doterra

THE SCIENTIFIC KNOWLEDGE OF ESSENTIAL OIL



W H A T M A K E S ESSENTIAL **OILS** UNIQUE

Imagine you have a magnifying glass strong enough to see down to the molecular level. Now take that magnifying glass and peek into a drop of essential oil.

What you would find is an astonishing array of natural plant chemicals carefully honed by millennia of evolution, meticulously sourced and harvested to preserve the unique bouquet, and painstakingly extracted to capture the true ratios of physiologically active components. What you would see in that drop of essential oil is one of nature's finest creations.

What are Essential Oils?

Like humans, plants need to communicate with their surroundings. They need to ward off pests, fight off invaders, attract the right helpers, and heal after an injury. Many of the chemicals they use in these processes are what we know as essential oils.

The variety of essential oil compounds is staggering: monoterpenes, diterpenes, sesquiterpenes, esters, alcohols, and terpenoids, to name a few. It is likely that some essential oils will contain compounds we have never seen before—only a fraction of plant species have been evaluated for their health benefits. Essential oils are useful in many ways, but their true distinctiveness lies in several characteristics: volatility, synergy, and adaptability.

Volatility

Essential oils are unique and elegantly functional, because they contain a mixture of highly volatile components. This is one of the stationary plant's best tools. How could a peppermint plant communicate with its surroundings? Since they cannot pull up their roots, they have to send over a volatile molecule. How could the peppermint plant tell a hungry bug to stay away from its leaves or roots? The volatile molecules it secretes will surround the plant like an invisible shield.

> Historically, humans have harnessed this chemical volatility for wellness purposes. Science is just now beginning to understand the physiological processes at work when an essential oil is inhaled.

*These statements have not been evaluated by the Food and Drug Administration. This product is not intended to diagnose, treat, cure, or prevent any disease. Take Lavender, for example. Multiple studies show that Lavender essential oil offers far more than just a pleasant smell. When taken internally, Lavender oil was shown to directly affect the brain's serotonin system¹. Experimental research suggests that lavender essential oil may also possess antioxidant properties² and also help to support the immune function of certain cells³. All those volatile chemicals have the potential to quickly and effectively enter our nasal cavity to interact instantly with us physiologically.

Synergy

Another key to essential oil chemistry lies in the delicate balance of components. A drop of essential oil is like a snapshot of the plant's unique makeup and environment. All of the chemicals in the essential oil (hundreds of chemicals, in some cases) play some role in the plant's physiology. And all of those components make a complete oil that is unique, like a fingerprint—and that is far more than the sum of its parts.

We do not fully understand the synergy of essential oils. We know that in many cases, an oil contains a handful of main active components—players like pinene, eugenol, limonene, linalool, and carvacrol—and a whole host of "trace" components. Sometimes these are precursors or reaction products of the main players. Sometimes these are just individual chemicals thrown into the mix—a little of this, a dash of that, all contributing to an amazing final product.

The interesting thing is that multiple studies have illustrated the synergy of essential oil components. One recent study, for example, took seven essential oils and tested their antioxidant properties, comparing those results against the same tests run with the single most abundant component in each oil. The study found that an oil's antioxidant capability cannot always be traced to one main component. Often, it is the supporting "trace" chemicals that modulate and interact with each other in ways we do not yet realize.

Adaptability

Humans evolved with plants. Our physical makeup is based on the same organic molecules. We are subject to similar environmental stressors and threats. It is, therefore, no surprise that the chemicals developed by plants for protection and environmental adaptation are powerful agents within the human body, too.

Unlike chemicals manufactured in a lab, essential oils change. They adapt. They morph into whatever chemical cocktail will best support the plant's survival. It is this adaptability that has caught the interest of scientists and medical professionals. Could natural, plant-based options be better for our wellness than static chemicals that have lost their effectiveness? Ongoing research will answer that question. A plant fights hard for survival; we benefit from that ever-changing fight.

A single drop. That is the unit by which we measure essential oils and talk about their chemical components. It is also the current extent of our scientific knowledge—a single drop in a vast ocean of possibilities waiting to be explored. We will glean that information about just how unique and powerful essential oils are one research study after another. One drop at a time.



Nicole Stevens, MsC

Nicole Stevens is an essential oil enthusiast with a professional desire to increase the credibility and scientific understanding behind natural products. She has been researching the various

properties of essential oils for much of her career. Nicole earned her undergraduate and Master's degrees at Brigham Young University. She also worked at the UNLV Cancer Research Center and completed a project looking at the possibility of using essential oils in a process called photodynamic therapy.

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Physiology of Essential Oils by Dr. David Hill



(Founding Executive, Science & Healthcare) Education Background:

> PhD in Chiropractic Physician from Parker College of Chiropractic in Dallas, Texas.

Experience:

General Practitioner in St. Mary's, Idaho; specializing in the use of essential oils in primary care. Current Position:

- Essential Oils and Pain Management
- Research in Florida Atlantic University
- Study of the efficacy of essential oils in the reduction of inflammation in joints in University of Miami, Florida
- Consultant for a study on the efficacy of essential oils in the care of critically ill patients in General Hospital, Opelousas, Louisiana
- Consultant for a study of essential oils in Alzheimer's care in Browne Medical Rehabilitation Center, Emeryville, New York

Dr. Hill is a leading expert in the application of special expertise in the field of integrative medicine, and has been working with natural medicine and focusing on the effectiveness of essential oils in the treatment of illnesses by finding viable solutions for self-care at home The beneficial effects of essential oils are easily perceived through an examination of their use in history, and ever-expanding acceptance throughout westernized health care. There are a number of adorning descriptors for essential oils, primarily because their effects on the human body are so pronounced and, at times, appear to be truly miraculous. We often refer to essential oils as "gifts of the Earth." However, when viewed from a scientific perspective, the explanation behind their biological activity becomes more easily understood. One can simply say that essential oils are physiologically active, or in other words, essential oils work by stimulating changes and specific functions within the body.

Physiologically Active

A well-understood principle specifically related to the benefits of essential oils is that they directly influence mankind. In fact, all functionality seen with essential oils is elicited at the most basic level. Two structural features of volatile aromatic compounds allow them to effectively influence you:

- 1. Lipid solubility
- 2. Low molecular size



Because essential oils are both lipid-soluble and offer small molecular size, they penetrate and disperse quickly and easily. Few other types of molecules can transverse so easily in this way. Molecules that are larger or are non-lipid soluble require specialized active or assisted transport methods to carry out their activities.

The unique structural characteristics of essential oils give them the independence to influence a human being easily. It is important to know that ubiquity does not mean that essential oils will affect you directly, but rather, they are selective at targeting specific part, which in turn triggers systemic responses. We can see one powerful example of this phenomenon by simply investigating limbic responses stimulated through the aroma of an essential oil. When inhaled, the oil directly influences the hypothalamus in the brain. Through its additional connections to the rest of the body, the hypothalamus is capable of triggering neurochemical response in selected tissues. This region of the brain controls many aspects of physiologic functioning, and this is a strong and reasonable explanation on how a small drop of essential oil can affect you.

Therapeutic Range

To receive the full advantage of these miraculous therapeutic agents, it is important to use essential oils appropriately. The term "therapeutic range" refers to the optimal dosage of essential oils to produce maximum benefits. This range is affected by a number of variables including age, nutritional status, and body composition, so it is important to be aware of your own unique health circumstances and adjust accordingly. For example, a young child will likely require less oil to see a therapeutic effect than an adult.

Although we cannot control every variable governing therapeutic use, we can more appropriately moderate individual benefit though consistency of application.

Consistent use involves lower, more frequent doses rather than single large doses. Using a model of consistency is important and is one way to increase sustainable benefit and minimize any risk of reactivity.

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Essential Oils Journey

Have you ever wondered where do essential oils come from? Come and discover how a tiny seed can become a powerful essential oil.



- A. We carefully select our growers, emphasizing expertise, provenance and growing experience to ensure the highest quality essential oils. We place great value on the expert knowledge of local farmers—many of whom have nurtured essential oil plants for generations. We pioneered the Co-Impact Sourcing[®] Program in these mostly developing countries where essential oils are grown, to help local farmers maintain the quality of their crops and to empower the farmers to become self-reliant.
- **B.** Special varieties of plants are selected for their specific aromatic compounds. The strength of their potency is taken into account as early as at the time of sowing. For essential oils to be safe and effective, they must have the correct chemical composition and be pure, natural, and free of additives.
- **C.** To ensure optimal potency, the plant must be harvested in the right way and at the right time. The extracted part varies from plant to plant and can be seeds, stems, leaves, flowers, roots, or outer bark. In addition, the region in which the plant is grown has a considerable influence on the composition of its chemical composition and thus will determine its effectiveness.





Factors that influence the efficacy of essential oils:

- Plant growing season Plant growing altitude
- Climate
- Soil
- pH
- HumidityTerrain
- Ierrain



While there are several forms of distillation, the main objective of the distillation process is to obtain the best quality essential oil. Most essential oils are processed by steam distillation, while citrus oils are through expression.

Steam distillation

- The vapors pass through the plant material under pressure (with different pressures) to release the volatile compounds
- 2. The volatile compounds will then condense again
- When the volatile compounds condense, the water and the essential oil are separated, and the essential oil is thus able to be collected



Cold Pressing

- 1. Place the citrus fruit in the expression machinery
- 2. The fruit will be cleaned automatically by the rotating brush
- **3.** The fruit will pass across rasping cylinders that cut up the surface, unpeel and essential oil is extracted from the peel
- **4.** The fruit is sprayed with water to help collect the essential oil once it has been released
- 5. The mixture of water and essential oil will be filtered to remove solid particles
- **6.** The essential oil is filtered and centrifuged to isolate the oil from any water or fruit particles



3 Testing

The CPTG Certified Pure Tested Grade[®] requires careful precision and full dedication to ensure that every batch of essential oil is free of impurities and unadulterated.

There are several tests to verify potency and ensure purity of the essential oils. These tests include:

- Heavy Metal Testing
- Optical Rotation Testing
- Organoleptic Testing
- ing Microbial Testing
- Fourier Transform Infrared spectroscopy (FTIR)

4 Packaging

The second round of testing is performed in isolation at the manufacturing plant to ensure that the essential oils produced are distilled and tested. While the third test for the chemical composition of the essential oils is performed at the third stage, then the tested oil will be funneled into the glass bottle, properly labeled, and packaged.



- Specific Gravity Testing
 Refractive index testing
- Gas Chromatography and Mass Spectrometry analysis (GCMS)
- Chirality Testing
 Isotopic Analysis



The essential oil is now ready and will be delivered to your doorstep after your order!



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Extracting Essential Oils A Work of Art and Science

Essential oil quality is notably one of the most debated subjects among essential oil enthusiasts. There are differing opinions on what an essential oil is and how it should be extracted and even used. Many have learned that a statement of purity on the label does not necessarily mean a guarantee of quality and are left disappointed. Yet, our CPTG Certified Pure Tested Grade[®] trademark represents the dōTERRA quality assurance standard of nature's most pure and potent plant extracts carefully selected from growers around the globe and quality checked by the world's brightest, most competent chemists.

A quick review of chemistry establishes that an essential oil is comprised of volatile aromatic compounds; a lesserknown principle, however, is how essential oil chemistry reaches its maximum potency in each individual plant. Providing each plant its own individual aromatic profile and other characteristics, aromatic compounds may be partially or, at times, dramatically altered due to environmental factors. Although each individual environmental factor cannot be directly controlled—such as rainfall, seasonal temperatures, etc—sourcing appropriate plant material is fundamental to ensuring the highest efficacy. Developing long-lasting and often exclusive relationships with growers throughout the world ensures sourcing longevity and the opportunity to select plants from the most appropriate environments for each plant or oil profile.

Extraction Methods

Varying extraction methods are used in order to extract the aromatic compounds from plant material. Oftentimes, toxic solvents are used to separate the essential oil from its corresponding plant— this practice is highly undesirable. We primarily use two types of essential oil extraction: steam distillation and expression (often referred to as "cold pressing"). Both of these processes are organic.

Expression (Cold Pressing)

Unlike steam distillation, expression, sometimes referred to as "cold-pressed," does not involve heat. In this process, oil is extracted from the product under mechanical pressure. Cold-pressed is often used to extract all of its citrus oils, such as Wild Orange, Lemon, Lime, Bergamot, and Grapefruit, from the rind.

Steam Distillation

Steam distillation is the most common way to extract aromatic compounds (essential oil) from a plant. During the steam distillation process, steam passes through the plant material. The combination of heated steam and gentle pressure causes the essential oil to be released from microscopic protective sacs. As the vapor mixture flows through a condenser and cools, it yields a layer of oil and a layer of water. The essential oil rises to the top and is separated from the hydrosol (floral water) and collected.

Some have asked about the difference between first distillations in comparison to complete distillations. Truth be known, almost all essential oils are distilled in a single process, so a first distillation and a complete distillation are one of the same. One exception is ylang ylang because it is highly prized in the perfume industry, where varying aromatic compounds are desired dependent upon their molecular weight and aroma. A disrupted distillation process is oftentimes used to collect different grades of ylang ylang essential oil to reduce cost. However, the best way to distill ylang ylang is wherein the blossoms are steam distilled in a single process so that all of the aromatic compounds from the plant material is collected. It is to ensure the actual effectiveness of the essential oil rather than for its intense aromas.

Ylang Ylang essential oil that is extracted by steam distillation method in Madagascar



Hawaiian sandalwood

DISTILLING ESSENTIAL OILS



Essential Oil Knowledge



Since different plants require different pressures, times, and temperatures, using this particular distillation method makes it possible to adjust the temperature based on the plant type, making it a very effective and precise way to obtain the purest compounds. For example, dōTERRA Hawaiian Sandalwood essential oil undergoes a laborious and time-consuming procedure. To collect the oil from the actual wood, the wood's outer layers are stripped from the heartwood. The heartwood is then chipped, filtered, and then chipped again into finer pieces before undergoing a 36-hour steam distillation process of high pressure and high heat. The whole process requires enormous amounts of fuel, energy, and time, making this exquisite essential oil so valuable.

The temperature for steam distilling is usually between 140-212 degrees Fahrenheit. Every element of the production process can affect the quality of essential oil—from planting and growing methods, variety selection, and harvesting to how the oil is distilled. The nuances of which are as diverse as the plants themselves. Improper handling can alter, or even destroy, the aromatic compounds that make up the essential oil, making the intended function and potency much different due to the altered substance. To obtain the best quality essential oils, the world's leading distillation artists dedicate their lives and time to specializing in a few plants. In doing so, they develop a depth of knowledge and experience to ensure that the distilled oils are consistent with the plant's original composition. Distillation is truly a profound discipline that straddles science and art.

A good distillation is through state-of-the-art testing and unrelenting innovation of extracting pure and effective essential oils that bring health and well-being to yourself and your family through its fascinating ingredients.

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Quality Testing



Purity is the most important characteristic of essential oils. We have learned from past experience that using the correct methods for planting, harvesting, and distillation is the key to maintaining the purity of essential oils. Because of the varying processes and the development of various synthetic oils, there is no other way to accurately identify pure essential oils than to rely on scientific analysis. Proper analysis of essential oils' composition is one of the most difficult and precise steps in the quality assurance process.

In the past, the individual components of essential oils could be detected using Gas Chromatography, but as the methods for synthesizing essential oils have become more sophisticated, more advanced verification methods are needed. Over time, various tests have been developed, such as Mass Spectrometry Analysis, Chirality Testing, Fourier Transform Infrared Spectroscopy, Isotopic Analysis, and other methods that allow different essential composition oils to be accurately detected.

Quality Validation

To ensure the essential oils' quality, tests are applied at different stages of the essential oil manufacturing process. After sourcing for the plants, harvesting and distillation, we carefully review the chemical composition of each essential oil shortly after distillation. Then, the production facility carries out the second round of testing to ensure that the essential oils distilled and tested during the first round are the same ones that arrived at our facility. Finally, a third chemical test is completed during the filling process. Each of these three layers of testing confirms that the essential oils are free of contaminants, and no unexpected alterations occurred during any stage of production.

The Aromatic Plant Research Center (APRC) is an independently owned and managed organization focused on the study of aromatic plants, with state-of-theart laboratories that use a variety of methods to detect adulteration and verify the purity of essential oils. The team members of the research center are world-renowned for quality control testing and expertise in the essential oil industry. So far, they have published about 700 peer-reviewed professional papers. The APRC continues to perform state-of-the-art quality testing, conduct innovative research, continue to publish the latest journal articles, and provide educational information on essential oils, making its essential oil research and expertise second to none, especially in the inspection of adulteration testing. With a complete database of essential oils, APRC's superior testing results far exceed those of other laboratories. Through the cooperation with APRC and this industry-leading quality assurance process, dōTERRA accurately identify the purity and potency of each essential oil to supply the CPTG Certified Pure Tested Grade[®] essential oils.

Organoleptic Testing

Organoleptic testing involves the use of the human senses sight, smell, taste, and touch. To expert distillers, the senses are used as the first line of quality testing to provide immediate clues

to the acceptability of a product. Oil that has an unusual smell, uneven consistency, or strange color instantly tells the distiller that something is wrong. Oftentimes, this testing is used as a preliminary quality control step before any other tests are conducted.

Microbial Testing

Microbial testing involves analyzing a batch of essential oils for the presence of bio-hazardous microorganisms such

as fungi, bacteria, viruses, and mold. The process involves drawing a sample and then adding that sample to a sterile growth medium in an enclosed dish or plate. The sample is incubated for a period of time and then observed for microbial growth. This test is performed on product entering the manufacturing facility and on finished products prior to distribution to ensure that the product has not been contaminated during the filling process.

Gas Chromatography and Mass Spectrometry Analysis (GC/MS)

In Gas Chromatography, an essential oil is vaporized and passed through a long column to separate the oil into its individual

components. Each component will travel through the column at a different speed, depending on its molecular weight and chemical properties, and is measured as it exits the column. Using this testing method, quality control analysts can determine which compounds are present in a test sample.

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Fourier Transform Infrared Spectroscopy (FTIR) is conducted to ensure the potency and consistent quality

of a batch of essential oil. This testing method identifies the structural components of essential oil compounds. In an FTIR scan, infrared light of different frequencies is shined through a sample of essential oil and the amount of light absorbed by the sample is measured. The quality of the sample is determined by comparing the results from an FTIR reading to a historical database with absorption patterns of high-quality samples.





Chirality, a word derived from the Greek word "hand," is a term used to describe the

3D orientation of a molecule. Just as you have two hands, chiral molecules exist in

two forms, distinguished as either the right or the left hand. You may visualize this principle by looking at your hands; when placed side by side, they are mirror images of each



other. However, when placed on top of each other, no matter how you turn them, you cannot get them to line up exactly.

In molecules, each "hand" has different chemical properties, which affects their physiologic interactions in the body. One hand is produced predominantly in nature. However, in a laboratory environment, the ratio of right to left-handed molecules is always 50/50 due to their structural similarities. The ratio of right to left-handed constituents can be determined through a special type of Gas Chromatography. Although not commonly performed on a batch-to-batch basis, this testing method is used to ensure that no synthetic elements are present.

Isotopic Analysis

Matter is made up of tiny chemical building blocks called elements. Although dozens of elements exist, each one is distinct due to the protons it contains. Sometimes, an element can exist in more than one stable form if it has more or less neutrons. When this occurs, the elements are called isotopes. The element carbon exists in two stable isotopes, carbon-12 (6 protons and 6 neutrons) and carbon-13 (6 protons and 7 neutrons). Because essential oils are organic compounds, they are composed primarily of carbon atoms and will have a certain ratio of carbon-12 to carbon-13 isotopes. This ratio varies based on different locations around the world.

Using a special type of Mass Spectroscopy, it is possible to determine which isotopes are present in an essential oil constituent and at what amounts. If sourced from the same location, every constituent in an essential oil should have the same ratio of isotopes. If a particular constituent has an isotopic profile different than that of the other constituents, then the quality control analyst will know that a particular essential oil contains an adulteration.



Samples from different sources will have different carbon isotope ratios

Heavy Metal Testing

Heavy Metal testing shows the amount of heavy metal content in the essential oil. When properly distilled, essential oils

should not contain heavy metals. ICP-MS testing uses a highenergy medium called Inductively Coupled Plasma (ICP) to ionize the sample. The sample is then run through a mass spectroscope, which separates the sample into its elemental parts and provides a reading about which elements are present and in what quantities.

> 11 CPTG

Certified Pure Tested Grade[®]

Essential oil with CPTG Certified Pure Tested Grade[®] means that it has passed the four main stages: sourcing, extraction, testing, and application to ensure natural purity, safety, non-toxicity, and stable effectiveness of high-quality essential oils.

Sourcing

The source of the essential oil is the raw material of the plant itself. This includes knowing the plant species, the environment in which it is cultivated, the best time to harvest it, and how it is harvested and delivered to ensure that the active ingredients in the raw material used to make the essential oil are at the best concentration.

Extraction

Extracting essential oils is a highly sophisticated technique, and essential oils are easily volatilized or damaged during the extraction process. When the pressure and temperature are too low, it may cause the plant's aromatic compounds to not be released. Simultaneously, when the pressure and temperature are too high, they will change the chemical composition and efficacy. The professional and prudent refinement process is not only a science; it is also an art.

Testing

Each batch of CPTG Certified Pure Tested Grade[®] essential oils must undergo a dual GC/MS (Gas Chromatography/Mass Spectrometry) test to ensure that the purity of the oils meets the following three major requirements.

- Only contain volatile aromatic compounds, no added chemical synthesis, and no heavy metals, insecticides, pesticides, and other foreign substances residue, safe for the human body.
- 2. The correct aromatic molecules each essential oil has its own unique fingerprint, just like the "essential oil ID card." The chemical structure to analyze the aromatic molecules of the essential oil is the key to distinguishing the quality of the essential oil.
- 3. These correct aromatic molecules must also be at a high concentration of conditioning grade to ensure its effectiveness.

Application

The final hurdle is to pass on the experience of using essential oils from cultures around the world and to continue to study and apply them in-depth in modern scientific and medical systems.



What to Compare Between Essential Oils?

- No added filler
- No added synthetic ingredients
- No harmful contaminants or toxins
- Choose the right environment to grow
- Harvested at the right time
- Harvested in the right way (bark and flowers are harvested differently from other plant parts)
- Proper heating temperature, the temperature should rise at the right rate; proper vapor circulation to reach the right pressure and temperature in the right amount of time
- The right cooling rate
- Efficacy testing to test purity and conditioning levels in a scientific manner
- Strict control of the extraction process
- Contain only volatile aromatic compounds, do not carry other ineffective compounds
- Use of Gas Chromatography and Mass Spectrometry Analysis (GC/MS) to achieve the balance of aromatic compounds

Modern Scientific and Medical System Research on Essential Oils





The Study on Diffusing Essential Oils

A study conducted by the Vanderbilt University Health Council in Tennessee, USA, on "The Effects of Essential Oils on Health Care Workers," showed that health care workers in fickle, high-pressure environments, such as emergency rooms in medical centers, were easily fatigued and overwhelmed, but this changed when citrus oils are diffused in the emergency room.

The results showed that 41% of the health care workers felt stressed before using essential oils; 25% were overwhelmed by stress. After that, only 3% felt stressed frequently, and 2% were overwhelmed by stress. In contrast, the percentage of those who felt they could handle stress well rose from 13% to 58%.

How Essential Oil Diffusion Interacts with The Mind and Body

Essential oils are volatile aromatic compounds that have the ability to diffuse quickly in the air. The volatility (or ability to change state quickly) of essential oils allows the user to quickly and easily experience the aroma of the oil, even when the cap is opened.

As mentioned, essential oils interact with chemoreceptors and can therefore react. These chemoreceptors are called olfactory sensors, and they are located in the olfactory system - the block that governs the sense of smell. The olfactory system is linked to the limbic system, which stores emotions and memories.

When diffusing essential oils, the aroma acts through the nose into the olfactory system and then in mind through the olfactory nerves into the limbic system. In the limbic system, the fragrance triggers a response to memories and experiences. Because of these effects in mind, essential oils can have a powerful effect on fragrance diffusion. Because of the volatility of essential oils, diffusion is the most effective way to use them. The essential oils users can experience the effects of the fragrance quickly and easily. Essential oils are easily absorbed and acted upon and then diffused into the body.

When inhaled, the aroma of essential oils can trigger responses to emotions, behaviors, memories, and experiences that we all possess. This is exactly why scent diffusion can have such a large impact on mood management, with the effects in mind leading to physiological responses that can change and uplift mood.

Molecular Docking



With the rapid growth of the essential oil industry worldwide and the new scientific findings that the "Gift of the Earth: Essential Oils" is used widely in everyday life to bring many benefits to humanity, many people have begun to wonder, "How can essential oils have such an effect? How does it work?" Fortunately, scientific teams and researchers around the world are beginning to uncover the answer to this question as they discover the amazing range of benefits of essential oils and their ability to improve our lives. This research has led to innovative applications by understanding the biological pathways of essential oils and creating breakthrough discoveries that further confirm that CPTG Certified Pure Tested Grade[®] essential oils are the most rigorously guarded and trusted oils in the market.

Conduct In-Depth Research

In order to fully understand how essential oils take effect and have a lasting impact on their components, we need to look much closer than physical manifestations, such as improved skin appearance or feelings of clear breathing. We need to take a journey into the cell and examine how essential oils work on a microscopic level. However, even at a microscopic level, there are still some unanswered questions and gaps in understanding, compelling us to look deeper and from totally different angles.

Let us start with the simple concept of "understanding the effects of essential oils". Recently, scientists have gone beyond the cellular level and have begun to use innovative research methods and advanced simulation techniques that have never been used in essential oil research to understand further how essential oils work and examine how they work at the molecular level. One of these innovative methods of discovery is molecular docking. Many of these methods of scientific investigation are completely new, not only to essential oils, but to the world of science as a whole. Using these front-line research methods, dōTERRA scientists have gone beyond the microscope to further our understanding of how essential oils do what they do.

Computer Simulation Technology for Essential Oil Research

Molecular docking is an in-silico tool of discovery, used to characterize interactions between two molecules. When the term "in-silico" is used to describe a scientific process, it simply means that it is accomplished via computer simulation. Molecular docking and computer-aided discovery are hugely beneficial to the scientific community, offering a time and cost effective way to assess how molecules will interact with one another. This is an especially useful tool in evaluating how molecules might behave before assessing them in cultured cells or in a living organism.

A New Research Methodology

Molecular docking in essential oil research involves the use of special programs and parameters, designed to characterize the interactions between essential oil constituents and protein targets inside the cell. With these programs, do TERRA researchers are able to gain a clearer understanding of what essential oils do by observing how they interact with their protein targets.



A Brand-New Effect

Technological advances have also led to the use of a large number of synthetic and adulterated substances. The invaluable data obtained from the proteomic tests carried out by our partner research institutes has allowed us to understand more about the effects of essential oils and detect more fully the foreign substances in high quality, natural oils. Computer simulations of the predicted interaction of essential oils and molecules in molecular chimeras have allowed the scientific team to understand whether current usage is effective, how to enhance formulations for specific needs, and identify more potential benefits of these unique aromatic compounds.

Conclusion

With the work being conducted daily by their own scientific experts and their research collaborations, dōTERRA continues to set the precedent for innovation and science in the essential oil industry. The scientists' team and researchers are currently working on several molecular chimerism projects that will be published in journals to share their growing research with the world and the scientific community. Although there is still a lot of investigation ahead, dōTERRA is beginning to piece together the complex scientific puzzle of essential oil. The knowledge gained from these studies not only will advance our overall understanding of essential oils, but may also help us further demonstrate the unmatched efficacy, purity, and quality of CPTG® oils and assist in future product formulation.





doterra **Scientific Advisory Board**

Our philosophy is simple: the best team that achieves the best results



Many people are already aware of essential oils' potential benefits and agree that they are a reasonable and appropriate way to enhance their lives. With a large team of scientists and medical experts, doTERRA has established a set of standards through scientific rigor and sound evaluation, a concerted effort that represents a consensus of professional opinion and experience. Collaboration with chemists, biological and microbiological scientists, botanists, and others creates the comprehensive expertise needed for the ideal ingredients, analysis, and use of essential oils. Our philosophy is simple: the best team achieves the best results.



CHEMISTS

Chemists

Help us identify each essential oil component, ensuring the correct content of the ingredient through proper sourcing and testing. In addition, we provide key techniques to identify the chemical composition, effectiveness, properties, and natural origin of essential oils and to confirm the absence of artificial additives.



Life Scientists

Microbiologists, physiologists, and nutritionists help to determine the physiological and biological response of chemical components. By studying health and the immune system or cellular health, we are able to increase our knowledge of the benefits and science of essential oils.



Medical Professionals

The medical professional team assists in education and helps individuals practice the best choices for their health. They are well-equipped with experience and research to help us better understand the proper use of essential oils. Our medical professional partners strive to bridge the gap between alternative and conventional medicine.

Team Introduction

Scientific Experts and Consultants

In addition to the excellent staff and personnel who help oversee the testing and chemical processes of essential oils on a daily basis, doTERRA has assembled the most distinguished team of consultants. Our scientific experts and consultants include global leaders in essential oil chemistry, botany, microbiology, physiology, research science, nutrition, and health medicine.

Dr. David Hill, DC (D.C / M.D.)

(Founding Executive, Science & Healthcare)



For many years Dr. David Hill has utilized the benefits of essential oils in modern health practices, and as a physician he is a wellknown expert in essential oils and integrative medicine. Dr. Hill partners with physicians and hospitals around the world defining and

establishing the medical integration and use of essential oils in modern health practices. He fosters education and advances in essential oil science through a number of university and research affiliations providing cutting edge science for essential oil users. He is a frequent guest on many radio and television shows and has authored a number of books and other publications. Dr. Hill stands at the head of a new era dedicated to empowering others to take control of their own health.

Nicole Stevens, MS

(Research and Development Scientist)



Nicole Stevens holds a master's degree in Botany and Integrative Biology from Brigham Young University. She has been conducting research with essential oils for more than 20 years. Nicole has worked in quality control laboratories in the nutraceutical industry as

well as academic research laboratories at the University of Utah and the University of Nevada Las Vegas Cancer Research Institute. In addition to research, she has taught chemistry and biochemistry courses at Brigham Young University – Idaho and University of Nevada Las Vegas. She is currently pursuing a Ph.D. in biochemistry and molecular biology at the University of Miami, where she is studying how essential oils affect human metabolism.

Alex M. DaBell, M.S. (Senior Scientist, Nutraceuticals)



Alex DaBell holds a master's degree in Physiology and Developmental Biology from Brigham Young University. He enjoys researching ways to combine the unique benefits of essential oils with other traditional nutritional ingredients to create better quality

nutraceuticals. With nearly a decade of industry experience, Alex has developed some of the highest-quality nutritional products available anywhere. He enjoys learning about developing innovations, improving productivity, and values partnerships with dozens of professionals worldwide who are committed to bringing new concepts to the market.

Thao Le

(Senior Research and Development Scientist)



Thao earned a Bachelor of Science in Chemistry from the University of Utah in 1999. She has a love of science as demonstrated through her work on Personal Care and Household products for over 18 years. Prior to joining doTERRA, she has been

instrumental in creating world class products for worldrenowned brands. She is passionate about making the best product using the most innovative, safe ingredients.

Damian Rodriguez, DHSc, M.S.

(Health and Exercise Scientist)



Dr. Damian Rodriguez holds a doctorate in health science, a master's degree in exercise physiology, and countless professional certifications in exercise and nutrition. He is also the health and exercise scientist for dōTERRA. He has spent most of his life

researching nutrition, exercise, and the lifestyle behaviors associated with optimal health. He is also involved in bringing awareness to autism spectrum disorders by serving as a mentor, as well as speaking and writing about his experiences as someone who lives with Asperger's Syndrome.



Medical Advisor

dōTERRA has assembled a medical advisory board of top experts in many different medical fields. dōTERRA works directly with these healthcare professionals and the larger medical community in developing and advancing the uses of essential oils in clinical environments.

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Dr. Brannick Riggs, MD

(Vice President of Healthcare Initiatives)



In 2001, Dr. Brannick Riggs graduated from the University of Arizona College of Medicine in Tucson while receiving some of his training in complementary and alternative medicine. He has been practicing medicine for 13 years. He enjoys treating the full spectrum of family

medicine and is a member of the American Academy of Family Physicians. Dr. Riggs enjoys using the oils in his home and integrating them into his medical practice. He is currently working with doTERRA to bring essential oils into medical assisting services and hospice care.

Dr. Paul Winterton, MD



Paul W. Winterton is a Board Certified Orthopedic Surgeon. He earned his medical degree from Harvard Medical School and completed his Orthopedic Surgical Residency at the Mayo Clinic. He completed two fellowships at The Institute For Bone and Joint Disorders in shoulder and knee

reconstructive surgery/sports medicine, as well as foot and ankle reconstruction in Phoenix, Arizona. He is a strong proponent of the practical use of essential oils and dietary supplements in the traditional western medical clinical setting, particularly with regard to bone and joint well-being.

Dr. James Geiger, MD



Graduated from the University of San Francisco, Dr. Geiger is an experienced anesthesiologist and worked in a San Francisco hospital doing cardiac anesthesia. Much of Dr. Geiger's time is spent doing anesthesia and giving lectures and webinars

on the safe use of essential oils in hospitals and surgical centers to improve patient care. Currently, he is on staff at several medical centers, orthopedic hospitals and surgical centers, where he has introduced therapy with essential oils into the operating and recovery rooms.

Dr. Joshua Yorgason, MD



Dr. Yorgason, a native of Salt Lake City, Utah, is an ear, nose and throat surgeon. He obtained his medical degree at Columbia University in New York, and did his residency at the University of Utah. He has been involved in research of drug toxicity and

hearing restoration in Los Angeles at the prestigious House Ear Institute, and at the University of Utah. He obtained further fellowship training in ear surgery at the University of Minnesota, and is a cochlear implant surgeon and hearing and balance specialist. He has been supportive of alternative medicine, and has used essential oils in his practice.

Dr. Jessica L.M. Herzog, MD, FAAP, ABHIM



Dr. Herzog is a board certified Holistic Integrative Medicine physician and pediatrician who is devoted to true wellness. She completed her undergraduate degree, medical doctorate, and pediatric residency at the University of Maryland. During her

studies, she was involved in research at the NIH and the University of Maryland, and although she loved the basic science, she found her true calling at the bedside of sick newborns and children. She has worked as a pediatric hospitalist in Maryland, Utah, and Pennsylvania. Wellness is a lifestyle that she demonstrates and teaches to her family, friends, patients and their families, medical students, residents, and colleagues. She believes that essential oils are a modern miracle of medicine that will continue to shape healthcare worldwide.



Dr. Gregory L. Woodfill, DO



Dr. Gregory L. Woodfill is a board-certified Obstetrician and Gynecologist. He completed his medical training at Michigan State University College of Osteopathic Medicine and completed his residency in Obstetrics and Gynecology there. Dr. Woodfill

developed the women's health program at the Virginia College of Osteopathic Medicine and served as Department Chairman of Obstetrics and Gynecology. He currently performs a full scope of practice, emphasizing minimally invasive office procedures, advanced laparoscopy, and urogynecology in Wilmington, NC.

Dr. Amy Wolthoff, MD



Dr. Amy Wolthoff is a Board-Certified Dermatologist. She received her Doctor of Medicine from the University of Texas Health Science Center in San Antonio, Texas. Dr. Wolthoff completed her internship year of Internal Medicine at Texas Health Resources Presbyterian Hospital, Dallas, Texas. She

then joined the Department of Dermatology at the Texas Tech Health Science Center in Lubbock, Texas, where she received the Resident Leadership Award for recognition in superior leadership qualities, professionalism, teamwork and dedication to the residency program.

Dr. Andrew Gough, DO



Dr. Andrew Gough completed a Sports Science degree from Chelmsford College before moving to the States where he graduated with honors from BYU-Idaho where he studied psychology and chemistry. Dr Gough graduated from the founding school of Osteopathic Medicine, Andrew

Taylor Still University, and completed his residency in Emergency Medicine in the St. Joseph Hospital System in Detroit, Michigan.









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