Chapter 3
Biochemical of Essential Oils

Presented by

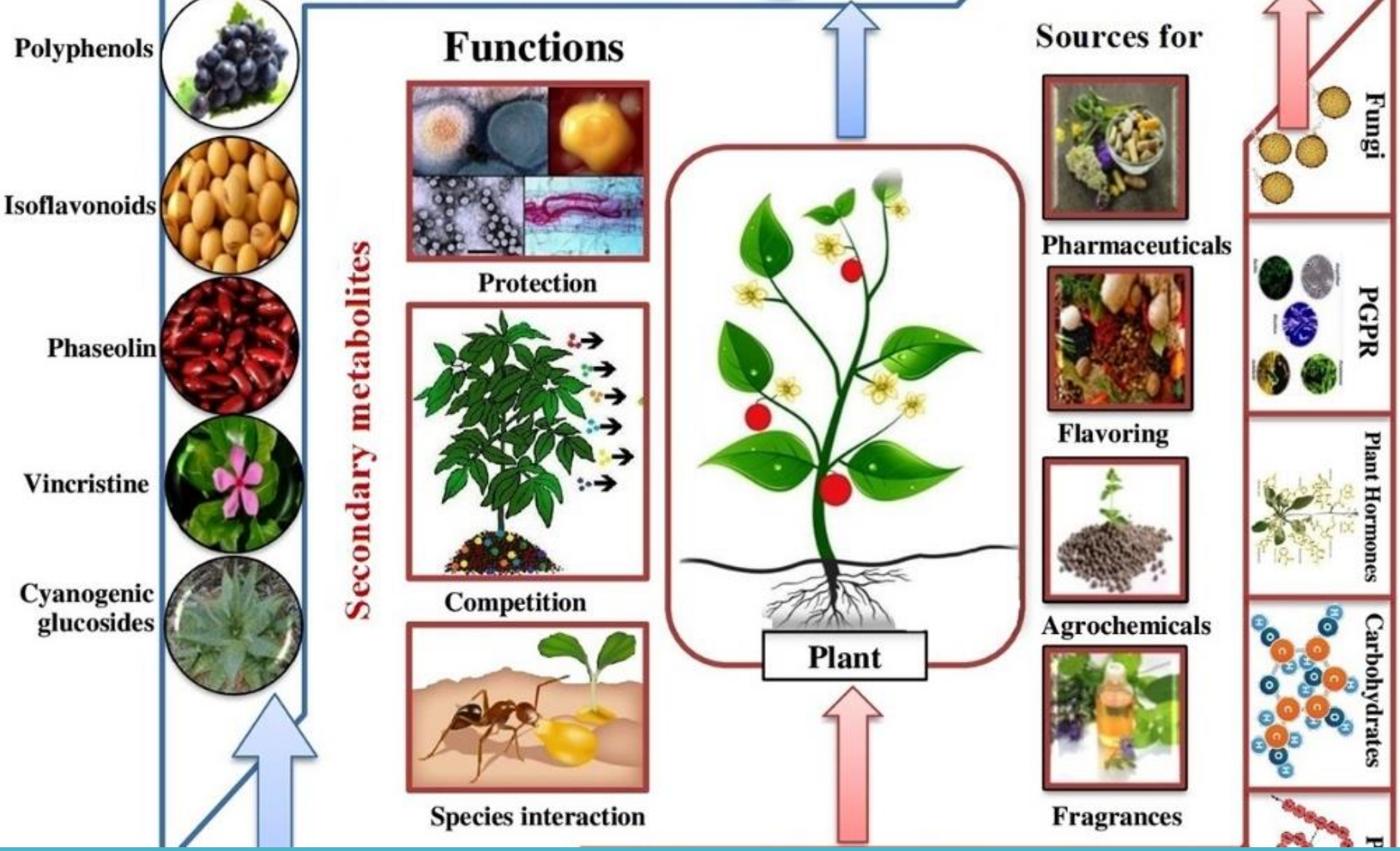
Dr. Rattana Panriansaen

Faculty of Allied Health Sciences

Suan Sunandha Rajabhat University

Topics

- Chemical compounds in organisms that give off aroma.
- Mechanism of action of essential oils
- Pharmacological effects of essential oils

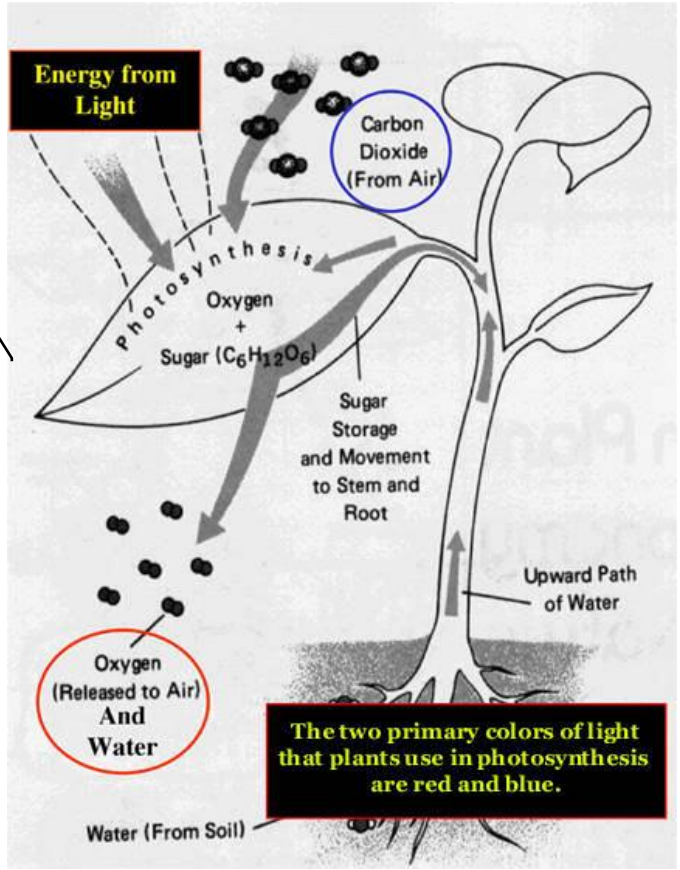


สารประกอบทางเคมีในสิ่งมีชีวิตที่ให้กลิ่นหอม

Chemical compounds in organisms that give off aroma.

Primary metabolite

- Carbohydrate
- Lipid
- Protein
- Pigment
- Organic salt

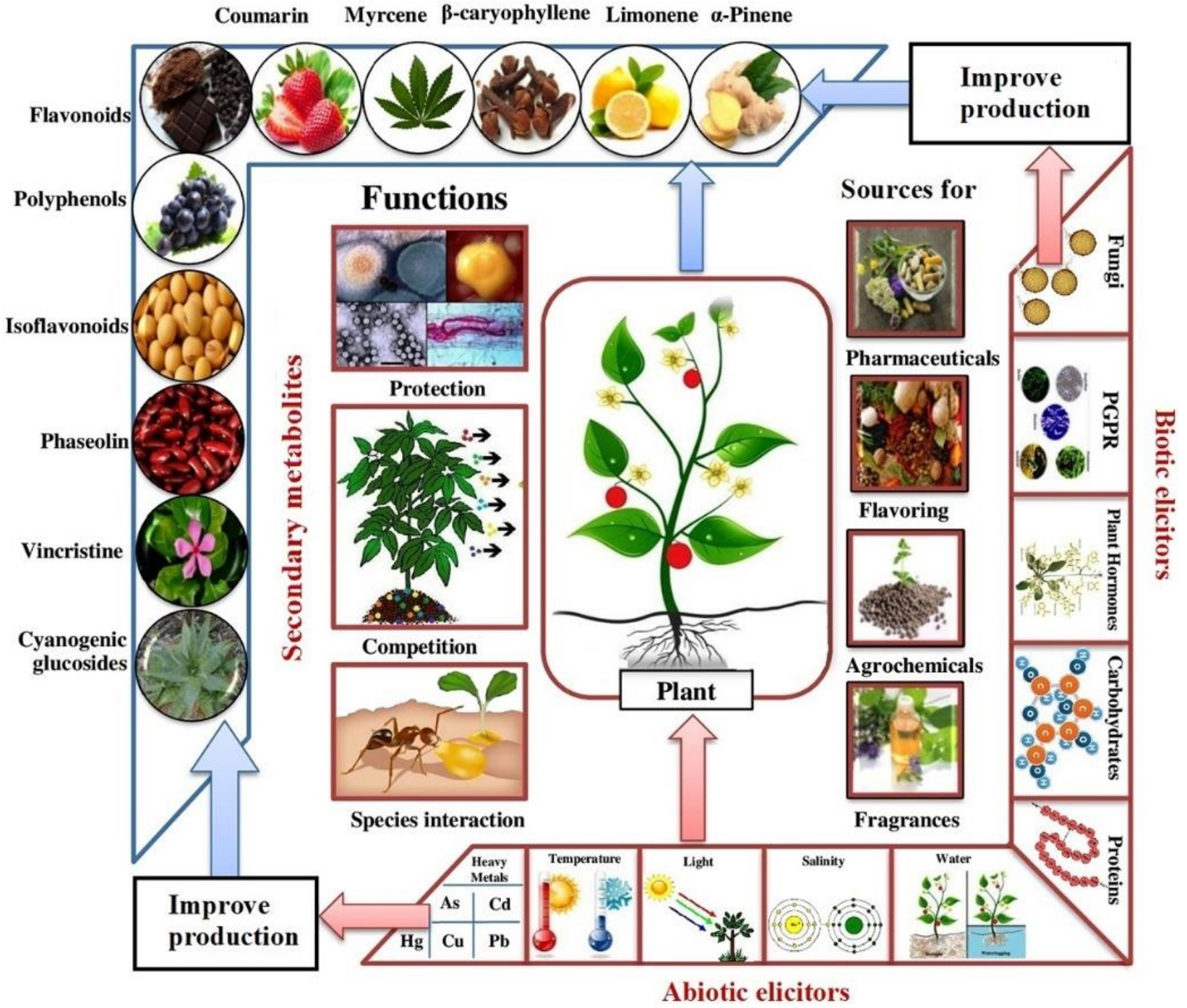


Secondary metabolite

- Alkaloid
- Anthraquinone
- Essential oil

Chemical compounds in aromatic plants

- **Primary metabolite** is a substance that exists in higher plants in general. found in all plants They are products of photosynthesis, such as carbohydrates, lipids, proteins, pigments, and inorganic salts.
- **Secondary metabolite** is a compound created by plants, animals, fungi or bacteria. There is no critical need for producer organisms.
- Most of the secondary compounds are natural substances that show pharmacological activity. and cosmetic benefits But the research found that Some primary compounds can show pharmacological activity. and cosmetic benefits as well


Coumarin
Myrcene
β-caryophyllene
Limonene
α-Pinene
Flavonoids
Polyphenols
Isoflavonoids
Phaseolin
Vincristine
Cyanogenic glucosides
Improve production
Functions
Protection
Competition
Species interaction
Secondary metabolites
Plant
Sources for
Pharmaceuticals
Flavoring
Agrochemicals
Fragrances
Fungi
PGPR
Plant Hormones
Carbohydrates
Proteins
Biotic elicitors
Improve production
Heavy Metals
As
Cd
Hg
Cu
Pb
Temperature
Light
Salinity
Water
Abiotic elicitors

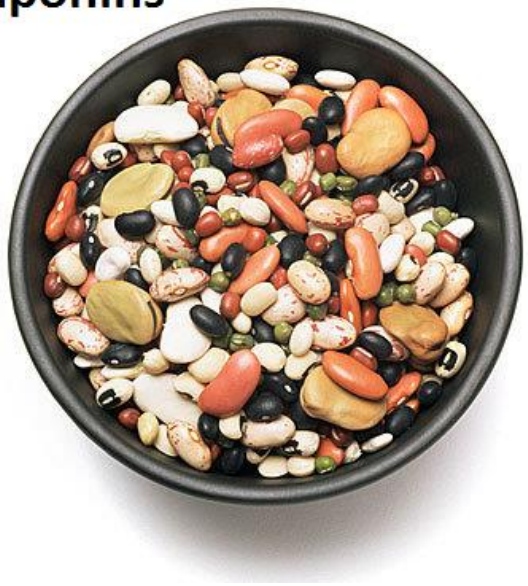
Chemical compounds in aromatic plants

- Secondary compounds are produced through biochemical processes to produce compounds that give specific odors, colors or plant properties that are quite unique.
- In creating this substance, enzymes are involved, such as alkaloids, anthraquinone, essential oils, etc. Most of them have medicinal properties.
- According to their chemical structure, these found natural substances may be divided into 7 groups : Carbohydrates, Alkaloids, Glycosides, แท ,Tannins ,Volatile oil, Essential oil, Fats and Fixed oil, Resins and Balsams.

Secondary metabolites are beneficial to human health

Sample of Secondary Metabolite for health

Saponins



Flavonoids

CAROTENOIDS

- Carotenoids are pigments in red, orange and yellow fruits and vegetables such as pumpkins and carrots, seaweed.
- The carotenoid that the body uses in the bloodstream or tissues is beta-carotene.
- Carotene (carotene) is a large molecule. and qualify as pro-vitamin A When carotene breaks down, vitamin A is obtained. This reaction takes place within the liver.
- Carotene is easily oxidized by oxygen in the air.
- It is a natural antioxidant that helps fight cancer and heart disease.

FLAVONOIDS

- Flavonoids are found in colorful fruits and vegetables.
- Flavonoids act as antioxidants. anti-inflammatory delay cancer
- Health enhancing properties in other areas such as
  - Strengthens the functioning of the immune system that may help protect the body from germs, toxins and irritants.
  - It stimulates chemicals in the brain that may help balance moods.
  - Slow down the deterioration of the brain from increasing age and the effects of free radicals.

GLUCOSINOLATES

- **Glucosinolates** is a sulfur compound found in cruciferous vegetables. It has a characteristic bitter taste and pungent smell.
- Plants that contain this substance include broccoli, Brussels sprouts, cabbage, kale, bok choy, collard greens and radishes. green mustard
- **Glucosinolate** Benefits in helping to reduce the risk and prevent serious diseases like cancer. Including colon cancer, breast cancer, bladder cancer and stimulates enzymes that cleanse the liver

CAFFEINE

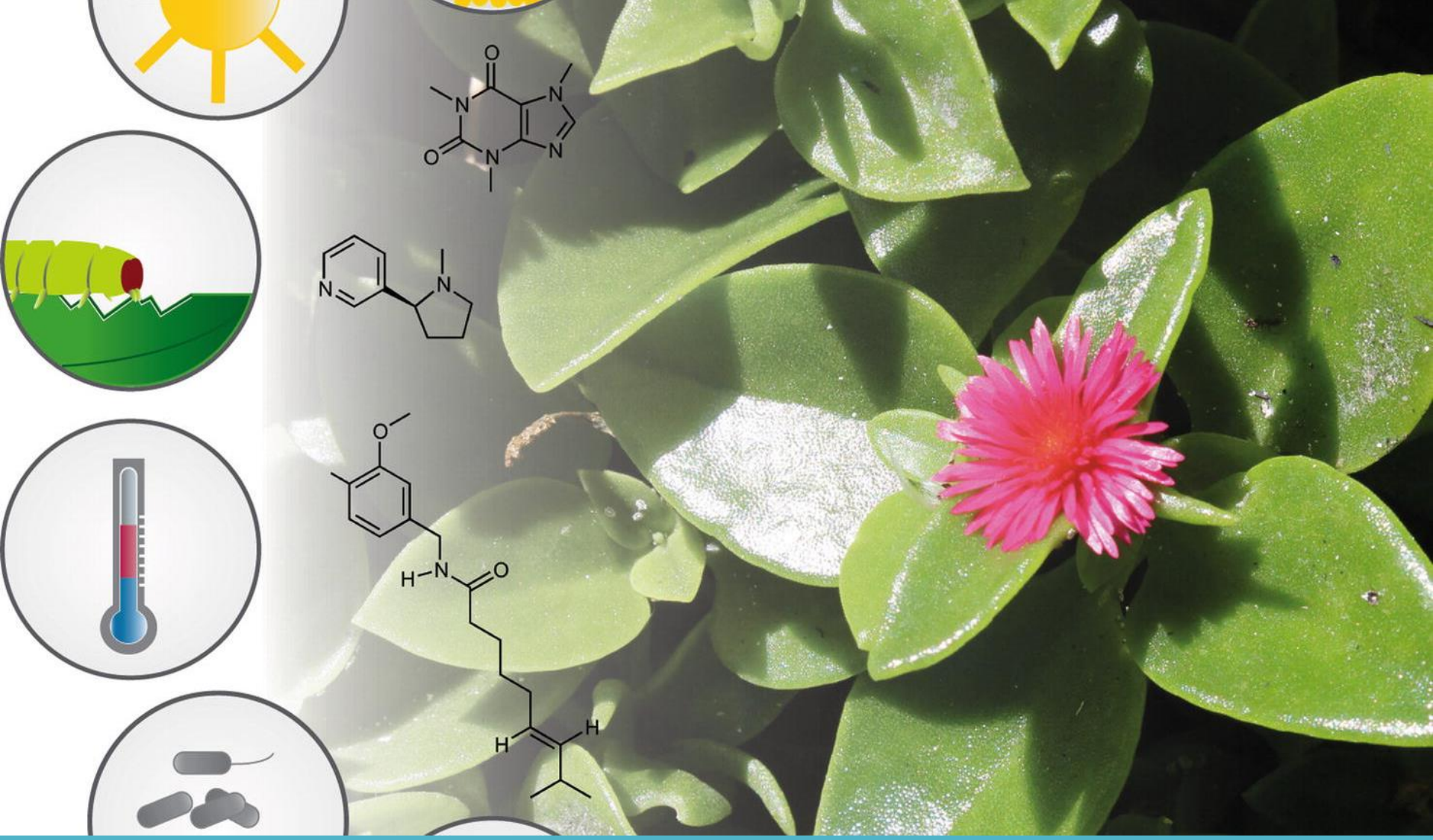
- Caffeine is found in tea, coffee or cocoa.
- Caffeine has health benefits if consumed in moderation, such as helping to reduce symptoms of fatigue. Helps to stimulate the body to be rejuvenated. reduce drowsiness Many skin benefits
- Benefits of caffeine to the skin.
  - Help protect skin from sunlight. and help slow down premature aging because it contains antioxidants
  - Helps make your skin smooth and soft. Caffeine has excellent exfoliation properties. Ready to stimulate cell regeneration Helps to eliminate toxins in the pores cleanly. Ready to tighten pores in the same time. resulting in smoother, smoother skin
  - reduces inflammation Reduce wrinkles Including redness, dullness as well It also stimulates the circulatory system to make the skin look brighter.
  - Helps to increase moisture. add elasticity to the skin Makes the skin look full of water, not dry.

How caffeine affects your body and mood

- **Low-dose caffeine (50-200 mg)** will stimulate the body. Energetic, refreshing, not sleepy
- **Moderate doses of caffeine (200-500 mg)** can cause headaches, stress, jitters, trembling hands, and insomnia**.**
- **High doses of caffeine (1,000 mg)** will begin to cause caffeine poisoning (caffeinism), characterized by restlessness. Fast heartbeat, nau.sea, loss of appetite, frequent urination

SAPONINS

- Saponins have a wide range of chemical and physical properties and can be used in many applications, namely soap, fish poison and shellfish exterminator. as well as industrial use As a foaming agent in the food industry such as beverages, cocktail mixes
- Antimicrobial and Anti-fungal used as an antinutritional factor is likely to be used to control mosquito larvae.
- It has limited use due to its bitter taste. Currently, there are health benefits such as lowering cholesterol. (cholesterol) and anti-cancer (Guclu-Ustundag, O. and Mazza, G., 2007) and used in herbal medicines such as soy saponin and garlic.
- Commercially, new processes are being developed. and improving the existing technology, especially the extraction concentration and purification of substances



Chemical compounds found in essential oils.

Chemical compounds in aromatic plants

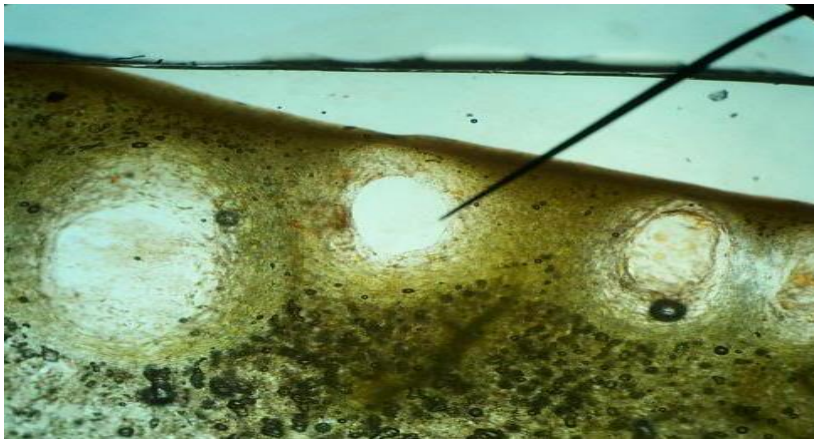
- The main pathways for essential oil production in plants are Mevalonate pathway and Shikimate pathway.
- Essential oils are complex chemical compounds. It is an aromatic substance that can evaporate at room temperature.
- The chemical compounds found in essential oils fall into two major groups: Terpenoids and Phenylpropanoids.
- **Plants of the same family often produce and excrete essential oils from the same plant structure.**

An example of the plant structure that produces essential oils.

Glandular hairs ในวงศ์ Lamiaceae

Modified parenchymal cells วงศ์ Piperaceae

Oil tube ในวงศ์ Apiaceae



Lysigenous/ shizogenous ในวงศ์ Pinaceae และ Rutanceae

Chemical compounds in aromatic plants

- **The chemical compounds found in essential oils fall into two majorgroups:Terpenoids and Phenylpropanoids.**

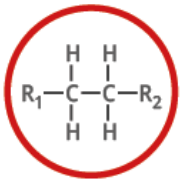
1. **Terpenoids are obtained by the mevalonate pathway. The basic molecule is isoprene units, which are carbon-based. The amount of carbon found is C5, C10, C15, C20, etc. Terpenoids are sometimes called aliphatic compounds.**
2. Phenylpropanoids or aromatic compounds are found in a small number, formed from the Shikimate pathway, which is based on a phenyl ring (6 carbon atoms in a circle).

- There are 12 types of chemicals found in essential oils: Monoterpenes, Sesquiterpenes, Diterpene, Phenol, Aldehydes, Ketone, Esters, Lactones, Coumarins, Ethers, Oxides และ Acids

FUNCTIONAL GROUPS IN ORGANIC CHEMISTRY

FUNCTIONAL GROUPS ARE GROUPS OF ATOMS IN ORGANIC MOLECULES THAT ARE RESPONSIBLE FOR THE CHARACTERISTIC CHEMICAL REACTIONS OF THOSE MOLECULES. IN THE GENERAL FORMULAE SHOWN BELOW FOR EACH FUNCTIONAL GROUP, 'R' REPRESENTS THE REST OF THE MOLECULE, AND 'X' REPRESENTS ANY HALOGEN ATOM.

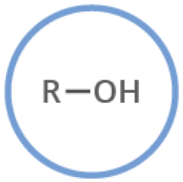
HYDROCARBONS | SIMPLE OXYGEN HETEROATOMICS | HALOGEN HETEROATOMICS | CARBONYL COMPOUNDS | NITROGEN-BASED | SULFUR-BASED | AROMATIC



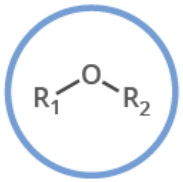
ALKANE
Naming: -ane
e.g. ethane

ALKENE
Naming: -ene
e.g. ethene

ALKYNE
Naming: -yne
e.g. ethyne



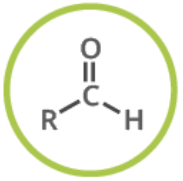
ALCOHOL
Naming: -ol
e.g. ethanol



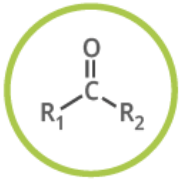
ETHER
Naming: -oxy -ane
e.g. methoxyethane

EPOXIDE
Naming: -ene oxide
e.g. ethene oxide

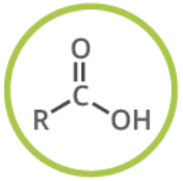
HALOALKANE
Naming: halo-
e.g. chloroethane



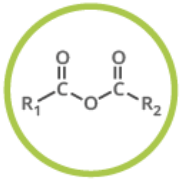
ALDEHYDE
Naming: -al
e.g. ethanal



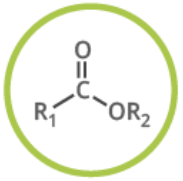
KETONE
Naming: -one
e.g. propanone



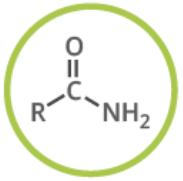
CARBOXYLIC ACID
Naming: -oic acid
e.g. ethanoic acid



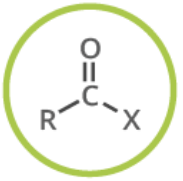
ACID ANHYDRIDE
Naming: -oic anhydride
e.g. ethanoic anhydride



ESTER
Naming: -yl -oate
e.g. ethyl ethanoate



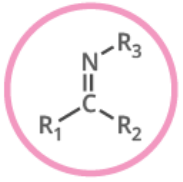
AMIDE
Naming: -amide
e.g. ethanamide



ACYL HALIDE
Naming: -oyl halide
e.g. ethanoyl chloride

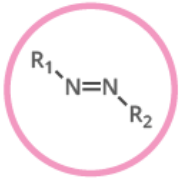
AMINE
Naming: -amine
e.g. ethanamine

NITRILE
Naming: -nitrile
e.g. ethanenitrile



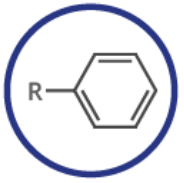
IMINE
Naming: -imine
e.g. ethanimine

ISOCYANATE
Naming: -yl isocyanate
e.g. ethyl isocyanate



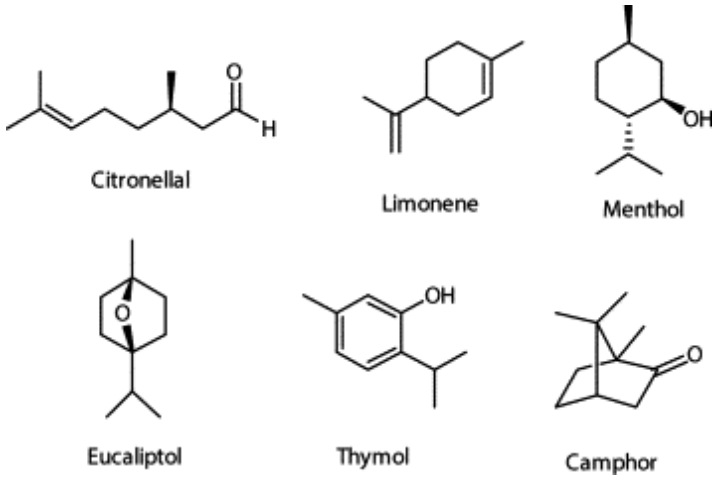
AZO COMPOUND
Naming: azo-
e.g. azoethane

THIOL
Naming: -thiol
e.g. methanethiol



ARENE
Naming: -yl benzene
e.g. ethyl benzene

Monoterpenes

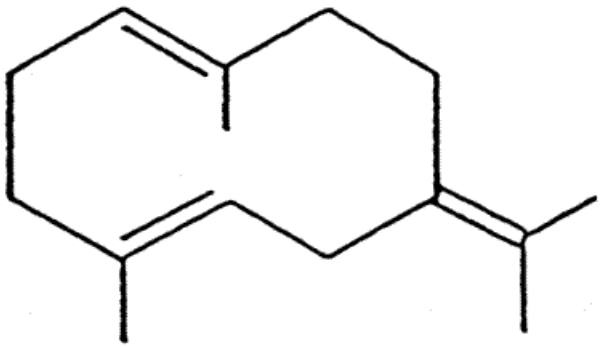


- It is found in most essential oils.
- There are about 10 carbon atoms.
- colorless, highly volatile (unstable) and rapidly deteriorating It should be handled with care and stored at cool temperatures.
- **Mostly found in citrus oils such as limonene found in lemon oil, orange oil, cardamom, camphene, camphor, P-cynene, found in coriander, cinnamon, pinene, eucalyptus, orange blossom, coriander.**

Pharmacological Actions of Monoterpenes

- **Skin penetration** oils containing monoterpenens It will absorb the skin quickly due to the fluidizing effect on the skin well. therefore effective faster than other essential oils
- **Immune stimulation** This group of substances can increase the number of white blood cells. Increases the body's immunity, for example, drinking water that contains essential oils in this group, such as lemon, pine, etc.
- **Antiseptic action** Citrus and pine plants have outstanding antiseptic, cleaning and antibacterial effects.
- **Volatility** These substances evaporate quickly. Has a beneficial effect on the respiratory system make breathing easier and as a scent for air conditioning
- **Oxygenation leading to skin irritation** These substances react quickly with air.

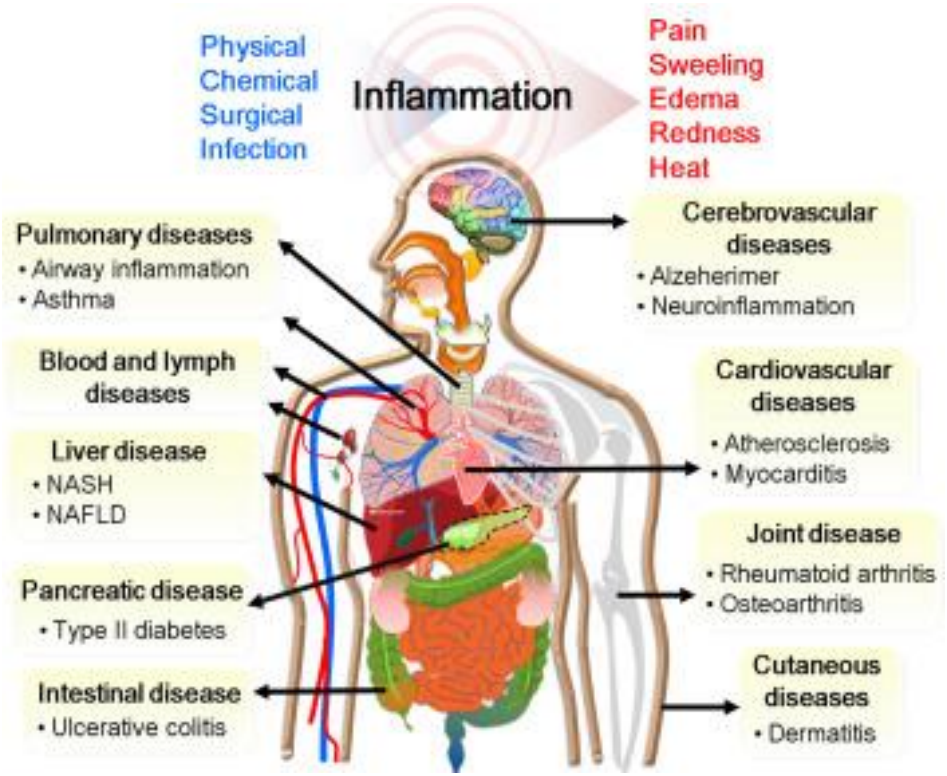
Sesquiterpenes



4

- **มีคาร์บอน 15 อะตอม หรือมี isoprene 3 หน่วย**
- ระเหยได้ช้ากว่า monoterpene มีขนาดใหญ่
- ตัวอย่างเช่น Zingiberene ในน้ำมันขิง, Cedrene ในซีดาร์และ Caryophellene น้ำมันกานพลู, Farnesene ที่พบในน้ำมันกุหลาบ

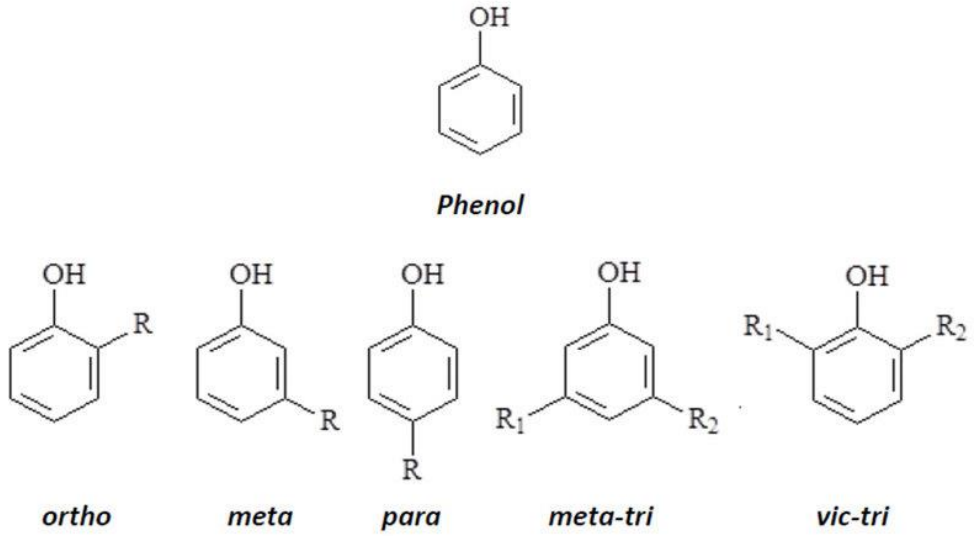
Pharmacological effects of Sesquiterpenes



- **Anti-inflammatory effect**
- **Calming effect** Causing calming, suppressing, lowering blood pressure It is commonly used in medications to relieve stress.

Phenol

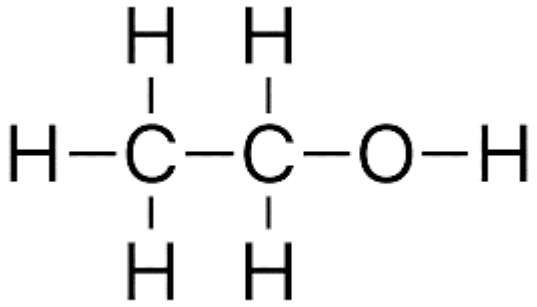
- 1 or more hydroxy groups share a benzene ring.
- Most of the disinfectant chemicals found in plants Small amounts stimulate body functions. But high doses can be toxic to the nervous system and can cause skin irritation. Helps to enhance the work of digestion.
- For example, thymol, found in basil oil, and eugenol, thymol, carvacrol, found in cloves.



Pharmacological Actions of Phenol

- **Strong antiseptic action** Oils high in phenols are highly antiseptic, such as thyme (Thyme, Thymus vulgaris), oregano (Oregano, Origanum vulgaris). Historically used in hospitals as fumigant and sterilization. (disinfectant)
- **Antifungal action** Efficacy in killing fungi
- **Anti-inflammatory effect** Oils high in phenols are highly anti-inflammatory. It is commonly used to treat joint inflammation due to rheumatoid or insect bites. because it can inhibit the synthesis prostaglandins that the body produces in response to inflammation
- **Skin irritation** High phenol oils tend to be irritating to the skin. Therefore, it is not popular to use without being diluted. And should be used less and mixed in a weaker active oil.
- **Hepatotoxic effect** when used in high doses and contact each other for a long time May have liver damage But conflicting studies have been found when used in small doses to inhibit liver damage.

Alcohol



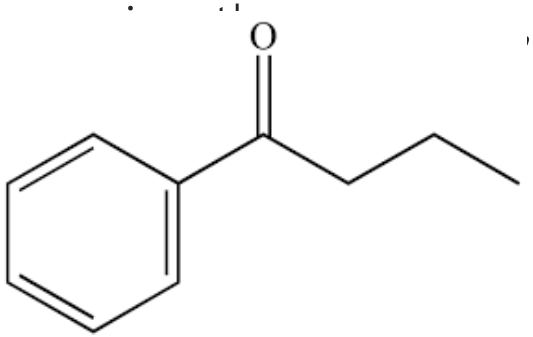
- Essential oils that are primarily alcohol-based, such as acyclic alcohol (geraniol, citronellol) and monocyclic alcohol (menthol, α-terpinol) Lavendulol in Lavender
- It is often included in the form ofmonoterpene alcohol, sesquiterpene alcohol, diterpene alcohol

Pharmacological action of Alcohol

- **Antimicrobial action** Effective against many types of bacteria And inhibit the growth of skin fungi such as athlete's foot.
- **Immune support** stimulate the body's immunity when used for a long time Because it has a mild effect and is non-toxic to the body.
- **Anti-inflammatory action** Among sesquiterpene alcohols, such as German chamomile, cedarwood, it has anti-inflammatory action both in the skin and in the tissues.
- **Antispasmodic effect** The use of german camomile in the right coordinates helps against cramps. or muscle spasms
- **Sedative effect** calm and relax

Ketone

- It is an essential oil with ketones as the main component.
- The main pharmacological effects are anticoagulants. relax Stay calm and heal scar tissue. immune system or respiratory system in the body
- **Ketones can harm the nervous system and result in seizures. Failure and epilepsy**
- Examples of the presence of ketones pinocamphone in hyssop and carvone in pepp

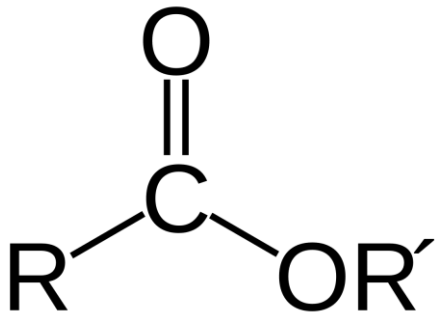


Pharmacological effects of Ketone

- **Mucolytic effect** **Most ketones have an expectorant effect, dissolving phlegm and reducing the viscosity of phlegm. which affects the respiratory system**
- **Antimicrobial action Ketones are active against bacteria and viruses.**
- **Skin-healing effect** Essential oils containing high amounts of ketones are commonly used to heal the skin, especially scars. Examples include rock rose (Cistus ladaniferus), jasmine (Jasminum gradiflorum).
- **Toxicity** May have negative effects on the body due to hepatotoxicity and nervous system damage, such as sage (Salvia officinalis), hyssop (Hyssopus officinalis).
- In use should be careful. May cause the metabolism in the body to decrease. which is chronically toxic to the body

Ester

- There are esters as the main constituents.
- **Pharmacological effects include antispasmodic. Bacteria and anti-inflammatory Helps to balance the nervous system.**
- For example, Cinnamyl acetate in cinnamon allyl isothiocyanate. in mustard oil, methyl salicylate in winter green oil

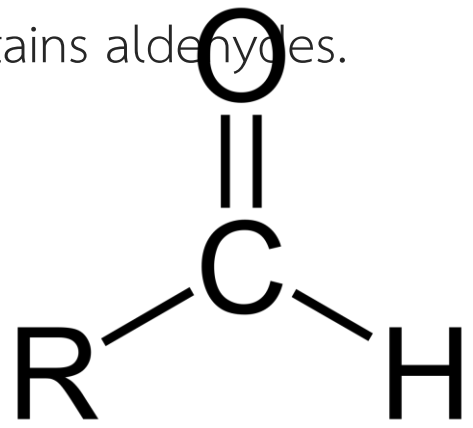


Ester Pharmacological Effects

- **Antispasmodic and carminative effects** High-estered essential oils, such as lavender, are commonly used to reduce spasms. and muscle cramps and drive wind in the stomach, wind in the intestines
- **Sedative effect** Calming and relaxing effect
- **Adaptogenic action** The effect of balancing the body Puts the body in a state of constant homeostasis and responds to stress. It acts in two ways depending on the condition, eg warming or cooling. calm or provoke
- **Anti-inflammatory effect** anti-inflammatory effect

Aldehydes

- Aldehyde is an organic compound with -CHO group in hydrocarbon molecules such as formaldehyde (HCHO) and acetaldehyde (CH3CHO). Formaldehyde
- products used in households or public health for the purpose of killing germs Cleaning floors, walls, sanitary ware and other materials or fixing blockages in pipes or sewage drains
- Pharmacological effects include anti-inflammatory aldehydes can cause significant irritation to the skin and mucous membranes. Furfurol in Lavender, Sandalwood, Cinnamon and Cypress contains aldehydes.

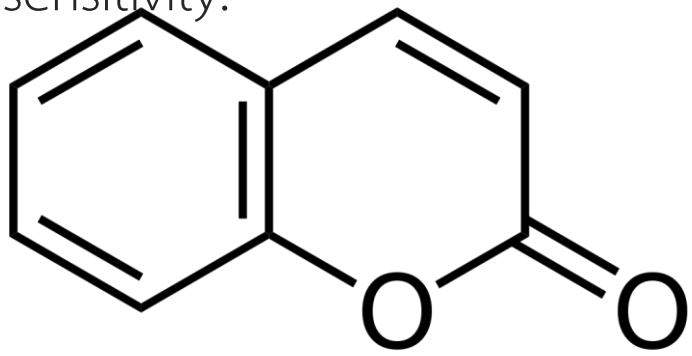


Pharmacological Actions of Aldehydes

- **Antimicrobial action** Aldehydes are powerful fungicides. High aldehyde essential oils, such as lemongrass, have antibacterial effects. as it is sensitive to oxygen but easily oxidized therefore should not be kept for too long It also has an antiviral effect.
- **Sedative effect** Sleep-inducing effect is found in substances in the terpenoid group. and an aldehyde that smells like lemon.
- **Skin irritation** The side effect found in aldehydes is skin irritation.
- **Possible hormonal effects** when using high doses affects the endocrine system has a reduced follicle effect in the ovary increase testosterone levels Estrogen action

Coumarins

- Anti-convulsant and anti-coagulant, coumarins have a soothing and sedative effect. As these chemicals are able to light, essential oils containing these constituents should be used with caution and should not be exposed to sunlight.
- Bergaptene in bergamot, angelicine in Angelica, and Citroptene in citrus oil are examples of coumarins.
- Pharmacological effects May cause photosensitivity.



Mechanism of action of essential oils

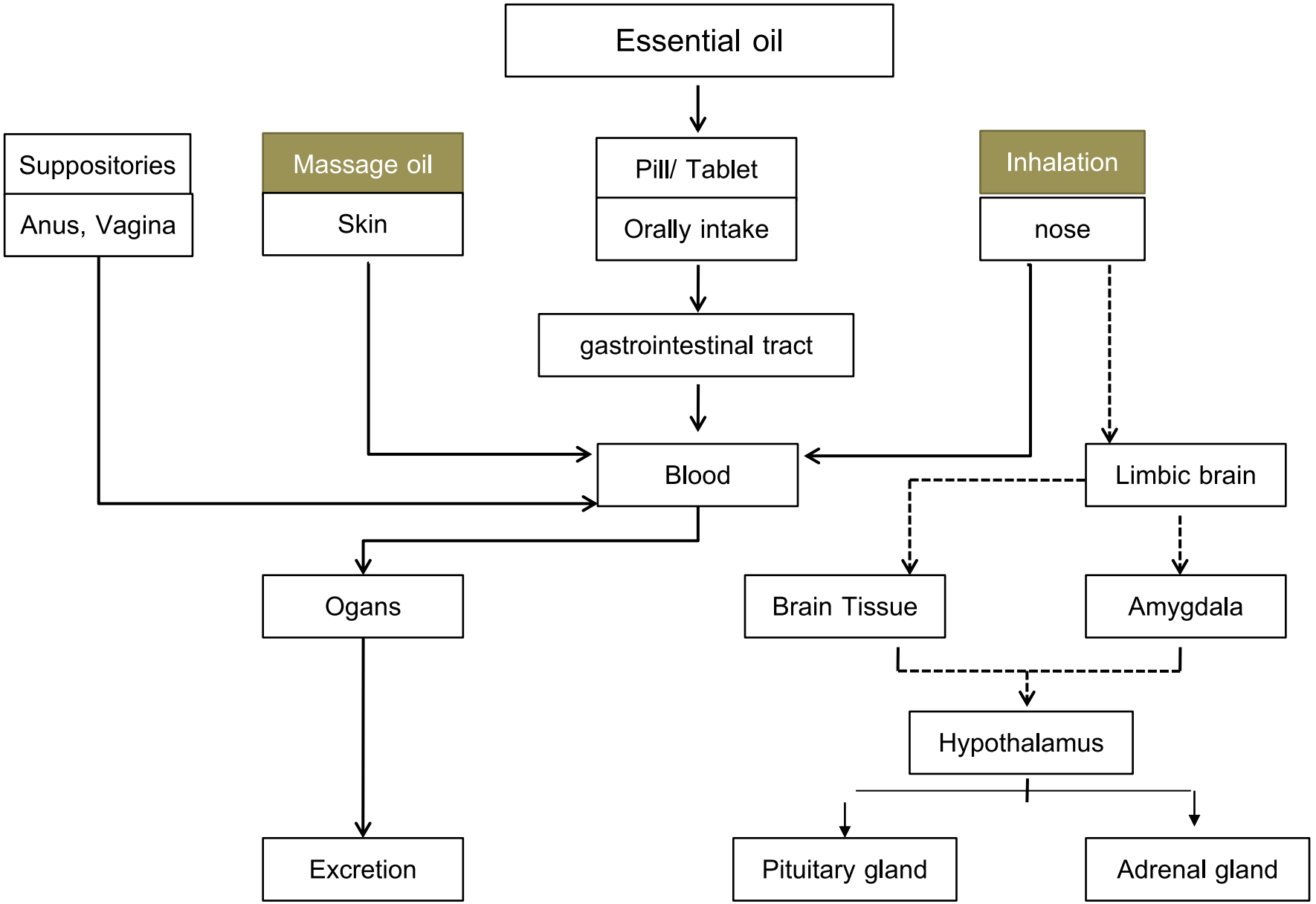
1. **Action caused by chemical changes** The essential oils will seep into the blood stream to react with hormones and enzymes, etc.
2. **Action that stimulates the body to secrete other chemicals in the body** affecting the functioning of the body
3. **Psychological performance** This usually depends on the individual's experience of smelling.

How to bring essential oils to the body

1. **Inhalation**
   - Essential oil molecules diffuse through the nasal septum to the olfactory nerves. to a part of the brain known as the emotional center
   - How the mood will be depends on the properties of that smell.
2. **Skin absorption**
   - Oil molecules permeate through different layers. of the skin and endothelial blood flow into the blood flow throughout the body and act on various systems or organs according to the properties of that type of oil
   - The time in the body is about 4-48 hours.

How to bring essential oils to the body

3. **Oral**
   - Enters the gastrointestinal tract passed to the bloodstream
   - Affects the functioning of various organ systems of the body according to the properties or effects of essential oils.
   - It will eventually be excreted through urine and feces.


Essential oil
Suppositories
Anus, Vagina
Massage oil
Skin
Pill/ Tablet
Orally intake
Inhalation
nose
gastrointestinal tract
Blood
Limbic brain
Ogans
Brain Tissue
Amygdala
Hypothalamus
Excretion
Pituitary gland
Adrenal gland

The Limbic System

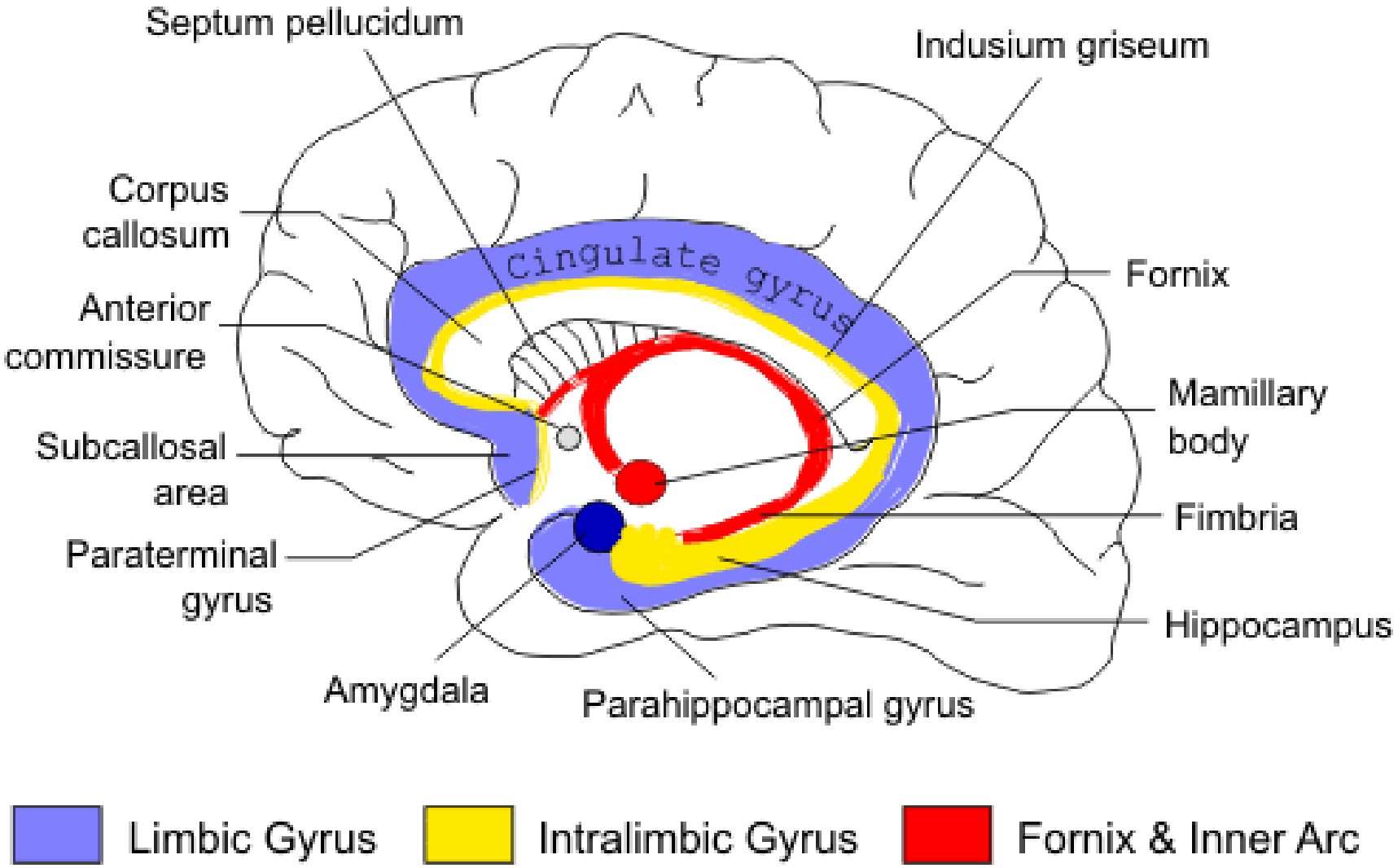
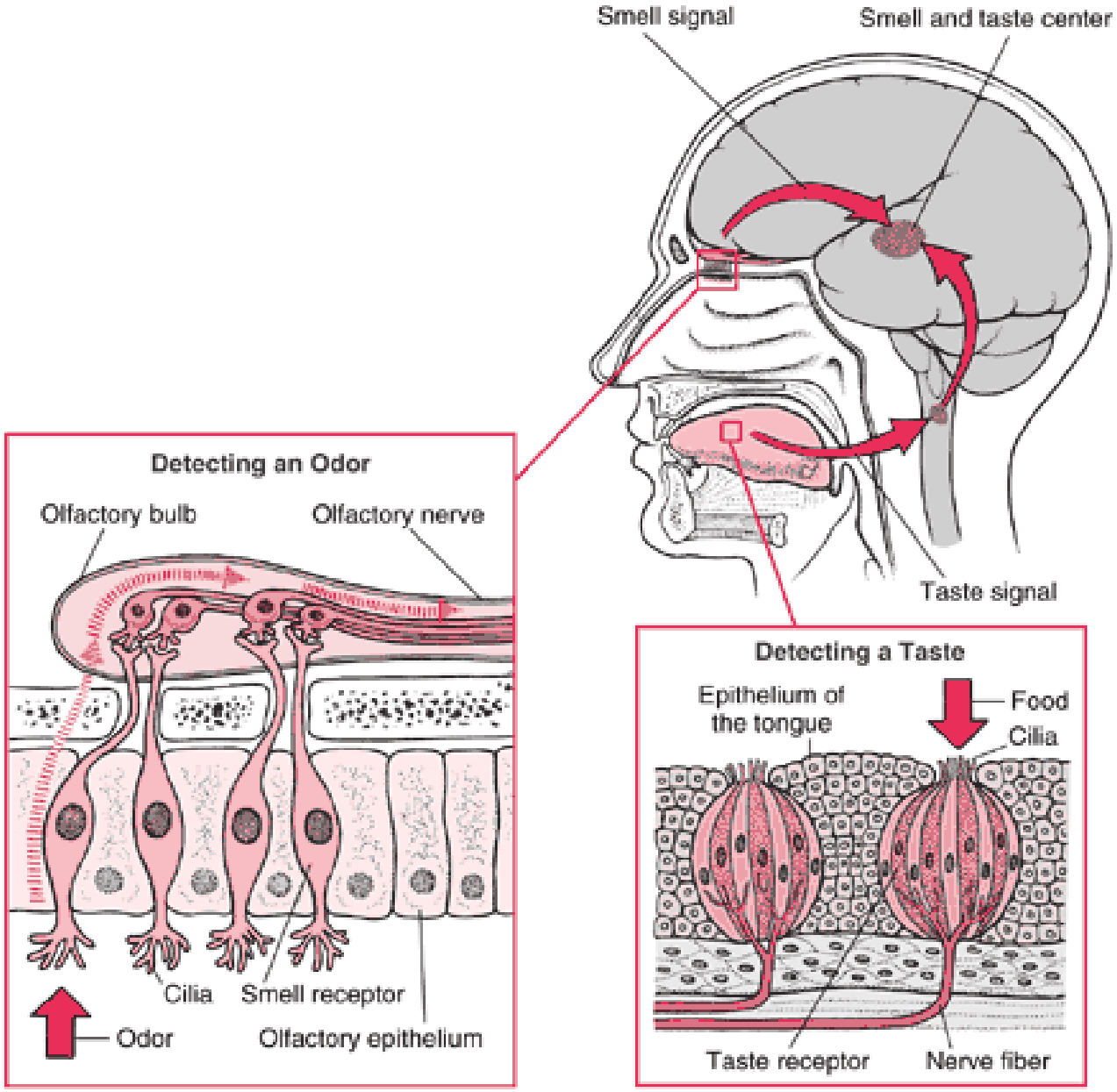


Chart showing the structures which form the limbic system: their role in the psyche: neurotransmitters secreted and their effect: essential oil stimulation and effect: associated immune function

Location	Structure	Function	e.g. E.Oils which effect structure	Effect of the essential oils	Substances found in or released by axons - (neurotransmitters)	Effect of substance	Immunological association
An almond shaped lobe of cerebellum - A structure in the floor of the lateral ventricle which in cross section resembles a sea horse) The Cerebellum is concerned with subconscious skeletal movement required for co-ordination, balance & maintaining posture	AMYGDALA	Are memory centres - can trigger a memory either recent or distant - concerned with mood, feeling & instinct.	Black pepper Lemon Peppermint Rosemary	Memory & mental stimulant	Dopamine Concentrated in mid-brain, hypothalamus & limbic system generally Generally excitatory	Involved in emotional responses Concerned with subconscious skeletal movement	
	HIPPOCAMPUS				Endorphins Concentrated in pituitary, hypothalamus, thalamus & brain stem Usually excitatory	Inhibit pain by inhibiting substance 'p' May have a role in memory, learning, sexual activity Linked to depression & schizophrenia	
Brain stem - a grey mass lying beneath the thalamus at the base of the brain	HYPOTHALAMUS concerned with rage & aggression	A neural endocrine control centre concerned with hunger, thirst, satiety, sleep & other autonomic functions. Pituitary stimulates to make hormones regulates & relays messages to other parts of the brain	Bergamot Frankincense Geranium Rosewood	Regulating Balancing	Enkephalin's Concentrated in thalamus, hypothalamus, limbic system & spinal cord pathways that relay pain messages	Inhibits pain impulses by suppressing substance 'p'	Delivers electrical & chemical messages via the blood Controls the output of ACTH
Brain stem -forms part of the lateral wall of third ventricle	THALAMUS	Relay station for sensory impulses to the cerebrum from spinal cord brain stem cerebellum & cerebrum Sensory area for pain, temperature, light touch & pressure Has some memory & emotional function	Clary sage Grapefruit Jasmine Rose otto	Euphoric Uplifting	Norepinephrine (Noradrenaline) Released at some neuromuscular & neuro glandular junctions, concentrated in the brain stem, also found in cerebral cortex, hypothalamus, cerebellum & spinal cord Usually excitatory	May be related to arousal, dreaming and regulation of mood	ACTH impairs the ability of the immune cells to replicate & produce antibodies
Suspended from the base of the brain by its stalk	PITUITARY	an endocrine gland & is connected by a neural net-work to the Hypothalamus - stores & releases hormones	Clary sage Jasmine Patchouli Ylang-ylang	Aphrodisiac	Seretonin Found in brain stem, limbic system, hypothalamus, cerebellum & spinal cord Generally inhibitory	May be involved in inducing sleep Sensory perception Temperature regulation Control of mood	Releases ACTH Stimulates the Adrenal gland to release more than 30 hormones including Cortisol & Adrenaline
A connecting ridge between the two halves of the medulla oblongata	RAPHE NUCLEUS	Releases seretonin	Camomile Lavender Marjoram Neroli	Sedative			Cortisol changes the numbers & function of the white cells
A small pigmented region in the floor of the 4th ventricle	LOCUS CAERULEUS	Releases noradrenalin	Cardamom Juniper Lemongrass Rosemary	Invigorating	Substance 'p' Sensory nerves, spinal cord pathways and parts of brain associated with pain	Involved in the perception of pain	Recent research from Germany suggests that Adrenaline ↑ the activity of natural killer cells

Summary of Comparison between Nervous & Endocrine Regulation of Homeostasis	Nervous	Endocrine
mechanism of control	neuro transmitters released in response to electrical impulses	Hormones
cells affected	muscle fibres, glands cells, and other neurons	Virtually all body cells
type of action that results	muscular contraction or glandular secretion	Changes in metabolic activities
onset of action	within milli seconds	Up to several hours or more
duration of action	generally brief	Generally longer

กลไกการออกฤทธิ์จากการสูดดมทางจมูก (inhalation)


Smell signal
Smell and taste center
Taste signal
Detecting an Odor
Olfactory bulb
Olfactory nerve
Cilia
Smell receptor
Odor
Olfactory epithelium
Detecting a Taste
Epithelium of the tongue
Food
Cilia
Taste receptor
Nerve fiber

Olfactory mechanism

- It consists of 3 steps
  1) Reception Smell → olfactory receptor cell (ciliated sensory neuron, supporting cells, basal cells) electrochemical message
  2) Transmission Information → Olfactory bulb → Olfactory tract → Limbic system
  3) Perception when hypothalamus Get information, there are commands to various parts such as release endophin ,encephalin,seratonin

Olfactory mechanism

- The inhalation effect affects the central nervous system, the limbic system of the brain, and the pituitary gland.

- Olfactory mucous membrane + odorant (odor)=odorant binding protein binds to the receptor→ Activated adenyl clyclase embedded in the hair cell epithelium, stimulating the conversion of ATP energy to cAMP.
- cAMP causes sodium channels to open causing sodium entry into the cell, creating a potential difference. Resulting in a nerve impulse sent along the first cranial nerve (Olfactory nerve) to the brain to interpret olfactory signals.

G-protein

↓

α-subunit

↓

Adenylyl cyclase

↓

↑cAMP

↓

Open cation channels

↓

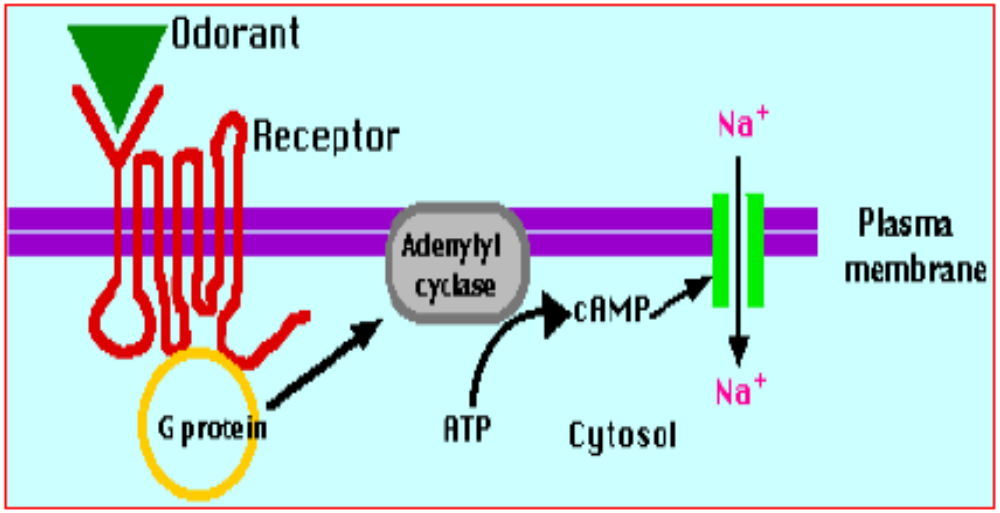
Membrane potential
from –55mV to –30mV
(Depolarization)

↓

A.P. in olfactory nerves

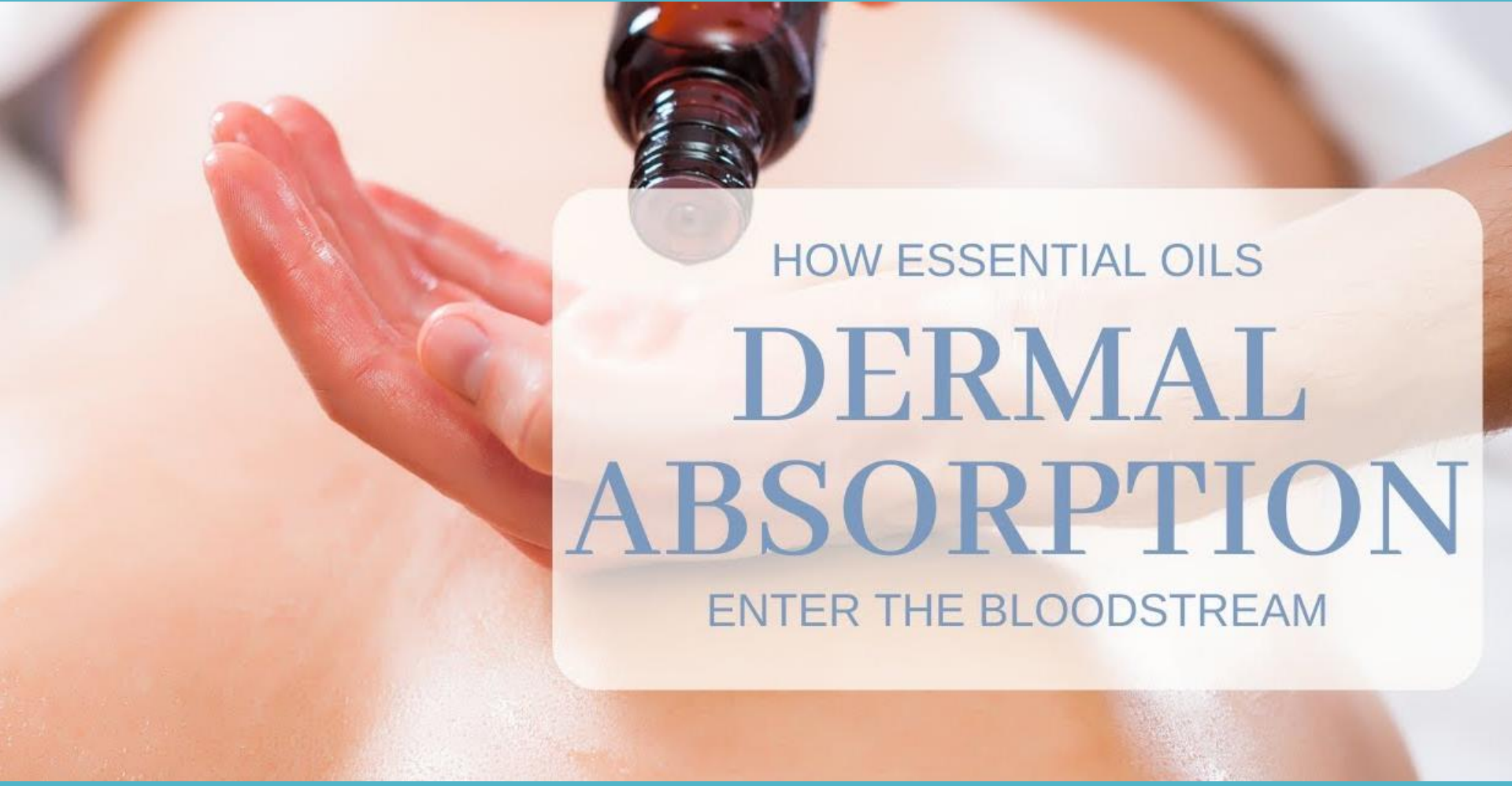
↓

Ipsilateral olfactory bulb

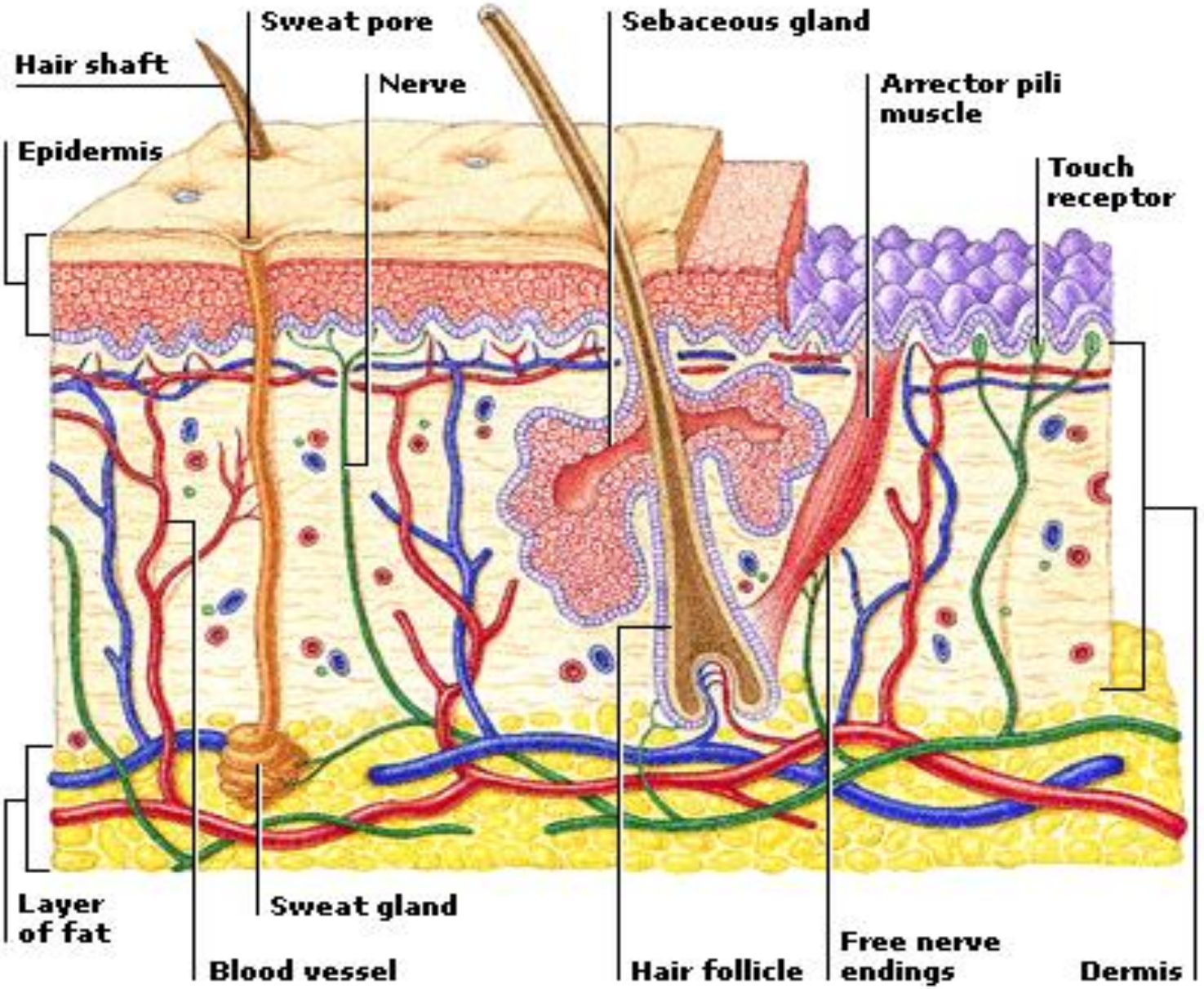


Mechanism of action from nasal inhalation

- The body can recognize and perceive odors according to the body's olfactory mechanism.
- Humans can distinguish about 10,000 different odors from the fact that olfactory receptor cells carry only one specific gene.
- Smells that stimulate cell receptors well should have the following properties :
    1. volatile in air
    2. Well dissolved in water, it easily passes through the nasal mucosa.
    3. Dissolves well in fat
- Loss of smell (anosmia or loss of smell can be caused by 3 factors: 1) head accident 2) viral infection 3) nasal and sinus diseases type 1 and type 2 causing nerve endings type 3 blocked nasal passages



กลไกการออกฤทธิ์จากการซึมผ่านทางผิวหนัง (skin absorption)

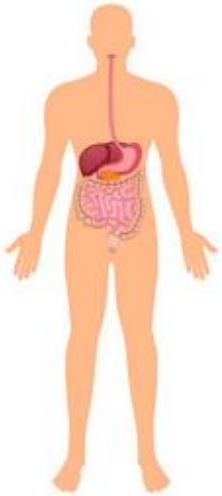

Sweat pore
Sebaceous gland
Hair shaft
Nerve
Arrector pili muscle
Epidermis
Touch receptor
Layer of fat
Sweat gland
Blood vessel
Hair follicle
Free nerve endings
Dermis

Skin absorption

- Small molecule essential oil soluble in fat→ Absorbed well through
- Skin → Blood stream→ Capillaries affect different parts of the body through the blood and lymphatic system.
- In addition, the dermal layer contains nerve patterns. and lymphatic vessels→ Essential oils that are touched can send messages to the brain just like inhaling them.
- For example, massage with 2% lavender can be detected in the bloodstream within 20 minutes and cleared in 90 minutes.
- The effect from inhalation is faster than absorption through the skin.

ฤทธิ์ของน้ำมันหอมระเหยต่อระบบต่างๆ ของร่างกาย

HUMAN BODY ORGAN SYSTEMS

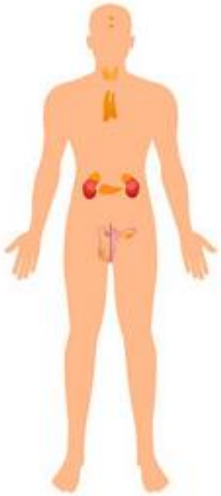


Digestive System

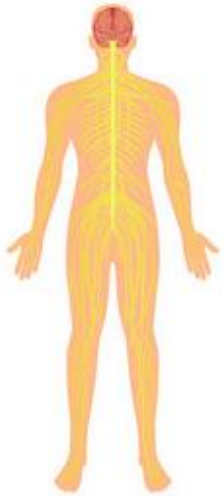
Muscular System

Integumentary System

Lymphatic System

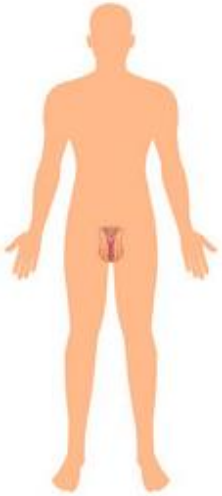


Endocrine System

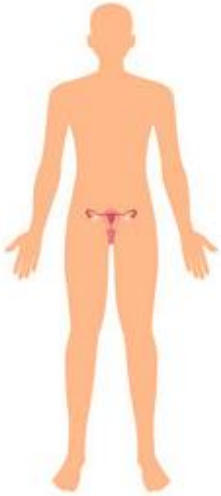


Nervous System

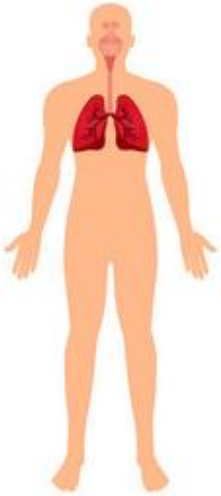
Skeletal system



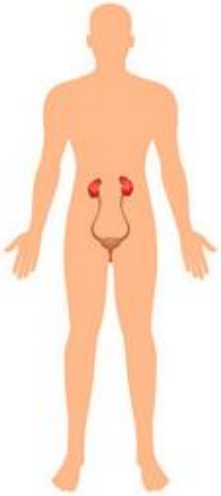
Male Reproductive System



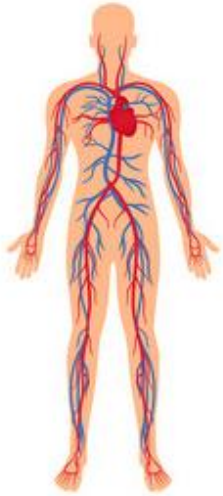
Female Reproductive System



Respiratory system



Urinary System



Circulatory system

Nervous system

- The nervous system is divided into two parts: the central nervous system and the peripheral nervous system.
- Essential oils have an effect on the peripheral nervous system (olfactory nerve) causing the transmission of signals to the brain (limbic system) by the olfactory mechanism. effect on memory emotions and feelings
- lower peripheral nervous system is the autonomic nervous system (Divided into sympathetic and parasympathetic) in which some essential oils may have a stimulating effect or some types may have a sedative effect on the autonomic nervous system.
- Most essential oils have a stimulating and relaxing effect on the nervous system. as well as controlling the equilibrium of other systems
- Essential oils are helpful, for example, in reducing stress. Nervous fatigue, calming, insomnia, anxiety, etc.

Nervous system

- Essential oils release Certain neurochemicals, such asเช่น
  - clary sage and grapefruit stimulate thalamus release enkephalins
  - jasmine and ylang ylang stimulate pituitary gland release endorphins
  - marjoram And Raphe nucleus release serotonin
  - Essential oils which are given through the skin Maybe with a massage. So it has a direct effect on the muscles. Helps to relax and reduce pain and directly affects the skin, such as increasing moisture Reduce skin sebum secretion Reduce allergies or irritation, kill germs, reduce inflammation, and slow down wrinkles, depending on the type.

Examples of essential oils that act on the nervous system

Active	Type of oil
Sedative	**Chamomile**, Melissa, Vetiver**, Lavender**, Clary sage, neroli, Petitgrain, Rose Wood, **Rose, Jasmine**, Marjoram
Stimulating	Cardamon, Fennel, Cinnamon, **Basil, Clove**, Anise, **Peppermint**, Pine, Thymol, Rosemary, Cajeput, **Camphor, Black pepper**
Balancing	Sandalwood, Bergamot, **Geranium**, **Cedar wood**

Cardiovascular system

- ปัญหาที่พบบ่อยในระบบไหลเวียนเลือด คือความดันโลหิตสูงและต่ำ กล้ามเนื้อหัวใจไม่แข็งแรง หรืออ่อนแอ
- น้ำมันหอมระเหยจะซึมลงผิว ผ่านไปยัง mucous membrane และเข้าสู่กระแสเลือดซึ่งอยู่ในระบบไหลเวียนเลือด
- น้ำมันหอมระเหยหลายชนิดมีผลกระตุ้นการไหลเวียนของโลหิต ทำให้หัวใจและสมองทำงานได้ดี และร่างกายขจัดของเสียออกทางไตได้มากขึ้น (การมีโลหิตไหลเวียนได้ดี ยังช่วยเสริมภูมิต้านทานแก่ร่างกาย)
- ในการใช้น้ำมันหอมระเหยให้มีผลโดยตรงต่อระบบนี้อาจทำโดยการนวดด้วยน้ำมันหอมระเหยที่มีฤทธิ์จำเพาะบนบริเวณหัวใจ หลัง และแช่อาบทั่วตัว

ตัวอย่างน้ำมันหอมระเหยที่ออกฤทธิ์ต่อระบบไหลเวียนเลือด

ฤทธิ์	ชนิดของน้ำมัน
Hypotensive (reduce high blood pressure)	**Lavender, Geranium**, Marjoram, Clay sage, Lemon, **Ylang ylang** **คนที่เป็นความดันโลหิตสูง**
Hypertensive (increase blood pressure)	**Rosemary, Camphor**, Thymol, Cumin คนที่เป็นคนดันโลหิตต่ำ
Rubefacient and Stimulating circulation	Benzoin, Cinnamon, **Black pepper**, Marjoram, **Ginger**, Nutmeg
Antispasmodic action on heart	**Rose**, **Orange,** Neroli

Lymphatic system

- It is a vascular system that helps transport substances back into the blood vessels. especially nutrients The fatty acids that are absorbed from the small intestine. The lymphatic system has no pumping organs to different parts of the body.
- The lymphatic system consists of lymph vessels, lymph
- Aromatherapy massage reduces edema in the cells. Maintain hormonal balance in the body And stimulates the elimination of toxins and waste from the body. which is the main cause of cellulite

Examples of essential oils that act on the lymphatic system

Active	Type of oil
Lymphatic stimulants	Fennel, **Geranium**, Juniper, **Rosemary**
Anti toxic agents	**Tea tree**, Thyme, **Pine,** Eucalyptus, Lemon

Immune system

- A system that protects our body from various foreign things such as various types of germs. Including other foreign things such as cells that are growing into cancer. receiving the wrong blood type allergens, etc.
- various unknown things It's what the body doesn't know yet, called Antigen.
- Many essential oils that stimulate the functioning of the immune system. Helps to resist foreign matter. Stimulates red blood cell formation and various antitoxins

Examples of essential oils that act on the immune system

Active	Type of oil
Promote WBC	**Jasmine**, Eucalyptus, Tea tree, **Chamomile**, Pine, Sandalwood, **Lavender**
Anti-bacteria and Anti-virus	**Camphor**, Clove, Eucalyptus, **Tea tree**, Cajuput, Neroli, Cinnamon, Rosemary, **Bergamot**, Basil, Pine

Integumentary system

- The outermost organ systems of the body are the skin and the organs from which it originates (nails, hair, and hair follicles). The sebaceous glands and sweat glands are among the largest organs of the body. It's an organ divider. With an area of about 1.5 square meters, it can synthesize vitamin D on its own.

- The main function of the skin is
  1. Protection body from environment
  2. Sensation
  3. Thermoregulation
  4. Control body Metabolism system

Examples of essential oils that act on the integumentary system

Active	Type of oil
Cicatrizing (healing wound)	**Lavender**, **Chamomile**, Geranium, Frankincense, Myrrh, Benzoin
Anti-inflammatory	**Chamomile, Lavender**, Myrrh
Anti-septic	Chamomile, Lavender, **Lemon**, Pine, Thyme, **Eucalyptus, Tea tree,** Clove, Cinnamon, **Bergamot**
Deodorant	**Bergamot**, Thyme, Juniper, Cypress, **Pine**, Tea tree, Peppermint, Lemongrass, **Citronella**

Reproductive system

- various hormonal changes to the body system
- Essential oils can be used to treat hormonal abnormalities such as premenstrual symptoms, stress, and back pain. Some types cause uterine contractions, so be careful. To use in pregnant women, such as rose, geranium, fennel.
- Essential oils help alleviate menopausal symptoms. menstrual cramps sexually transmitted infection arouse sexual feelings
- A massage with active oils on the abdomen, buttocks or a bath.

Examples of essential oils that act on the female reproductive system.

Active	Type of oil
Anti-microbial and antiseptic	**Bergamot**, Sandalwood, **Tea tree**, Chamomile, Myrrh, Benzoin, Cinnamon, Lavender
Emmenagogue	**Juniper**, Fennel, Parsley, **Neroli**, Caraway, Cypress, Marjoram
Aphrodisiac	**Jasmine, Ylang-ylang,** Neroli, **Rose,** Sandalwood, Patchouli, Clary-sage
Antispasmodic	Anise, **Basil, Peppermint**, Melisa, Marjoram, **Chamomile, Lavender, Rosemary**
Relief menopause symptom	Sage, **Geranium, Clary sage**, Fennel

Respiratory system

- Respiration is the process of exchanging oxygen and carbon dioxide. between environment and living things to be used in the metabolism of tissue cells consisting of
- Essential oil molecules It can penetrate into the alveoli and bloodstream.
- The properties of some essential oils kill germs. smooth muscle relaxants such as eucalyptus, tea tree
- Massage with essential oils on the back and chest

Examples of essential oils that act on the respiratory system

Active	Type of oil
Antiseptics	Cinnamon, **Tea tree, Eucalyptus,** Pine, Camphor, Clove, **Lemon,** Peppermint, Cajuput
Expectorant	**Eucalyptus,** Camphor, Pine, Rosemary, Lemon, Myrrh, Cajuput, Benzoin
Antispasmodic fox coughs	Clary sage, **Anise**, Cypress**, Frankincense**

Digestive system

- Digestive system consists of many organs such as mouth, esophagus, stomach, liver, pancreas, small intestine and large intestine, some organs are not digested but related to the gastrointestinal tract.
- Digestion is the process by which macromolecules of food are made. are smaller until they can be absorbed into the cells
- Some essential oils have a soothing effect on the smooth muscles in the digestive system. Helps reduce residual gas such as peppermint.
- Use of drinking water containing essential oils or a massage on the stomach and back

Examples of essential oils that act on the digestive system

Active	Type of oil
Antispasmodic	**Chamomile**, Caraway, Sage, **Peppermint, Anise**, Fennel, Cumin
Carminative	**Basil, Peppermint,** Fennel
Hepatic for liver congestion	**Rosemary, Peppermint**, Lemon, Lime
Stimulating the gall bladder	**Peppermint,** Caraway
Promoting appetite	**Peppermint, Basil, Anise,** Angelica
Mild laxative	Fennel, Camphor, **Peppermint, Black pepper,** Marjoram, Rosemary

Musculoskeletal system

- The musculoskeletal system is the system responsible for the movement of the body. The movement of internal organs such as heartbeat, compression of blood vessels, compression of the stomach, intestines, and lung function, etc.
- All muscles in the body have Approximately 2/5 of the body weight is mostly on the circumference of the arms and legs.
- Massages and baths combined with essential oils cause the muscles to contract and release lactic acid and uric acid residues such as rosemary, black pepper, ginger.

Examples of essential oils that act on muscles

Active	Type of oils
Relief muscle aches	**Lavender**, Rosemary, **Black pepper**, Marjoram
Joint stiffness	**German chamomile**, Rosemary, Juniper, Fennel

Conclusion

- Essential oils are complex chemical compounds in living organisms. In one essential oil contains many chemicals. When can be subdivided into 12 types: Monoterpenes, Sesquiterpenes, Diterpene, Phenol, Aldehydes, Ketone, Esters, Lactones, Coumarins, Ethers, Oxides, Alcohols and Acids.
- The proportions of chemicals found in essential oils cause essential oils to have different pharmacological effects on the body, such as stimulating the immune system, anti-inflammatory, antiseptic, etc.
- There are three ways to bring essential oils into the body: inhalation through the nose. Permeation through the skin and eating, each of which affects the mechanism of action on the body differently.

Conclusion

- Inhaling through the nose will have the fastest effect on the body. through the control of the functions of the limbic brain to stimulate the functioning of different parts of the brain To secrete neurotransmitters such as Dopamine, Endophins, Serotonin, which have an effect on controlling the body's functions. followed by Permeation through the skin and ingestion, essential oils will be excreted from the body within 48 hours depending on the type of essential oil.
- The effect of essential oils affects the functioning of various systems. of the body are different This may result in both in a way that stimulates work. work inhibition and balancing the functions of various systems in the body