with others, and alleviate depression and anxiety." She calls peonies, roses, and other fragrant flowers fabulous mood-boosters. Scented blooms even increase innovative thinking and productivity in the workplace.

Stimulants and memory scents

Aromatherapy studies from Toho University School of Medicine in Tokyo determined that basil, clove, jasmine, and peppermint are very stimulating. Next in line are lemon grass, patchouli, rose, and sage. These scents prevent the sharp drop in concentration that typically occurs after thirty minutes of concentrated work. They are not as strong as



▲ Oregano may enhance feelings of well-being by affecting neurotransmitter activity.

▲ "There's rosemary, that's for remembrance," said Ophelia in *Hamlet*.

drinking coffee, but also don't overstimulate adrenal glands.

The uplifting fragrances of basil, jasmine, peppermint, and rosemary appear to stimulate the brain's beta waves that focus mental activity, awareness, and alertness, and simply make a person feel good. They reduce stress and slow breathing by blocking stress-related nerve responses, but without depressing the nervous system. Mae Fah Luang University in Thailand and several other institutions found that air traffic controllers were more alert and computer operators made fewer errors and worked faster when workrooms were scented with either peppermint or eucalyptus.

The brain is imprinted with hundreds of specific scents that are attached to our personal memories. Events that are associated with our sense of smell are retained far longer and come back much quicker than memories that are connected to either sight or hearing. You probably have had at least one déja vu experience after taking a whiff of some familiar plant that whisked you back in time. You may vaguely remember your grandmother's house without prompting, but smell lilacs that she grew in her garden, and the memories come flooding back. Since memory is so tied to our sense of smell, past experiences also greatly influence whether we like or dislike a particular scent.

Psychologists call our association of smell with memory the Proust phenomenon, from Marcel Proust's novel *Remembrance of Things Past*. When the French novelist dipped a madeleine cookie in his lemon-blossom tea, the aroma brought back a flood of childhood memories, filling him with inexplicable happiness. Researchers hope to use this association to treat memory problems, even dementia and Alzheimer's disease. Strong, sharp scents such as bay laurel, jasmine, rosemary, and sage sharpen memory. Sage seems to slow short-term memory loss by blocking a brain messenger associated with memory loss. Sweet flag helps with learning and recalling facts by improving the functions of the central nervous system. Peppermint and lily-of-the-valley improve sustained concentration. In a 1992 study at the Bishop's University Department of Psychology in Lennoxville, Canada, volunteers memorized a list of words more easily if they smelled jasmine. When a study at Tottori University in Yonago, Japan, asked elderly individuals to sniff rosemary and lemon every morning and lavender and orange in the evening for one month, they had less memory loss. In aromatherapy lore, juniper counters mental fatigue, physical debility, and insomnia. The ancient Greeks found hyacinth and thyme to be invigorating and to improve memory. Europeans said that lilacs make you reminiscent. To help remember some important fact, sniff one of these plants while you memorize it. When the time comes to recall that information, smell that scent again.

▶ A brick entry greets visitors with a riot of roses and other blooms.

THE PASSION BEHIND SCENT

The sense of smell is not the same in both sexes. Women will usually recognize a scent more readily than men, especially food aromas. They take more time to consider scents that they prefer and can readily describe them. Men, on the other hand, do not pick out scents as easily and have little to say about them.

Aroma can definitely alter an attraction to another person. Men see women differently if the males smell a perfume they like. For one thing, they will estimate a women's weight around four to twelve pounds lighter. Researchers say that the reaction of both sexes to scent is probably hormonal, since the sense of smell declines in women taking testosterone shots.

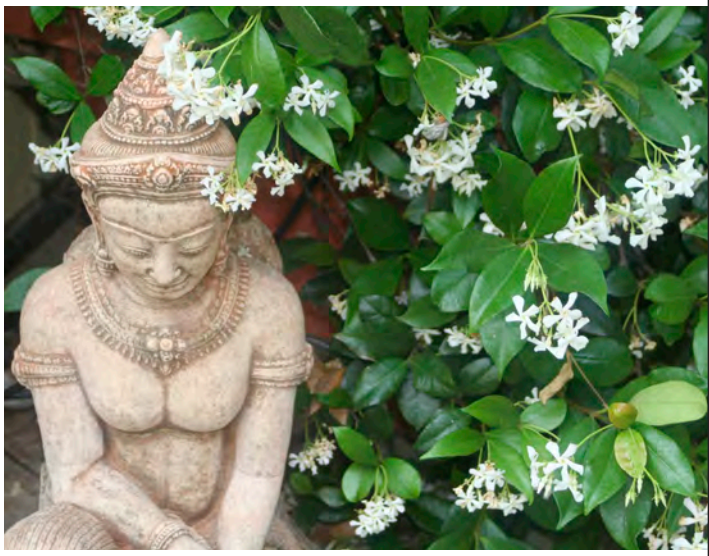
Fragrant aphrodisiacs

Men and women are attracted to different scents. Studies show that what turns on women are licorice and cucumber scents, followed by lavender. Men are also responsive to licorice and lavender, and in much higher numbers than women. Licorice-scented plants in the fragrance garden are anise hyssop and fennel, which are added to some perfumes and colognes in small amounts. It is no surprise that chocolate is also on the list for women, bringing to mind the chocolate-scented clematis, geranium, and peppermint plants. By the way, what women do *not* care for is the scent of cherry.

Men found pumpkin pie spice to be the most stimulating aroma of all. Its overriding scent is cinnamon, a well-known aphrodisiac historically. The strongest cinnamon scents in the fragrance garden are found in cinnamon basil and sweet flag, both aphrodisiac fragrances that are used in perfume. Garden plants that hint at cinnamon are primrose, some scented geraniums, and the white-flowering wisteria cultivar 'Alba'. Men like their cinnamon, licorice, lavender, and cola scents combined with the smell of doughnuts, but it's not entirely clear how one would match that in the garden! Pumpkin pie spice also contains clove, which was discussed earlier as a known relaxant, and is a popular scent in men's colognes.

▲ Primrose contains a trace of cinnamon scent, which is favored by men.

Older men and women of any age favor vanilla scents. Women particularly find the vanilla-like scent of baby powder appealing. Vanilla-scented plants are clematis, dried sweet woodruff, oleander, and the softly fragranced, modern-day wallflower. Wisteria flowers also carry a note of vanilla. Women are generally more receptive to men's advances if there are aromatic flowers nearby, say University of South Brittany psycholo-



▲ Star jasmine, the scent of passion.

◀ Beautiful vessels delight the eye; what's inside pleases the nose.

gists. They recommend highly scented flowers, such as roses and lily-of-the-valley. Flowers only need to be in the room and not presented as a gift.

Plant-inspired perfume

It is no secret, with perfume brand names such as Tabu, My Sin, Opium, Perhaps, Shocking de Schiaparelli, Poison, and Sexual, that personal fragrance has long been all about sex appeal. Like most perfume, these well-known scents are based on plants that have age-old reputations as aphrodisiacs. Jasmine, labdanum, orange blossom, patchouli, rose, sweet flag, tuberose, and vetiver were originally made into exotic, solid perfumes that predated the modern alcohol-based products. Coriandre perfume by Jean Couturier for Women is based on the spicy coriander seed, which was an aphrodisiac mentioned in *The Arabian Nights*. Cardamom is another well-known aphrodisiac spice that finds its way into modern perfume. It was a key ingredient in ancient Egypt's once-famous *kyphi* perfume, as well as another traditional fragrance from India in which it is blended with coriander, jasmine, basil, and cloves. Many perfumes have been inspired by lily-of-the-valley, or *muguet* in French, including Christian Dior's Diorissimo. Gardenia is the foundation for at least

fifty perfumes. Popular for nearly one hundred years, My Sin and Arpege are a few of the many perfumes based on jasmine.

Today, in addition to all the traditional plants used for fragrance, fruity-violet mignonette, daffodils, and a few strongly scented bee balm species are also cultivated for the perfume industry. A small hint of a potent scent (such as clary sage, curry plant, lemon marigold, or santolina) give high-end perfumes a fragrant boost. Among contemporary popular scents, lavender is the star of Chanel Jersey; orange blossom is integral to Dolce & Gabbana Velvet Sublime and Elie Saab Le Parfum; and Roberto Cavalli Paradiso combines notes of bergamot, jasmine, and cypress.

Cologne is a lighter version of perfume. It often contains at least one aphrodisiac aroma, but it tends to be less floral than perfume and more herbal, spicy, or woodsy. It often contains cloves, cedarwood, or juniper. The original eau de cologne from the seventeenth century was orange blossoms, bergamot, lavender, lemon balm, and rosemary. The tuberous earthnut sweet pea is sometimes used in cologne. Tobacco gives cologne a dry, masculine scent with a heavy base note, for its musty appeal.

fragrance garden history

The gardens of antiquity were heavy with fragrance. Persian palaces, Egyptian temples, Roman villas, and European estates and monasteries were all based on formal garden design. A garden that was constructed with a geometric design and filled with aromatic plants was considered especially tranquil. Tall walls surrounded the gardens, creating a retreat from the outside world and inspiring inward reflection. The walls also served to capture the fragrance of the plants contained within. Aromatic trees were an important source of medicine, spiritual inspiration, and shade, so they were often grown in the fragrance garden or an adjoining area. Through most of garden history, fragrant gardens were thought able to ward off illness. A sixteenth-century poem tells of a walled garden with benches and arbors; it is so sweetly fragrant, it counters disease.

The fragrance garden was a place to seek peace and contemplation. Throughout Europe, the Middle East, and India, gardens were considered a perfumed heaven on earth where one could purify the soul. The plants in these gardens held important religious symbolism that was often associated with their aromas. Their fragrance was said to be able to transform raw emotion into religious passion. This transference was considered possible in the garden because passion for both worldly desires and spiritual development were associated with scent.

Aromatic gardens for love and beauty

Scented gardens also have their secular side. Most often the garden's theme turned to love, romance, and even passion. The plants grown in a fragrance garden were often the same ones found in a religious garden, but their scents carried new symbolism. Favorites, such as the rose, were able to span the

◀ Sweet-smelling favorites such as roses have long been hallmarks of a welcoming garden.

spiritual and common nature of the individual, so they found a welcome home in both types of gardens.

Perhaps the most famous ancient gardens that were constructed for love are the Hanging Gardens of Babylon. They are usually credited to Nebuchadnezzar II, but according to Oxford scholar Stephanie Dalley, they may have been the gardens that surrounded the Nineveh palace in modern-day Iraq. These elevated gardens were built by Assyrian king Sennacherib for his beloved wife in the seventh century BC. Sennacherib described the highest platform that imitated the Amanus Mountains, with "all kinds of aromatic plants, orchard fruit trees, trees that enrich not only mountain country but also Babylonia."

Fragrance captivated ancient Greece and Rome. Sailors said they knew when they were approaching the Greek isle of Rhodes because the fragrance of rose wafted over the sea. An entire street in Capua, Italy, devoted to manufacturing scented products like rosewater was said to be thick with heady fragrances. Greek and Roman gardens were dedicated to their gods and goddesses, so they contained the bay laurel, lilies, myrtle, and narcissus that were associated with such mythology. Their gardens were also scented with chamomile, oleander, violet, and roses. The fragrant herbs they grew were hyssop, juniper, lemon balm, mugwort, orris root, mint, pennyroyal, and rue for use as culinary herbs and medicine. The many aromatic spices cultivated in these classical gardens included basil, coriander, dill, fennel, marjoram, oregano, sage, wormwood, and thyme. Pliny the Younger chose aromatic rosemary hedges to surround his garden at his coastal villa because they tolerated wind and sea exposure better than the common boxwood hedge.

It seems that gardeners have always been fascinated with acquiring new plants. Botanical exploration for fragrant plants led Egyptian queen Hatshepsut to send an expedition

to Punt—possibly Somali—around 1500 BC. Her boats carrying fragrant myrrh trees for her garden are depicted on a wall relief at her temple on the Nile's west bank at Deir el-Bahari. These trees were said to have eventually grown to a good height, thanks to their roots being carefully wrapped for the voyage. As the collection expanded, Egyptian gardens became botanical showplaces. A mural in the Botanical Garden room at the fourteenth-century temple of Amun at Karnak in Egypt illustrates two hundred fifty species that were grown in that temple's twenty-six gardens. They included all kinds of beautiful flowers and aromatic spices, such as cumin, marjoram, anise, and coriander.

Much of garden history corresponds with the conquest of new territory. King Ramses III had pots of exotic trees and flowers shipped back to Egypt from his army's twelfth-century BC conquests in Libya, Syria, and Cyrenia. Alexander the Great sent plants from lands that he conquered in the fourth century BC to his tutor, Aristotle, to establish a botanical garden outside of Athens, Greece.

Monastery gardens

The Romans brought fennel, rue, rosemary, southernwood, sage, and thyme to British gardens during their conquest. When they left Britain, the aromatic herbs remained. The Damask rose, and probably jasmine and lilac, are fragrant plants that arrived in medieval Europe when crusaders returned from the Middle East. Roman emperor Charlemagne decreed around AD 800 that all of the monasteries and estates under his extensive reign in Europe should grow eighty-nine herbs and trees listed in the *Capitulare de villis vel curtis imperialis*. This list was likely compiled by the French abbot Benedict of Aniane, who was already exchanging garden plants with Alcuin, the abbot of Tours and one of Charlemagne's advisors. Alcuin was known for his beautiful lilies and gallica roses, which were included on the mandatory list, along with other aromatics such as coriander, dill, fennel, juniper berries, mint, pennyroyal, and rue. The *De naturis rerum* by Alexandri Neckam notes in 1210 that Londoners were growing fragrant flowers such as heliotrope, lilies, roses, and violets in their private gardens.

Dominican monk Albertus Magnus specified in 1260 that gardens should have "a great diversity of medicinal and scented herbs, not only to delight the senses by their perfume, but to refresh the sight with their flowers." He described gardens containing "every sweet smelling herb such as rue, and sage, and basil, and likewise, all sorts of flowers, as the violet, columbine, lily, rose, iris, and the like . . ." German herbalist Hildegard von Bingen (1098–1179) grew all of these in her cloister garden, plus catnip, chamomile, clary sage, myrtle, oregano, tansy, thyme, valerian, and yarrow. She recommended the scents of fennel, rose, violet, and wormwood to counter depression, and spike lavender to improve one's disposition.

The medieval monastery herb gardens, or herbaries, contained aromatic plants intended to nurture the soul and provide

▶ A Celtic garden of fragrant herbs and flowers. Stone carving by Martin Akerstone.

▲ Saint Fiacre, patron saint of herb gardens.

herbal remedies. Benedictine, Chartreuse, and similar liqueurs were flavored with dozens of aromatic medicinal herbs that were grown by the monks. Monastery gardens were filled with symbolic plants. They often had an alcove dedicated to the Virgin Mary that was overflowing with the fragrant flowers associated with her, such as lily-of-the-valley, roses, and violets.

Fifty of the plants in the Trie Cloister garden—at The Cloisters museum, part of the Metropolitan Museum of Art in New York—were chosen from those displayed on famous tapestries titled "The Hunt of the Unicorn." These lavishly woven, plant-dyed European tapestries made around 1500 hang at The Cloisters museum. In the most famous panel, a unicorn is portrayed in the middle of an informal meadow filled with highly scented flowers. Such fields were referred to as millefleurs, or "a thousand flowers." Eighty-five of the plants on the tapestries were identified by two botanists. These include the fragrant flowers of clove pink, Madonna lily, and violets.

Gardens of delight

The late Middle Ages saw spirituality give way to pleasure and sensuality in the European garden. Arbors of fragrant roses, representing both love and religious devotion, concealed intimate seats where one could play music, embroider, contemplate, or be romantic amidst the fragrance. Part of the medieval love poem *Roman de la Rose* by Guillaume de Lorris takes place in a walled garden like this. He describes lovers meeting where "the earth was very artfully decorated and painted with flowers of various colors and sweetest perfumes." The garden's design stayed formal, but the walls surrounding it were lowered to see the world beyond. Boccaccio, in his book of tales, *The Decameron*, describes a fourteenth-century garden in which "the sides of these walks were almost closed in with jasmine and red and white roses, so that it was possible to walk in the garden in a perfumed and delicious shade." The inner lawn, which was bordered by orange trees, "pleased the sense of smell."

The New World had its own spectacular fragrance garden. In 1519, Bernal Diaz del Castillo arrived from Spain to the Aztec capital of present-day Mexico City as a Spanish

▲ Spain's tenth-century Mosque of Cordoba was originally renowned for its fragrant gardens.

foot soldier. He was amazed to see the city covered in beautiful floating and rooftop gardens. In *The True History of the Conquest of New Spain*, he wrote, "I was never tired of looking at the diversity of trees, and noting the scent each one had and the paths full of roses and flowers."

Zahir-ud-din Muhammed, a descendant of Gengis Khan known as Babur, was interested in literature, art, music, and gardening. He established gardens in every Central Asian city he conquered in the early sixteenth century. Babur was greatly influenced by the Persian culture and its love of fragrant flowers, so he made sure that every garden in the Mughal dynasty that he established in India was filled with "sweet herbs and flowers of beautiful color and scent." One of his first acts as emperor was to have several gardens created in the city of Agra, which were followed by more gardens in other Indian cities. He personally designed landscaping for ten gardens in Kabul, Afghanistan. The most famous example of Mughal architecture, the Taj Mahal, was once surrounded by extensive gardens.

The Moors brought their passion for fragrant flowers, shade, and garden pools with them when they conquered Spain. Roses, carnations, jasmine, lilacs, lilies, narcissus, wallflowers, and orange tree flowers perfumed their gardens. A fragrant, trimmed myrtle hedge surrounds the Court of the Myrtles, at the medieval Alhambra palace and fortress in Granada, Spain. The tenth-century Mosque of Cordoba was renowned for its fragrant gardens. A well-known twelfth-century writer, Al-Fath Ibn Khaqan, described the breeze "blowing day and night

over the garden loaded with scents." The Court of Oranges had orange trees planted in a sunken garden that was fifteen feet below the walkway. This allowed visitors to smell the pure aroma of neroli orange blossoms as it floated off the treetops.

In the seventeenth century, many women who had the means to do so put aside their embroidery and began botanizing and designing gardens as a hobby. The 1617 *Country Housewife's Garden* by William Lawson presented them with ideas for kitchen and flower gardens. He suggested that they plant rosemary, roses, and sage, among other plants. Even Josephine, the wife of the French emperor Napoleon Bonaparte, was an amateur botanist who brought nearly two hundred plants to France for the first time. Through France's conquests, she acquired rare species to grow in her garden. She commissioned Belgian botanical artist Pierre-Joseph Redouté to illustrate the flowers at her Chateau de Malmaison. He painted marvelous renditions of five hundred lilies and two hundred roses. Known for her beautiful roses, Josephine had several varieties named after her and properties, including the fragrant 'Souvenir de la Malmaison'.

Under the influence of Louis XV's Marquise de Pompadour, plants in her eighteenth-century garden at the rustic hermitage at Versailles were arranged by scent, so that one heavenly smell led to another. An avid gardener who loved fragrance, the Marquise had lemon trees, gardenias, jasmines, myrtles, tuberoses, oleanders, lilacs, and fifty orange trees planted in straight avenues with trellised walkways leading to the rose bowers.

Fragrance gardens enter the modern world

The expanding imperialism of nineteenth-century Britain brought exotic plants from the far reaches of the world into British gardens. The country style garden took off and gentry who had the time and money to garden raised splashy displays of fragrant flowers. Scented geraniums and orchids were kept in large, glass houses that were made possible by advances in steel and glass manufacturing. Thanks to the invention of cast plate glass in 1848, large sheets of inexpensive, strong glass were used to build the Crystal Palace for the 1851 World Exhibition in London. My great-great-grandfather, Jesse Keville, was a gardener in London at that time. In his memoirs, he recounted how impressed he was by the advancements in gardening technology that were displayed at the exhibition.

The home gardener needed a supply of seeds, and the R. K. Bliss & Sons seed company led the way, offering nearly seven hundred varieties of flowers in their full-color seed catalog. By the turn of the twentieth century, there were about eight hundred seed companies in the United States alone. A growing middle class rolled up their sleeves, grabbed shovels, and set to work planting colorful, fragrant gardens. A renewed appreciation of flowers developed as more potted plants and bouquets were brought into the house. Specially designed pots for tuberose plants, which grow in low light conditions, became popular in Victorian parlors. Books were written about the symbolic folklore of fragrant flowers.