

Smells –unconscious component in our behavior



Pizza-smell is added to the air conditioning of shopping malls to put you in the mood to visit the restaurants. “Ok, sweetheart, you look bored. Let’s have a bite before we continue.”

The “new car “ smell is used just before you take a test ride in a used car dealership. You feel much better than in your old warthog that smells like food and burnt oil.



Cake-baking aroma is spread in the kitchen of a house by the real estate agent or owner who wants to sell it

Perfume is used by guys & girls to draw attention or suggest a highly cultivated lifestyle.



Garden stores can smell like fertilizer or like flowers. Which one will sell better?

Hospitals & waiting rooms can have the aseptic smell of carbolic acid or the distracting smell of flowers. A female perfume would be really irritating!



Smells –unconscious component in our behavior

Odor greatly affects our evaluation of things and people. Only 20 % of the perfume industries income comes from perfuming humans, 80 % comes from ‘perfuming’ the things of our daily life.

Anosmia or the loss of the ability to smell leads to depression and a life where you recognize your food just by the taste alone; salty, bitter, hot , cold, sweet. Also your sex drive disappears. What? ... Already the ancient Greeks “healed” sex offenders by cutting off their
Noses! Why are the noses of many ancient statues broken. Do they all represent **sex offenders**? Oh my .



Super Smellers. can smell “cyanide” - a non volatile salt in extreme dilution (my boss at Penn State). Can smell a weather changing to a storm and GKW (God knows what). They may be as good as dogs or pigs and resemble the abilities of our hunted ancestors.

Which flowers have which Odor

Wind-pollinated flowers do not need odor, neither do **bird-pollinated flowers** that often have red petal color invisible to bees

Smell of excrements & decay: Indol & Skatol
in Aristolochia, Rafflesia to attract dung beetles & flies

Fishy & stinky odor: Trimethylamine in
Craetegus hawthorn, Spiraea meadowsweet, some
Sambucus elderberry, Sorbus ash, Simferic. snowball

Freshly mowed hay: Coumarins
in *Galium odorata* wood, Vanilla leaf *Achlis triphyll*

Vanilla smell: Vanillin in Heliotrope, in sev. orchids

Benzoic smell: eugenol, geraniol in carnations & roses

Terpenoid odors: essential oils in Lavender, lemonene
in citrus flowers, lemon grass, thyme, menthol in mints

Not all bee odors perceived by humans: odor of wild vine Vitis



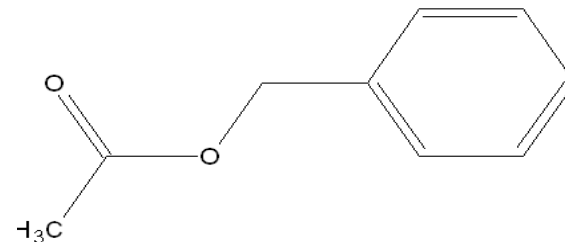
Benzyl acetate – the smell of Jasmine is an ester?

Benzyl acetate is an ester that is found naturally in many flowers. It has a pleasant sweet aroma reminiscent of jasmine & is the **primary constituent of the essential oils from the flowers jasmine, ylang-ylang and tobira.**

Jasminum is a genus of shrubs in the olive family (*Oleaceae*), native to warm regions.

Ylang or *Cananga odorata* is a fast-growing tree that attains an average height of 12 m. The evergreen leaves are smooth and glossy, the flower is drooping, long-stalked, with six narrow greenish yellow like a sea star in appearance, and yields a highly fragrant essential oil.

Tobira *Pittospermum* is a beautiful broadleafed evergreen shrub & can reach up to 15 feet. It has pleasant sweet aroma reminiscent of *jasmine*.



Jasmine



Ylang



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Benzyl acetate is also used as a **solvent in plastics and resin, cellulose acetate, nitrate, oils, lacquers, polishes and inks**

Chenopodium vulvaria – the stinking goosefoot

The name come from *vulvarius* = *having a foul smell*.

The smell is fishy - ????

→ This tells us that this plant uses which volatile to attract its perverted pollinators??

→ Your input :

Digitalis purpurea extract is used for the treatment of heart conditions as first by **William Withering, 1785**.

It **increases cardiac contractility** and as an **antiarrhythmic agent** to control atrial fibrillation.



The smell of Pelargonium = geraniums scaring flies

Pelargoniums (geraniums) are perennials of African origin that have a particular smell. Europe's women often kept window boxes of Pelargoniums since they repel flies.

*Species such as **Pelargonium graveolens** are important in the perfume industry and are cultivated and distilled for its scent. Although scented Pelargonium exist which have smells of citrus, mint, or various fruits, the varieties with rose scents are commercially important. Pelargonium distillates are commonly known as "scented geranium oil" are sometimes used to adulterate expensive rose oils.*



Pelargonium zonale



*Stalked glands =
glandular hairs =
trichomes of P. zonale leaf*

Many other plants have stalked glands, most famously Cannabis, hops, but also often roses (below flower), butterwort, Drosera, Silene catch flies, mints, etc.

What is an essential oil?

An essential oil is a **mixture of a few to hundreds of volatile terpenoids**. Oil of wintergreen is sold as an essential oil but it is an ester and consists to 99 % of methyl salicylate. If an essential oils sit for a long time they will turn into **resins** (amber is such a resin containing pinene from ancient conifers).

Most common monoterpenoids:

pinene in essential oils like black pepper, juniper & pine

limonene in essential oils like citrus, lemon, ylang, fennel, black pepper

camphene in essential oils like juniper, pine, camphor,

borneol in essential oils of lavender & rosemary

geraniol in essential oils of Geranium, rose,

menthol in essential oils of peppermint and other lamiaceae

myrtenol in essential oils of myrtle, sweet cicely & geranium

Most common sesquiterpenoids:

chamazulene in essential oils of German or Roman chamomile

Most common diterpenoids:

lavicol in essential oils of sage, **Citral** in lemon grass



Essential oils also can contain phenols:

anethole in fennel,

eugenol in cloves,

thymol in thyme & oregano

What the smell of Essential Oils reveals about the ingredients

An essential oil is a mixture of many terpenes plus other volatile substances turn into gas molecules at room temperature & are easily distilled

Aniseed *Pimpinella anisum*, **fennel** = trans anethole (75-90 %)
Basil *Ocimum basilicum* = linalol (50%), methyl chavicol (25%) etc.
Bay laurel *Laurus nobilis* = cineol (40 %), pinene, linalol, methyl eugenol
Benzoin *Styrax benzoin* = coniferyl cinnamate, benzoate, cinnamic acid
Calamus *Acorus calamus* = beta-asarone (80 %), oral toxin
Camphor *Cinnamomum camphora* = cineole (75-95 %), pinene,
Caraway *Carum carvi* = carvone (60 %), limonene (40%)
cinnamon *Cinnamomum zeylandicum* = eugenol 95%
Wormwood *Artemisia absinthium* = 71 % thujone, azulene, terpenes
Ylang-ylang *Cananga odorata* = methyl & acetyl benzoate, methyl salicylate, eugenol, geraniol, linalol, terpenes: pinene, cadimene

Some essential oils are not oils at all

esters “oil of Wintergreen” *Gaultheria procumbens* = methyl salicylate 98 %
oil of tonka beans *Dipteryx odorata* = 99 % coumarins = phenolic compounds
garlic *Allium sativum* = allicin, allyl propyl disulphide, citral, linalol

Chemical Dictionary of Aromas

Allspice *Pimenta dioica* has up to 80 % = **Eugenol.**

Almond *Prunus dulcis*: has 95 % = **Benzaldehyde**

Aniseed *Pimpinella anisum* has up to 90 % = **trans-Anethole**

Sweet Basil *Ocimum basilicum* has 85 % = **methyl-chavicol**

Camphor tree *Cinnamomum c.* has 90 % = **Cineole**

Caraway *Carum carvi* has 60 % = **Carvone**

Cassia *Cinnamomum cassia* has 90 % = **cinnamic aldehyde**

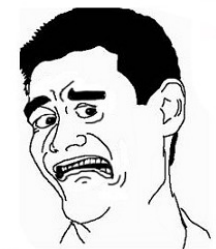
Celery *Apium graveolens*: has 60 % = **Limonene**

Cove *Szygium arom.* has up to 90 % = **Eugenol**

Coriander *Coriandrum sat* has up to 75 % = **Linalol**

Eucalyptus *Euc. globulus*: has 80 % = **Cineole**

After Lawless Julia "The Encyclopedia of Essential oils. Barnes & Nobles 1983



THEN I SMELL HER PERFUME
????????????????



NOT BAD

Chemical Dictionary of Aromas

Fennel *Foeniculum vulgare* has 60 % = **anethole**

Gardenia *Gardenia jasmonoides* : has 95 % = **Benzyl acetate**

Grapefruit *Citrus X paradisi* has 90 % = **limonene**

Horseradish *Armoracia rustic.* has 75 % **Allyl- isothiocyanate**

Jasmine *Jasmiun officinale* has 60 % = **Benzyl Acetate**

Lavender *Lavendula angustif.* has 50 % = **Linalyl Acetate**

Lemon *Citrus lemon* has 70 % = **limonene**

Lemongrass *Cymbopogon citratus* has 80 % = **Citral**

Peppermint *Mentha piperita.* has up to 50 % = **Menthol**

Spearmint *Mentha spicata* has up to 70 % = **L-Carvone**

Mugwort *Artemisia vulgaris* has 50 % = **Thujone**



Chemical Dictionary of Aromas

Onion *Allium cepa* has 60 % **Dipropyl disulfide**

Oakmoss lichen *Evernia prunastri* : has 80 % = **Evernic acid**

Parsley *Petroselinum* has 70 % = **Apiol**

Scotch Pine *Pinus sylvestris* has 75 % = **Pinene**

Rosemary *Rosmarinus officinalis* has 60 % = **Pinene**

Sage *Salvia officinalis* has 45% = **Thujone**

Sandalwood *Santalum album* has 90 % = **Santalol**

Sassafras *S. officinale* has 90 % = **Saffrole**

Tansy *Tanacetum vulg.* has up to 80 % = **Thujone**

Thuja *plicata* has up to 60 % = **Thujone**

Tonka *Dipteryx odorata* has 40 % = **Coumarine**

Vanilla *Vanilla planifolia* has 3% = **Vanillin**



Where do the Essential Oils & Fragrance Oils come from?

Barks: Commonly used barks are cinnamon and cascarilla and also sassafras root bark.

Flowers and blossoms: These are the largest source of aromatic oils. Rose, jasmine, osmanthus, mimosa, tuberose and blossom of citrus and ylang-ylang trees are commonly used in fragrance industry.

Fruits: Fresh fruits like apples, strawberries, and cherries do not yield odors well and usually are obtained synthetically. Exceptions include litsea cubeba, vanilla, and juniper berry and the most commonly used oranges, limes and grapefruit.

Leaves and twigs: Commonly used are lavender leaf, patchouli, sage, violets, rosemary, and citrus leaves.

Resins: Commonly used resins in perfumery are labdanum, frankincense, myrrh, Peru balsam, gum benzoin and also pine and fir.

Roots, rhizomes and bulbs: Iris rhizomes, vetiver roots are very often used for perfumes.

Seeds: Tonka bean, coriander, caraway, nutmeg, mace, cardamom and anise.

Woods: Very important in providing base notes. Commonly used woods include sandalwood, rosewood, agarwood, birch, cedar, juniper and pine.

Ambergris: Commonly called "amber" is obtained from Sperm Whale.

Castoreum: Obtained from the odorous sacs of the North American beaver.

Civet: Obtained from the odorous sacs of the civets (family of Mongoose).

Honeycomb: Distilled from the honeycomb of the Honeybee.

Musk: Originally obtained from the musk odorous sacs from Asian musk deer, but now replaced by synthetic musk.

Lichens: Lichen is a sort of fungus growing in patches on the trees and rocks. Commonly used lichens are oakmoss and treemoss thalli.

Protists: Seaweed is commonly used as an essential oil in perfumes.

Synthetic sources: Created through organic synthesis from petroleum distillates or pine resins. They can provide scents which are not found in nature. Synthetic scents are often used as an alternative source of compounds that are not easily obtained from natural sources. Typical examples include musk, orchid scents, linalool and coumarin.

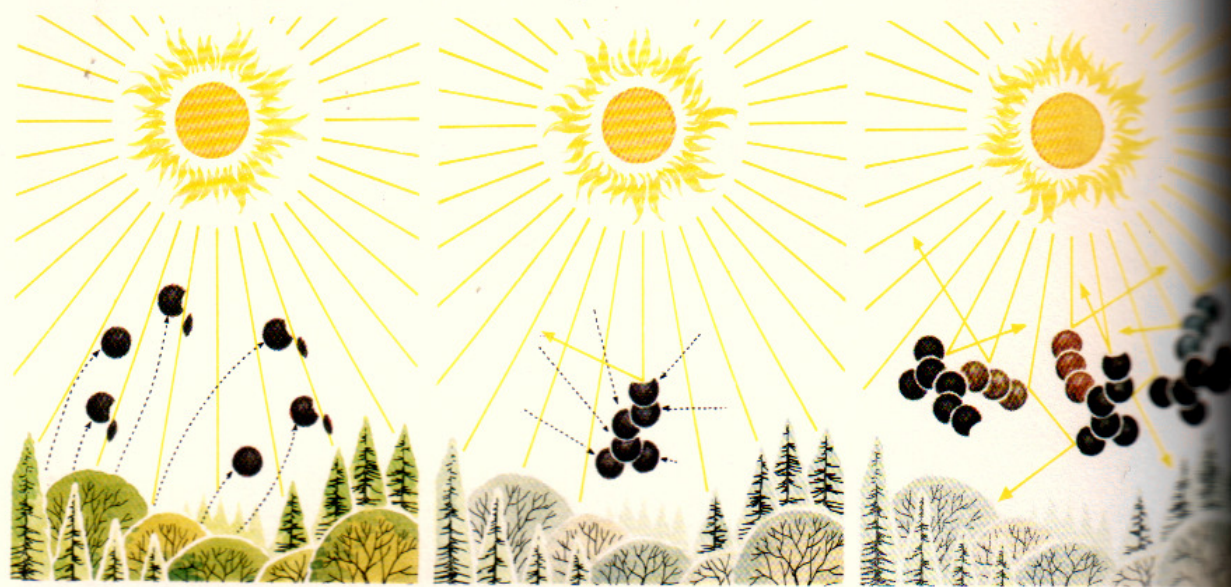
Terpenes and air pollution

It is generally accepted that the forests (called “lungs of the planet”) clean the air of pollution, add oxygen & remove CO² to restore an air that is pleasant to breath. The opposite would be the smoky & stinky air of industrial places and cities. However, there is an exception to this rule as observed from the forests of the “ Smoky Mountains”.

Exception

The production of volatile terpenes is highest in the early fall.

The terpenes are exuded through the stomates & often polymerize under the influence of the UV of the sun, **creating the blue haze the Smokies are famous for.**



The Great Smoky Haze: a Brew of Sunlight and Greenery

The haze that lies almost constantly over the Smokies has its origin in the forested hillsides. Trees exude terpenes, which are hydrocarbon molecules derived from their essential oils. Sunlight breaks the molecules down.

The fragmented molecules interact and form new and larger molecules, which begin to refract, or bend, the sun's rays. Terpene production—and therefore haze—is particularly heavy in fall as the leaves begin to decay.

The larger molecules then aggregate with each other, and with molecules of various forms of pollution (different colors absorb different wavelengths of light). The sunlight able to penetrate without refraction is now limited—and the “smoke” is thick.

Essential = Fragrant Oils are healing mind & body

Aromatic plants are easily recognized & are used by animals and people for millions of years. They were soon **part of rituals**: juniper sprigs are burnt in Tibetan Temples, frankincense in Roman Catholic Church, Gum Benzoin in Greek & Russian Orthodox Church.

Essential oils are the **key components for aroma, taste and flavor** *in perfumes, spices, & condiments*.

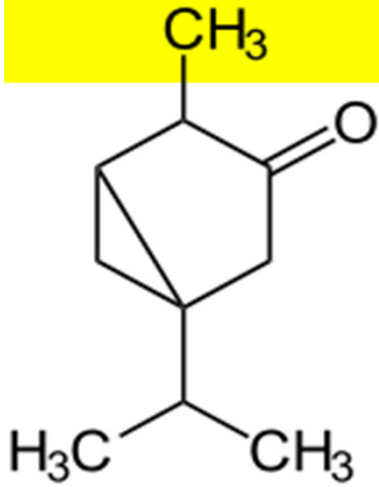
Essential (**misleading term** = not like essential amino acids or fatty acids; i.e. a substance we absolutely require for health but cannot produce) from the distilled alchemical essence of plants), **volatile, fragrant oils**. **Lipophilic substances** taken up through nose & skin **with twofold action: psychological and physiological effects**.
➔ **Aromatherapy is healing mind & body** : fragrant oils provide more than aroma

Essential oils are **products of steam distillation, mechanical processing of citrus rinds or dry distillation of natural materials**. Essential oils are physically separated from the water phase.

Aromatherapy: established by **Rene-Maurice Gattefosse** in 1920s, popularized by Dr. **Jean Valnet 1964** with strong reductionist emphasis on pharmacological ingredients, **1978 Paul Belaiche** ➔ 3 volumes on Clinical Use of Aromatherapy for infections etc. : **oils for medicinal use must be genuine** (= unchanged) **& authentic** (from one plant)

Julia Lawless (1992) The encyclopedia of essential oils. Barnes & Noble Books N.Y.
Roszak, Theodore (1994) Eco-psychology – voice of the earth. Stuttgart

Toxic essential oils



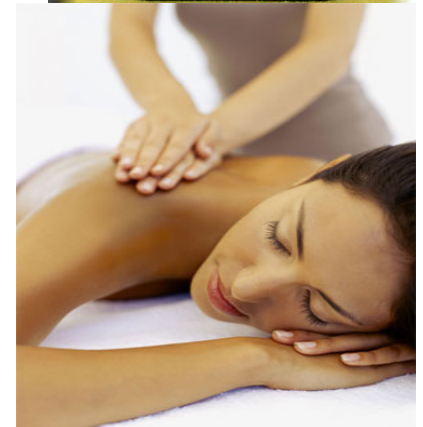
thujone

Because of their concentrated nature, essential oils should **not** be applied directly to the skin in their undiluted or "neat" form. Instead, essential oils should be diluted with a "carrier" oil to about 0.5–3% before being applied. **Common carrier oils include olive, almond, hazelnut and grapeseed** Some essential oils like citrus oils, are photosensitizers. Others contain high amounts of thujone – a nerve toxin.

Thujone & pulegone from Thuja, juniper, cedar, sage, tansy, artemisia, *Artemisia absinthium* → **neurotoxins**

Safrole from sassafras oil, **myristicin** from nutmeg oil, **asarone** from Asarum species (wild ginger) & Acorus calamus, **methyl-eugenol** from aniseed → **carcinogens**

A- and b-asarone from cultivars of *Acorus calamus* & *Guatteria gaumeri* and **safrole** (major constituent of *Sassafras albidum* & *Oceotea pretiosa*) have already been banned (only tiny doses are permitted in foods) due to demonstrated carcinogenic effects in laboratory animals.



Antibacterial effects of Fragrant Oils

As Gattefosse demonstrated already during WWI: Fragrant oils are antibiotics as strong as penicillin – a remedy developed during WW II.

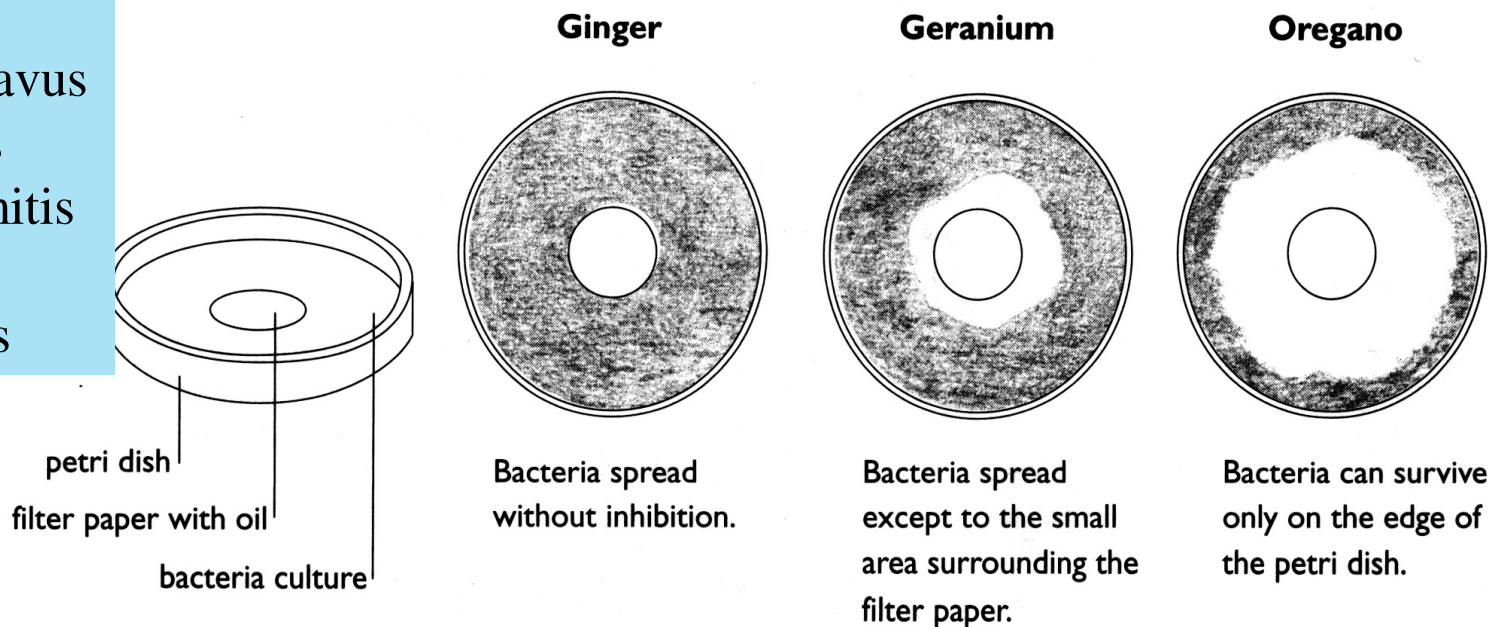
Geraniol: effective against Candida yeast

Thymol: knocks out Micrococcus flavus Staphylococcus aureus, epidermitis E. coli, Bacillus subtilis

Geraniol, thymol & many other ingredients are found in thyme oil etc.

The aromatogram gives us a graphic depiction of the effectiveness of essential oils: the bacteria-free area around the drops of oregano oil shows its effectiveness against a specific bacterium.

aromatogram



Paul Belaiche (1978) Phytotherapie et d'Aromatherapie (3 volumes). Paris

Antimicrobial effects of Fragrant Oils

Bactericidal components in essential oils:

Monoterpenes in oils of Tea tree, Niaouli, Eucalyptus radiata, Ravensare aromatica

Phenols in oils of Thyme, Oregano, Mountain savory

Fungicidal components in essential oils:

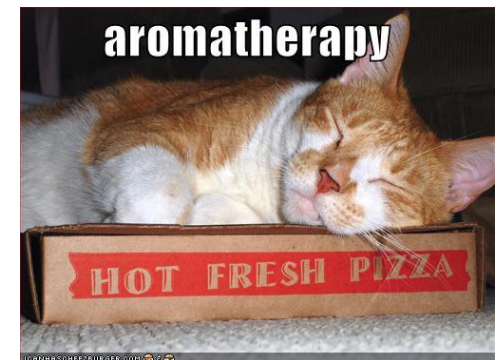
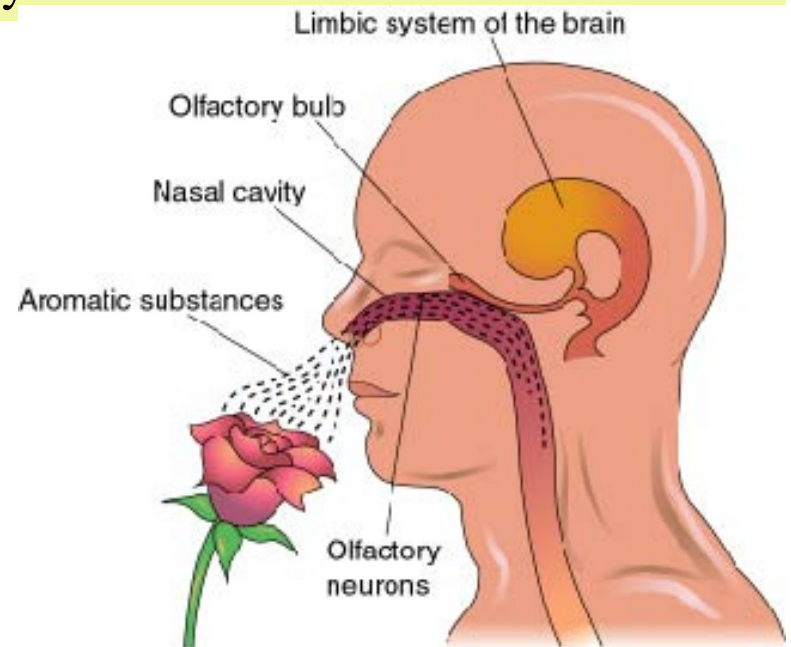
Esters in oils of Lavender, Roman chamomile, Geranium, aldehyde from Cinnamon

Mucolytic components in essential oils:

Ketones in oils of Eucalyptus dives, Rosemary,
Lactones in Inula graveolens

brochodilatory components in essential oils:

Terpenes in oils of Pine, Cypress, Hazelnut ,
rubbed on chest for relieve



Paul Belaiche (1978) Phytotherapie et d'Aromatherapie (3 volumes). Paris

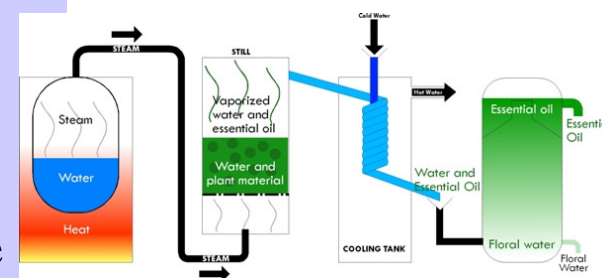
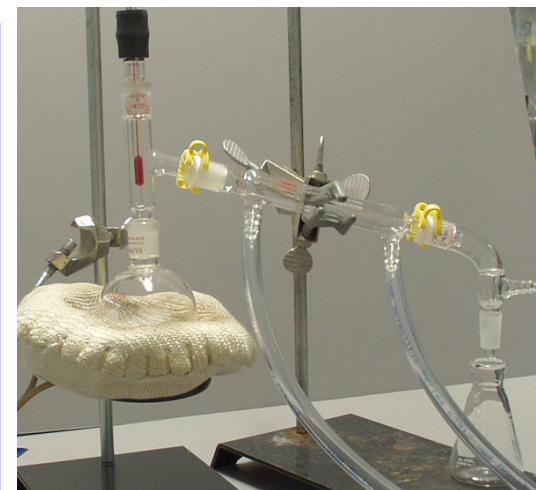
How to get essential oils?

Distillation: Common essential oils, such as lavender, peppermint, eucalyptus, are distilled. Raw plant material, consisting of the flowers, leaves, wood, bark, roots, seeds, or peel, is put into a distillation apparatus over water. The steam passes through the plant material, vaporizing the volatile compounds. The vapors flow through a cooled coil where they condense back to liquid, collected in the receiving vessel.

Most oils are distilled in a single process. The recondensed water is referred to as a **hydrosol**, hydrolat, herbal distillate or plant water essence.

Popular hydrosols are rose water, lemon balm, clary sage.

The use of herbal distillates in cosmetics is increasing. Some plant hydrosols have unpleasant smells & are not sold.



Expression: Most citrus peel oils are expressed mechanically. Lemon or sweet orange oils that are obtained as by-products of the citrus industry are even cheap. Prior to the discovery of distillation all essential oils were extracted by pressing.



Simple distillation methods

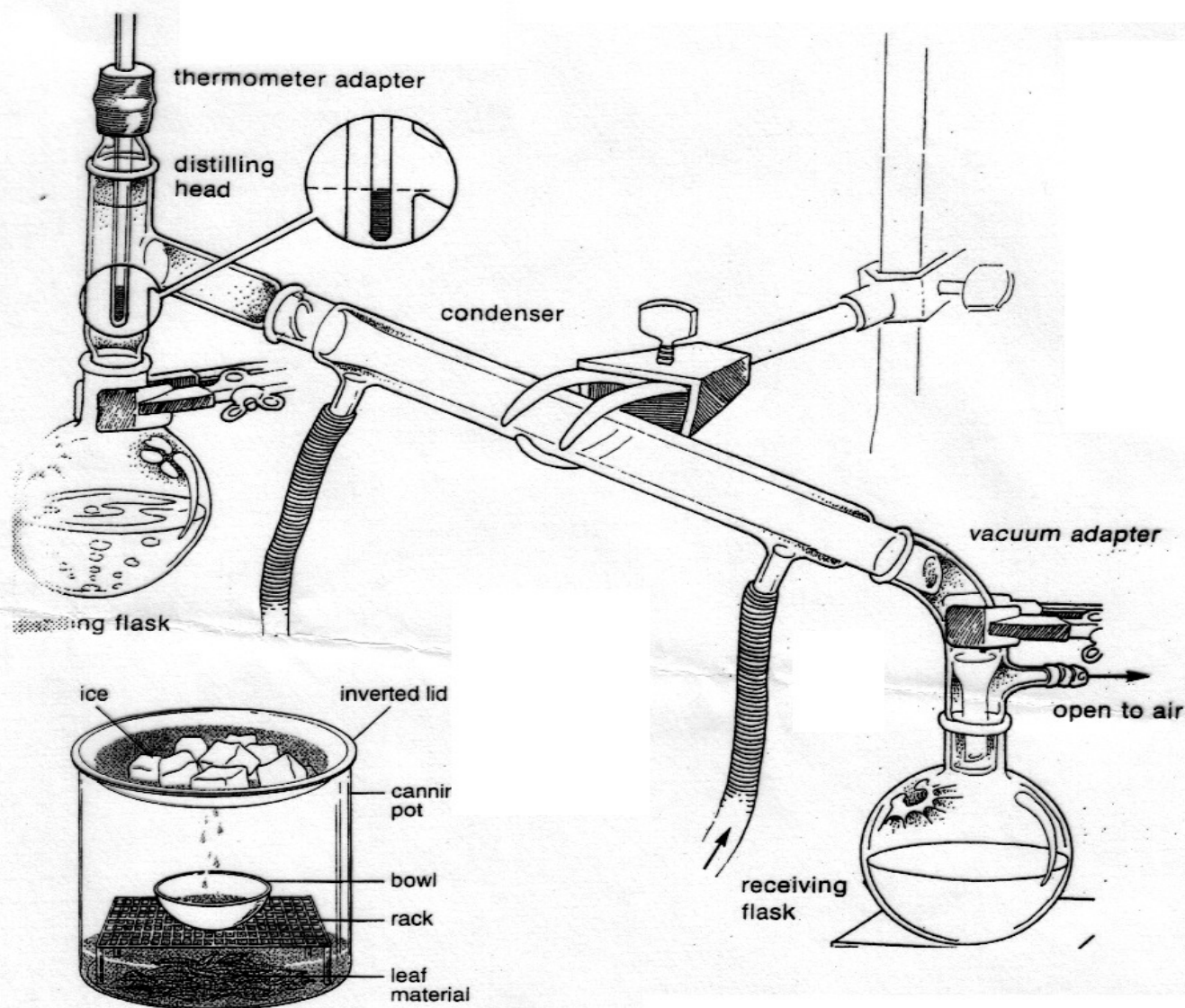
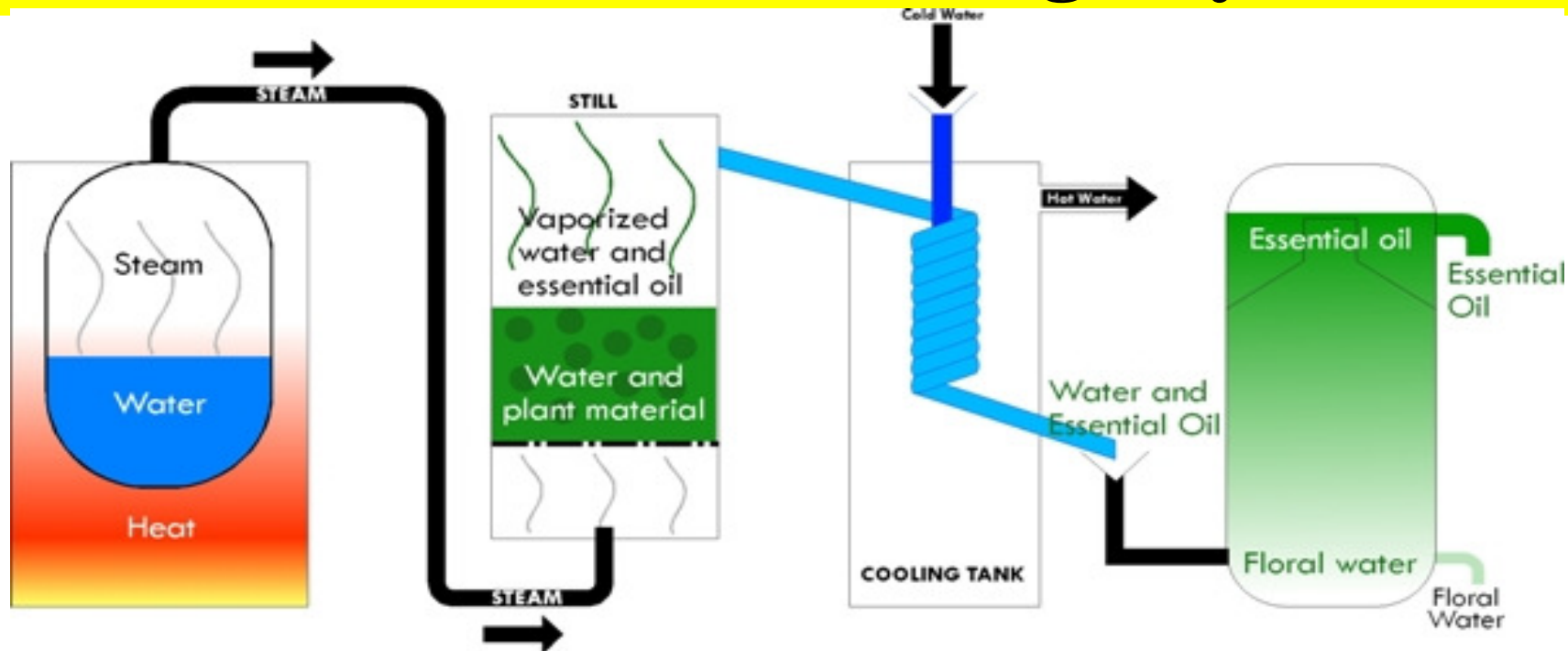


FIGURE 24.17 A simple apparatus for distilling mint oil. See text.

How Steam Distillation gets you the oil!



Pressurized steam is generated in a separate chamber from which it is circulated into a still (a separate chamber) which contains water and plant materials. The hot steam causes the walls of cells in the plant that store the essential oil to open and to release the oil. The released essential oil evaporates and is carried by the steam into a condensation chamber (cooling tank) where steam cools. **Steam condenses into water and the essential oils floats on the surface of it. The pure essential oil is skimmed off the water while the remaining water is called floral water or hydrosol & can be used for various purposes.**

History of Distillation

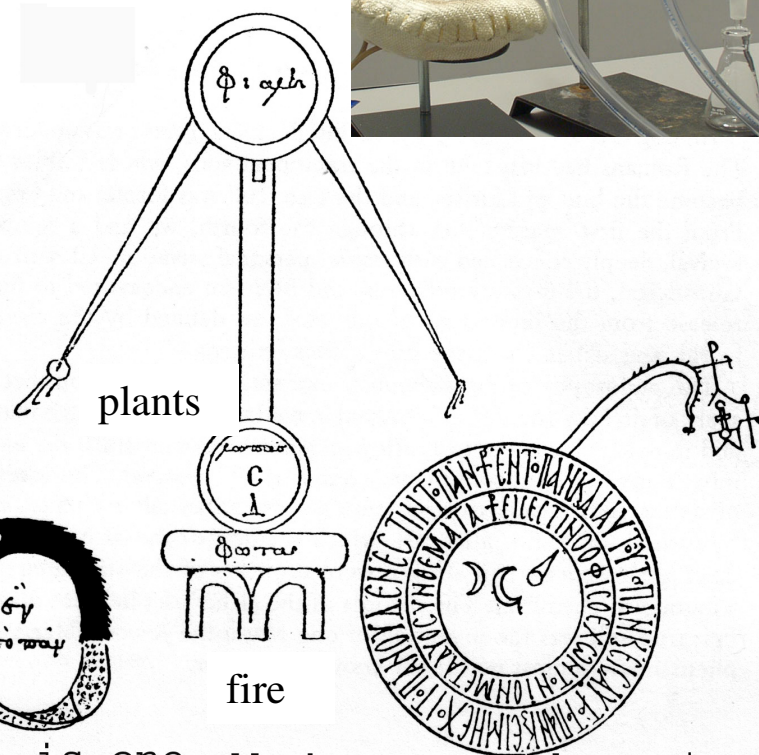
Egyptian craftsmen, metallurgist, jewelry makers, electricians, glass workers & ceramic artists were **far ahead of their time**. Inspired the Alchemists, who followed conviction that **a spark of divinity can be extracted from any matter**. By heating minerals and plants in waterstills they extracted the essence (hence essential oils) or spirit (pneuma).

The first true still was invented by woman **Maria Prophetissima** the Jewess to make perfumes. Perfume oils easily separate from water as they evaporate & then condense at the cool glass head.

However, she & later the Arabs never succeeded separating ethanol from water to make liquors (Cooling to be improved)

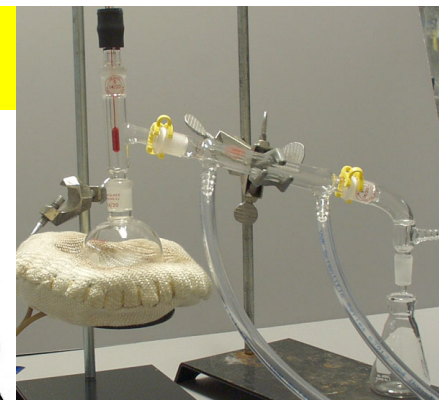
Yakub al-Kindi 803-70 “The book of Perfume Chemistry & Distillation”

Water-filled glass sphere



all is one all phenomena tend to unity
The first representation of a still, from The Gold-Making of Cleopatra, an Alexandrian text of the first or second century of our era. The text credits the invention of this, the perfumer's tool par excellence, to one Maria Prophetissima, or Maria the Jewess. Although unusual in having two lead-off ducts instead of the one conventional goose-neck, we are in the unmistakable presence of a true still, with the heat source below, the flask for the matrix, the glass condensing head (called the phiale, in Greek) and the two tubes with the condensate coming out. Underneath, the cosmic serpent grasps his tail with the alchemical creed "All is one," inscribed within; the circle on the left announces that "It is towards oneness that all phenomena tend."

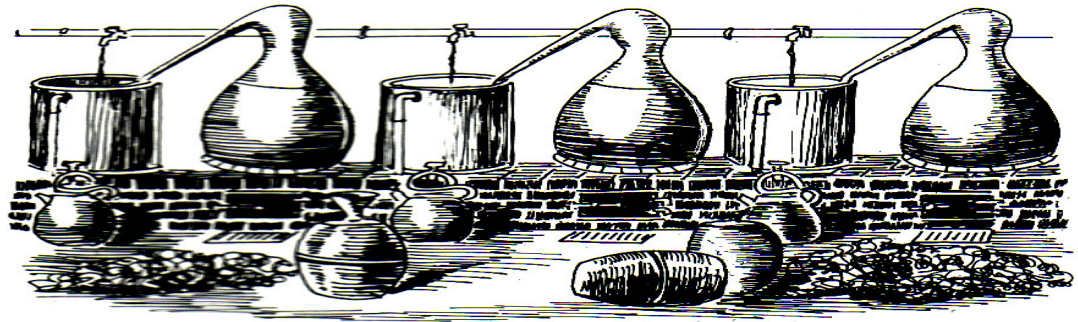
from Cleopatra to Chanel. Scribner's Sons, NY



Three methods of extraction for essential oils

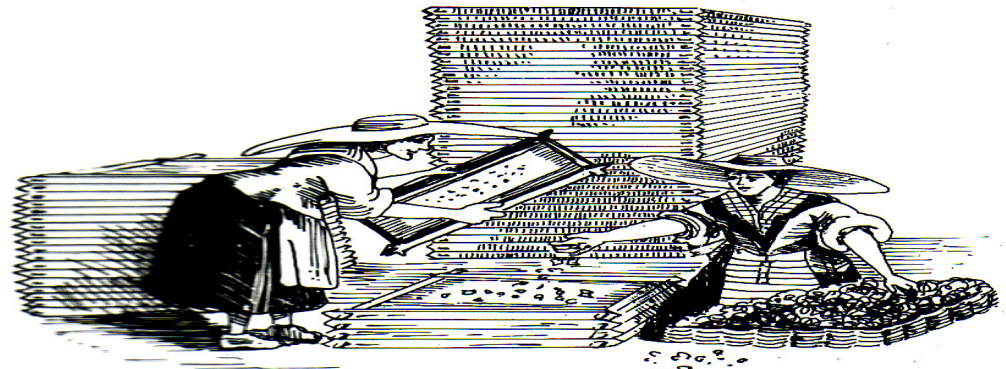
Figure 9.41 Capturing the essential oils of flowers by different techniques. From top to bottom: distillation, enfleurage, and maceration. Redrawn from *The Art of Perfumery* by C. H. Piesse, 1891.

distillation



enfleurage

Essential oils are
extracted by a layer of
animal fat



maceration



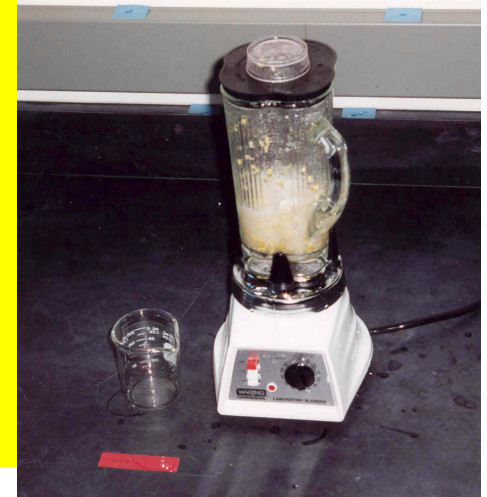
Maceration technique of flowers for perfume

Maceration is extraction by means of soaking in a fluid. *It* is similar to *enfleurage* except that warmed fats are used to soak up the flower smell. The grease and fats are dissolved in alcohol to obtain the essential oils.

1. Pick fresh and fragrant flowers like jasmine, roses, lily of the valley,
2. Remove green parts. Put flowers in glass container and add just enough olive oil to cover them since with time flowers will sink down.
3. After 24 h most flowers have surrendered their essential oils to the oil.
4. Decant or strain the oil testing for the flowery smell. If too weak repeat process until satisfied.
5. **Now you have your own perfume oil.**
6. This oil can be **preserved** by adding benzoic acid as tincture of benzoin (4 drops per each ounce of perfume oil)



Flower maceration
maceration of fruits

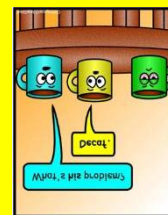


Extraction

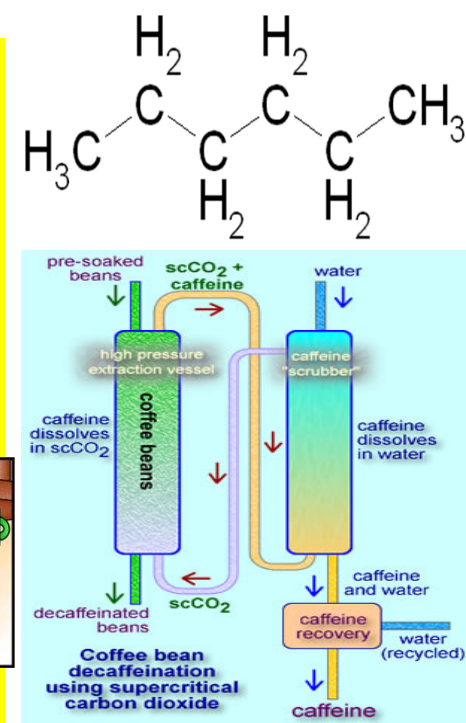
Most flowers contain too little volatile oil to undergo expression. Their chemical components are too easily denatured by the high heat used in steam distillation. Instead, a solvent **such as hexane** or supercritical carbon dioxide is used to extract the oils.

Extracts are called **concretes**, which is a mixture of essential oil, waxes, resins, and other lipophilic plant material. Although highly fragrant, concretes contain large quantities of non-fragrant waxes and resins. Another solvent, **ethyl alcohol**, only dissolves low-molecular weight fragrances. It can be used to extract the fragrant oil from the concrete. When alcohol is removed by second distillation, we get **the absolute**.

Supercritical carbon dioxide is used as the solvent in supercritical fluid extraction. This method avoids petrochemical residues in the product and the loss of some “top notes” compared with steam distillation. The lower temperature process prevents the decomposition and denaturing of compounds. It will extract both the waxes and the essential oils that make up the concrete. When the extraction is complete, the pressure is reduced to ambient and the **carbon dioxide reverts back to a gas, leaving no residue**.



Supercritical carbon dioxide also used for decaffeinateing coffee!



The chemistry of smellable molecules → volatility?

The chemical categories to which most odoriferous substances belong are:

- | | |
|--------------------------------------|---|
| 1. Terpenes (= isoprenoides): | e.g. Menthol, lemonene, thymol |
| 2. Phenoles | e.g. Coumarin, vanillin, heliotropin |
| 3. Sulfuric compounds: | e.g. Allyl isothiocyanate = volatile mustard oil |
| 4. Amines | e.g. Methylamine (dead fish) |
| 5. Aldehydes | e.g. Acetaldehyde (ripe fruits)
benzaldehyde (bitter almond) |
| 6. Esters & Lactones (cyclic esters) | e.g. Allyl amyl glycolate (pineapple) |



1. We smell only short molecules, large ones are no longer volatile and hence not odorous.
2. If molecule is very short, short is also its endurance, it will be a top note like e.g. dimethyl sulfide CSC – the transient smell of truffles
3. If a molecules carry a large net charges they will stick to each other and form hydrogen bonds. This prevents volatility.
4. Most olfactory molecules are made of C, H, O, N, S

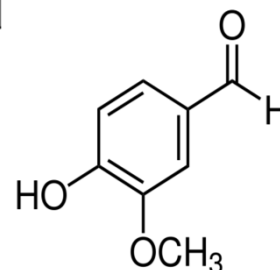
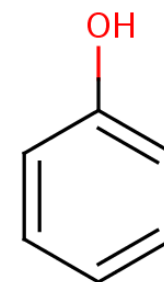
Phenolic Volatiles

Phenol: 1865 Joseph Lister used phenol to kill bacteria during surgery. Phenol is throat-irritant & unpleasant to smell. Today disinfectants are lemon-based, Jeyes' fluid & Wright's coal tar soap, similar smell is found in guaiacol

Vanillin: from orchid seed pods (correct capsules) of *Vanilla planifolia*. **1874** Fred Tiemann & Wilhelm Haarmann (Holzminden) extracted vanillin from wood **1876** synthesized vanillin from guaiacol + chloroform. Natural extract is better (more phenolic) for perfumes.

Heliotropin: also known as piperonal 1869 synthesized resembles wonderful smell of heliotrope flowers. Extract better (more phenolic) for perfumes.

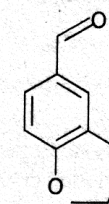
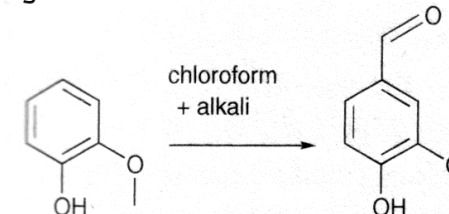
mandelonitrile: is a cyanoglycoside that falls apart → to hydrogen cyanide & **benzaldehyde** (both smell of bitter almonds). Bitter almonds are rare today but sweet ones do neither have taste of marzipan nor aroma of Amaretto – an Ital. liqueur made from apricot or almond pits.



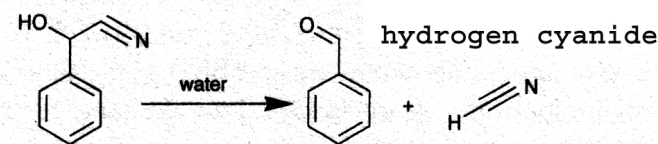
guaiacol

==>

vanillin



heliotropin



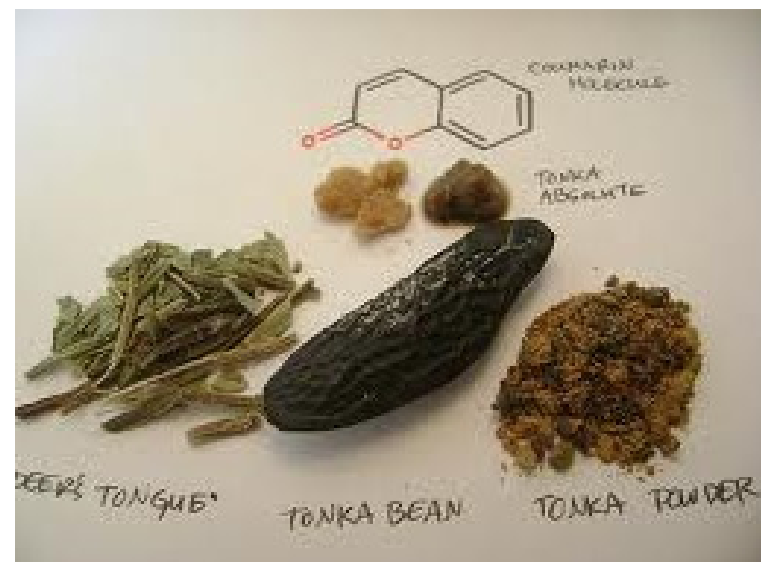
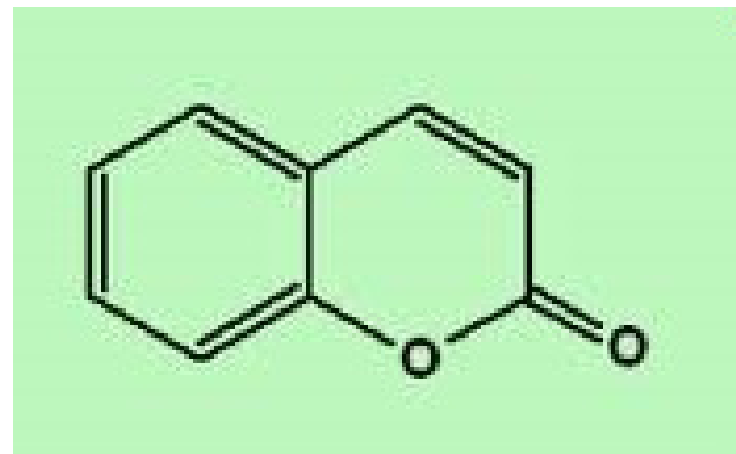
mandelonitrile

benzaldehyde

Phenolics → Coumarins

Characterized by the lactone double ring, volatile with smell of mawn hay, reduces capillary permeability & edemic swelling

Sources: *Apium graveolens* (celery seeds radix), leaves, *Angelica*, *Gallium odorata* = woodruff
Melilotus officinalis (sweet clover)
Achlys triphyllum Vanilla leaf Tonka beans
Liatis odoratissima = deer tongue



The secrets of Scents - coumarin

1881 perfume **Fougere's "Royal"** was created with freshly available synthetic coumarin with a hay-like smell. Coumarins can be extracted from tonka beans. The **tonka bean** is the seed of *Dipteryx odorata*, a legume tree.

The seed is black and wrinkled in appearance with a great fragrance, which is reminiscent of vanilla, almonds, cinnamon, and cloves: a once suggested substitute for vanilla used in perfume and was commonly used in tobacco.

Seed contains coumarin which can be lethal in large doses.

Coumarines can be extracted by water from these beans
They can be used for perfumes not for consumption.

Luca Turin (2006): The secret of Scent. Adventures in perfume and the science of smell. Faber Ltd., London



Coumarin derivatives as aphrodisiacs

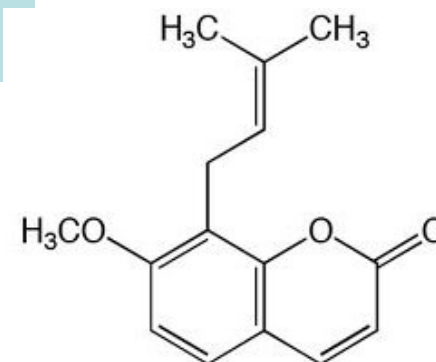
Imperatorin is a **furanocoumarin** and a phytochemical that has been isolated from *Urena lobata* L. (Malvaceae), *Angelica archangelica*, *Angelica dahurica*, *Glehnia littoralis*, *Saposhnikovia divaricata*, *Cnidium monnieri*, *Incarvillea younghusbandii*, and *Zanthoxylum americanum* mill. It is biosynthesized from umbelliferone, a coumarin derivative.



You may find **Cnidium seeds** in bulk at Chinese pharmacies and some health food stores. **Cnidium is found in an effective sexual enhancement product called Passion Rx.**



Active ingredient is coumarin osthole



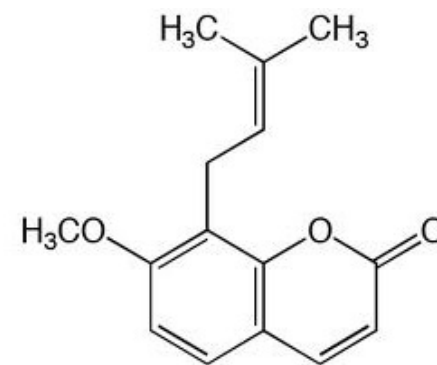
- 1) Increased sexual drive and desire;
- 2) Increased Nitric Oxide and cGMP levels;
- 3) Increased blood flow to the sexual organs;
- 7) Relieve asthma;
- 8) Antifungus, antiviral

Coumarin derivatives

Cnidium monnieri is a plant in the Apiaceae which grows in China (possibly in Oregon) whose seeds are used **in classical traditional Chinese medicine for skin problems and as a natural libido booster**. C. is known in China as She Chuang Zi.



You find **Cnidium seeds in bulk at Chinese pharmacies and some health food stores**. Cnidium is found in an effective sexual enhancement product called Passion Rx. Active ingredient is **coumarin osthole**



- 1) Increased sexual drive and desire;
- 2) Increased Nitric Oxide and cGMP levels;
- 3) Increased blood flow to the sexual organs;
- 7) Relieve asthma;
- 8) Antifungus, antiviral



Examples for selected fragrant oils

Oil of wintergreen Methyl salicylate ester of salicylic acid + methanol

Monoterpenes:

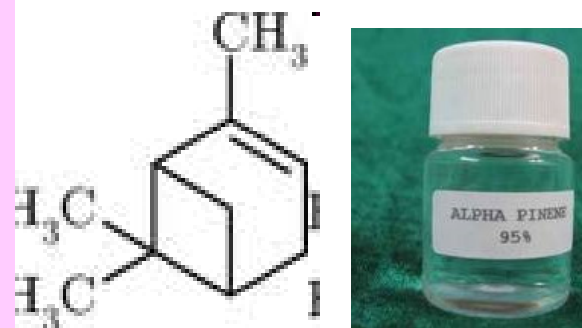
Limonene – main constituent (> 90 %) of citrus oils, .

. but also in black pepper and Apiaceae like fennel

Pinene – main constituent in pine oil, juniper, & .

. eucalyptus, black pepper

Camphene- in camphor, juniper and pine



Monoterpenoids = monoterpenols

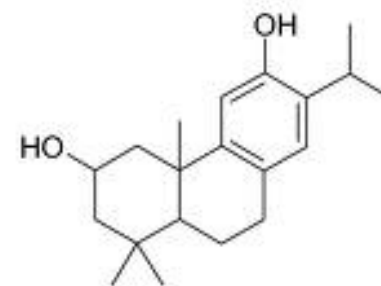
borneol – major constituent in lavender + rosemary .

Lavendulol – characteristic fragrance in lavender oil

geraniol – major constituent in geranium, rose, clove

menthol – characteristic fragrance in peppermint

nerol – patchouli, bergamot, myrtle, neroli, melissa



Salviol

Diterpenoids = diterpenols

salviol – major constituent in Salvia or sage .

sclareol – in clary sage

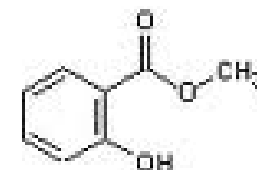
Examples for selected fragrant oils

Esters

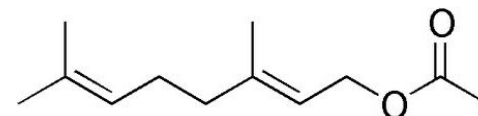
Benzyl benzoate – gum benzoin, tincture of benzoin

Methyl salicylate - Oil of wintergreen ester of salicylic acid + methanol

Geranylacetate – geranium, lemon grass, melissa, ..
fruity rose aroma. liquid has a slightly yellow color.



Methyl 2-hydroxybenzoate



Phenoles :

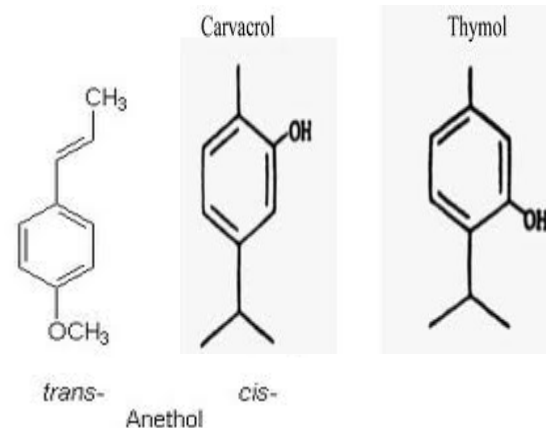
anethole – characteristic constituent in fennel

eugenol – main constituent in clove, cinnamon, pepper

Thymol - in thyme & oregano

methyl-chavicol – in thyme and basil

cavracol - in thyme, oregano, peppermint



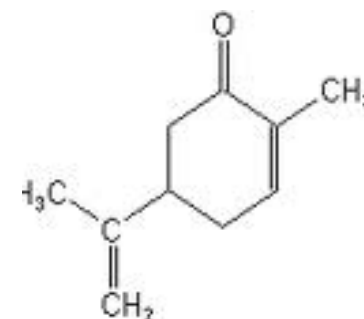
Ketones

carvone – major constituent in caraway seeds

fenchone – in fennel together with limonene

jasmone – major constituent in jasmine oil

menthone – in peppermint, pennyroyal,



Synthetic fragrant substances

What are fragrance chemicals or fragrance oils?

Fragrance oil(s), also known as **aroma oils**, **aromatic oils**, and **flavor oils**, are

- (1) blended synthetic aroma compounds or
- (2) natural essential oils that are diluted with a carrier like *propylene glycol, vegetable oil, or mineral oil*.
- (3) Wintergreen, limonene & other ingredient can easily be chemically manufactured



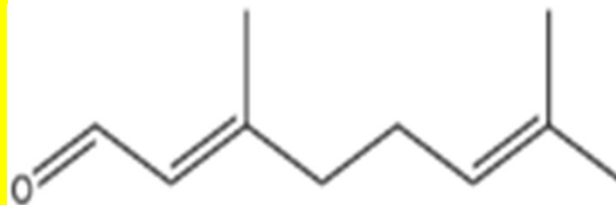
Aromatic oils are used in perfumery, cosmetics, flavoring of food, and in aromatherapy. Synthetic fragrance oils are less desirable than plant-derived essential oils in perfume.

Synthetic Odorants - aldehydes + Esters

Trans, cis-2,6-Nonadienal: powerful aldehyde immediately identified with the *smell of cucumber*



Citral: amazingly strong lemon scent: fresh, clean & sour but use in acidic detergents, bleaches, toilet cleaners is not possible (here we use the stable nitriles) in lemon grass, lemon balm, lemon verbena



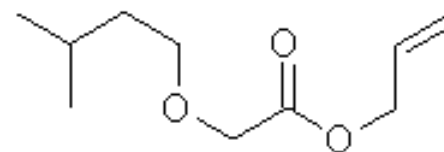
Apple: Aldrich lists 38 esters from allyl propionate to

... .. **Pear:** 15 esters **Quince:** diethyl sebacate

Allyl Amyl Glycolate Fruity, Green, Pineapple, Clear liquid

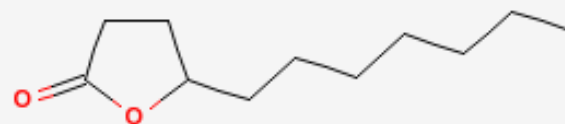
Recommended Uses of Products :

Acid Cleaner Liquid, Detergent, Alcoholic Lotion, Fabric Softener, Anti Perspirant, Foam Bath, Bleach, Surface Cleaner, Deo Stick, Shampoo, Soap



Benzyl salicylate is widely used in perfumes although it has no smell of its own → **smell enhancer!**

Delta-undecalactone 1908 Schestakov named **Persicol:** peach aldehyde lactone = cyclic ester with **peach odor**

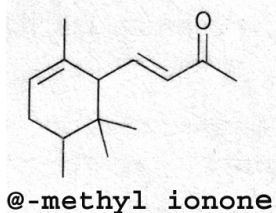


Reconstituting smells of real flowers - God's Perfumery School

Headspace: The real smell of a flower when included in a jar. Cannot be bottled since the amount is microscopically small. So, you replicate Nature as close as possible with synthetics. Not only the smell but also their volatility will have to match.

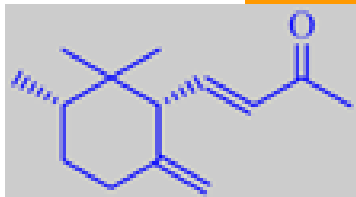
Rose oil (\$ 3000 to 25 000): A good substitute contains phenyl ethanol (synth. ester), geraniol, eugenol + upper notes e.g. Estee Lauder's synthetic "Pleasures" vs **Jean Patou's** more natural "**Joy**" with **> 30 % Bulgarian rose oil**.

Lily of the Valley is complex between rose & lemon. Hydroxycitronellal is not a bad likeness, also Bourgeonal, Lilial, Cyclamenal (1919 by G. Blanc)

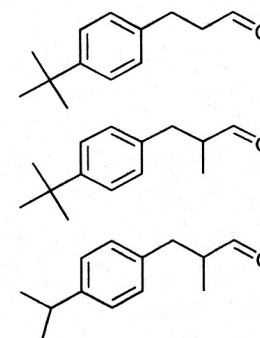


@-methyl ionone

Violets: Harmann & Reimer 1903: 80,000 Goldmark/kg violet flower = \$ 400,000/kg synthesized @-methyl ionone. Violet became the!!! Found in Chanel's # 7



Iris Harmann & Reimer 1902: synthesized **irone** resembling iris root butter (\$ 75,000/kg). Chanel's Cuir de Russie



aldehydes resembling lily of the valley





Perfumes – art, witchcraft or science?

Perfumes are mixtures of raw materials: fragrant essential oils and other odorants, musk, fixatives, chemicals + solvents to give the human body, food, detergent, soap, juice, books etc pleasant smells.

Why perfumes? Extracts from plants do not really smell like the real flowers but like **a weak fake which might resemble but never match nature**. The perfume maker therefore combines various raw materials to get something that **resembles real flowers**, or may even create some desirable **fantasy smell**

The **first perfume that used pure chemicals** was in 1881 Fougere Royal or Royal Fern by Parquet: it used lots of **coumarin**. Coumarin was used before but it was extracted from woodruff, vanilla leaf, & Tonka beans (\$ 450/ kg), but not the pure, cheap chemical (\$ 10/kg).

Synthetics: Many chemicals that resemble natural odors like hydroxymethyl pentylcyclohexene alias Lylal® & hydroxycitronellal (\$ 40 /kg) resemble **lily-of –the –valley odor** (narcissus absolute = \$30,000/kg) in soap. Many synthetic chemicals are **allergens causing skin rashes or more severe symptoms** → label “contains potential allergens” disturbs on a perfume bottle

Luca Turin: The Secret of Scent. Adventures in Perfume & the science of smell, Harper Collins Publ., NY 2006,

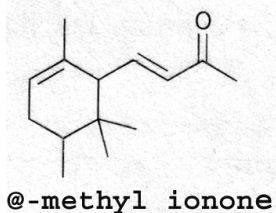
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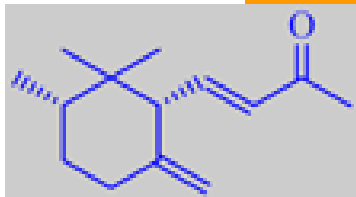
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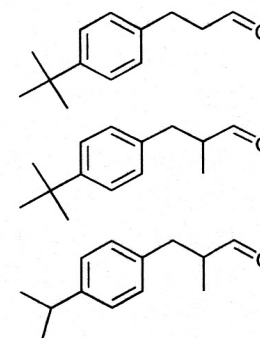


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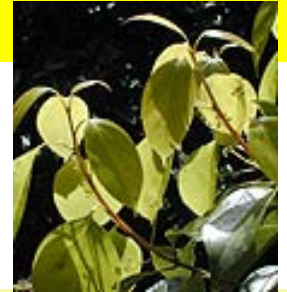


Spice oils are used in perfumes as well



Cloves *Syzgium aromaticum* (old *Eugenia caryophyllata*), Indo-Malayan archipelago, undeveloped flower buds of a large tree, major ingredient is eugenol., clove-bud oil sweet spicy note adds richness to rose perfumes

Cinnamon oil (*Cassia zeylandicum*) Sri Lanka Taiwan inner bark has eugenol, easily converted into vanillin. Ingredient of oriental perfumes, related to camphor *Cinnamomum camphora*



Nutmeg oil *Myristica fragrans* pale yellow oil with warm Muskat odor distilled from seeds & used in men's colognes

Pepper *Piper nigrum* –extracted with ethanol or distilled for a warm, dry woody note



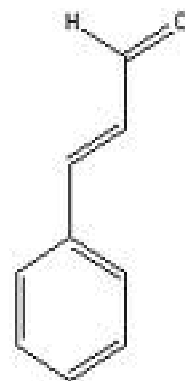
Ginger oil *Zingiber officinalis* distilled from tuberous rhizomes spicy note in men's aftershaves ,

Cardamon oils *Elletaria cardamomum* in the ginger family extracted form seed capsules. Oil has pleasant, fresh spiciness



Cinnamonic aldehyde is fragrant

Cinnamon trees are native to South East Asia, but its origin was mysterious in Europe until the sixteenth century. Due to the presence of coumarin, European warned against consuming large amounts of Cassia which cause liver and kidney damage in high concentrations. Ceylon cinnamon has negligible amounts of coumarin.



Cinnamaldehyde gives cinnamon its flavor and odor. A pale yellow viscous liquid from the bark of cinnamon trees and other species of the genus *Cinnamomum*. The essential oil of cinnamon bark is about 90% cinnamaldehyde. from the cinnamon tree *Cinnamomum zeylandicum* by steam distillation of the bark.

Cinnamomum zeylandicum



Root oils



Valerian *Valeriana officinalis* The piper of Hamel seduced the rats with isovaleric acid. Objectionable smell but diluted it brings woody, musky, balsamic. Valerian flowers smell nice.



Vetiver (*Vetiveria zizanioides*) distilled in India from thin, wiry roots that smell like a sliced potato. Viscous oil has amazing freshness and fixative properties (= long-lasting fragrance)



Orrisroot (*Iris pallida*, *Iris germanica* var. *florentina*) resembles violets with fruity notes. Rhizomes are dried and peeled & solvent extracted, today Tuscany is major source.

Ginger oil *Zingiber officinalis* distilled from tuberous rhizomes spicy note in men's aftershaves,

wood oils



Bois de rose, rosewood *Valeriana officinalis*
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Lichens & Smell: the fragrant Oakmoss



Evernia prunastri & *Pseudoevernia*

furfuracea: The lichens which produce this resinoid are found on oak and other trees. Chemical Constituent is **lichenol** - an ester of evernic acid.

Perfumery Uses: Blends well with Neroli Lavender, Ylang, Jasmin, Tuberose . often used as **perfume fixatives and base notes** key components of Fougère and Chypre class perfumes. **The lichen has a distinct odor:** woody, sharp and slightly sweet. when growing on pines → turpentine odor.



Psuedevernia furfuracea, or **tree moss**, is a lichen that grows on bark of firs and pines. Lichen is sensitive to air pollution indicating good air quality in growing place. The species has numerous uses, including use in perfume, embalming and in medicine. **Large amounts annually processed in France for perfume**

Animal sources of Perfumes → search for human pheromones

Ambergris: secretion or vomit of spermwhale *Physeter macrocephalus*, Chinese thought it aphrodisiac close to woman's natural scent, today 100 % synthetic sources

Musk is the secretion of the sexual glands of the musk deer *Moschus moschiferus* (Tibet, Nepal) browsing on dandelions and honeysuckles & musk ox.

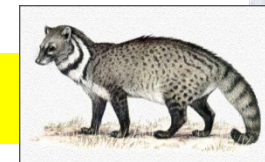
Castoreum is the oily secretion from the anus of beaver *Castor fiber* with a warm, pungent, leathery smell. Still widely used in modern perfumes as base note or fixative.

Swiny is secretion of European wild boar *Sus scrofa*, suggested to be very close to scent of human male.

Andron animal steroids androsterone & 5 α -androstenol

Civet is secretion of civet cats *Viverra civetta* from Ethiopia, India & Indonesia. Cats are caged & harassed since this produces lots of norephedrine & civet, which is extracted through anus. Cats hate humans. Smell is fecal & repugnant but dilution makes it warm, leathery & sexual. Good fixative too.

Excr. ambergris floats



Plant aromatics dominate the perfume industry

Plant determine perfumer's language: a "rosy", note, a hint of "peach" or "pine. There are floral oils, leaf oils, spice oils, root oils, citrus (fruit) oils, resins & fragrant woods. → **floral oils**

Rose bulgare (*Rosa damascena*) deep intense rosy note; always distilled. Sufi poets of Iran & Turkey → attar of rose

Rose de mai (*Rosa centifolia*) has sweet, lighter odor produced in the Grasse region of France, also Marocco (Atlas range)

Jasmin cultivated in Persia for cosmetics & to perfume tea obtained from *Jasminum grandiflorum* (Italy) *Jasminum officinale* & Arabian jasmin *J. sambac* grown in Egypt. Exudes perfume at dawn. No grand perfume without jasmine.

Tuberose *Polianthes tuberosa* is native to Mexico or *bone flower* from its white flower (Aztecs) or *mistress of the night* intensely sweet odor extracted by enfleurage. \$ 3000 per lb

Broom (*Spartium juncum*) known as genet from old genus name Genista. Grows in France + Mediterranean. Solvent extraction

Flower aromatics dominate the perfume industry

Chamomille *Matricaria chamomilla* by distillation (oil has blue color) or tincture. In old herb liqueurs, has sweet herby/fruity note constant with evapor.

Cassis (*Ribes nigrum*) extract from the buds of the black current. 16% essential oil with intensely fruity smell. Burgundy

Amaryllidaeceae with *Narcissus jonquilla*, *N. Tarzetta* and *N. poeticus* considered very “green” violently crude, savage

Hyacinth *Hyacinthus orientalis*, favorite of **de Pompadour** obtained by solvent extraction. Costly floral green smell

Champac *Michelia champac* from India & China, solvent extraction with petrol ether. Velvetly heavy scent.

Lavender *Lavendula officinalis*. Today lavender is a hybrid *L. offic.* X *L. latifolia* is major crop. steam distilled or solvent extracted. Fresh, sporty note for masc.

Carnation *Dianthus caryophyllus* has sweet, honey-like smell only resembling fragrance of the flower in extreme dilution. Little essential oil is in petals

Cassie (*Acacia farnesiana*) American origin, became famous in Villa Farnese at Rome. Mimosa refers to *Acacia dealbata* (Provence) & smells like beeswax.



Herbal aromatics: seeds, leaves, roots

Rosemary *Rosemarinus officinalis* by distillation or steam (Spain, Morocco). Healthy sportive notes but a sharpness that demands caution.

Basil (*Ocimum basilicum*) king = basileus” sweet, spicy, woody undertone, steam distilled



Thyme *Thymus vulgaris* distilled → brown-red oil with sweet warm odor. soaps

Clary sage *Salvia sclarea* has wine-like odor, *closest plant smell to ambergris*

Majoram *Origanum vulgare* , oil adds *spicy note to colognes*, oriental

Mint *Mentha arvensis* field mint is stem-distilled grown in Japan. *Solid crystals* on top of distillate. Lifting green notes, **use in lipsticks for cooling**

Laurel *Laurus nobilis*. Mediterranean spicy note blends well with citrus oil. Mostly used in “haute cuisine”



Coriander *Coriandrum sativum* **distilled from seeds** in Southern Europe, **spicy, sweet, woody tones** blend well with sage, jasmine, lilac prod. in Russia

Apiaceae distilled from seeds in France of celery (*Apium graveolens*)

Angelica oil from seeds plus roots of *Angelica archangelica* has fresh, light, peppery tones root oil herbal & earthy as felt in **Cointreau cognac**

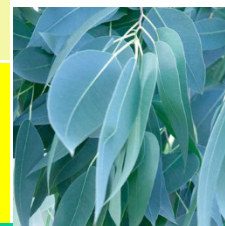
Leaf absolutes & oils = heavy artillery of perfumes

Lemongrass *Cymbopogon citratus* 1500 tons/a, Indian native grown in China distilled by remote steam oil with 80 % citral content, for synthesis of ionone
Cymbopogon martini is **palmarosa** with sweet, rosy tones, inexpensive in soap

Patchouli (*Pogostemon cablin*) Indo-Malayan grown in China, extensive use in perfume industry, **mint family** *steam-distilled, then aged*.

In 1960's patchouli was favorite of hippies since herbal notes mask smell of marihuana, ➔ sweet-herbaceous, woody-balsamic odor blends well with sandal, rose, lavender in “**Tabu**” 1931, “**Miss Dior**” 1947, “**Polo**” 1978

Pelargonium = Geranium *Pelargonium x hortorum* propagated vegetatively only. Native of S Africa now grown in Egypt. **Oil glands all over the hairy geranium leaves distilled for 1 hour ➔ 250 kg leaves gives ➔ 700 g oil** . Only in fragrances, not in flavoring



Eucalyptus *Eucalyptus globulus* leaves are steam-distilled for fragrance & flavor for low-cost perfumes, mouthwash, gums, candy

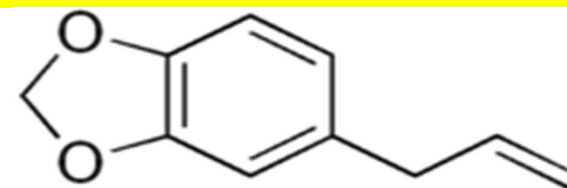
Rum Tree *Pimenta acris* West Indies leaves have familiarscent of bay rum

Coniferous (hemlock, spruce) oil *Tsuga heterophylla, Picea glauca* ➔ with **fresh balsamic odor**, used in soaps & cleaners, blends well with sandalwood

Leaf absolutes & oils = heavy artillery of perfumes

Juniper/Genever *Juniperus communis* berries are crushed and steam-distilled
→ fragrant oils that are cheap with fresh pine smell for soaps , colognes

Camphor Taiwan once had virgin stands of **camphor laurel** (*Cinnamomum camphora*), a large evergreen tree with 1 % brown ess. oil consisting mainly of **safrole with** ethereal scent (root beer) sense of coolness upon inhalation.



Safrole; colorless oily liquid extracted from the root-bark of sassafras plants

Violets *Viola odorata* solvent leaf extract, expensive green smell of crushed leaf

Rue *Ruta graveolens* – the “ herb of grace” or Spanish oil with **intensely feline odor of cat-spray**, phototoxins, halts evil spirits



Myrtle *Myrtus communis* evergreen shrub provided **classic scent in Baghdad, Granada** etc. fresh strong, camphorous, spicy smell –top note, grown in Marocco & Spain

Labdanum rock rose *Cistus ladaniferum* Dioscorides goats for harvest, today **General method to isolate resin**: bushes are cropped and boiled in water → dark resin rises & is skimmed off. formed to age, alcoholic extract for perfume

History of Aromatic Fragrances

Human's sense of smell was prerequisite for survival. Except for bitter, salty, sour, sweet all nuances of taste are olfactory. Subtleties are all olfactory-related.



myrrh
dried



Perfumes were developed to counteract body odor
Mummification involved to replace stinky guts with myrrh, cassia, cinnamon



Cinnamomum
cassia



First perfumes in mesopotamia were based on sesame oil & wine, also a common drink



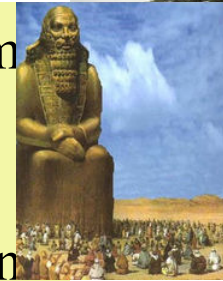
Malodorous conditions in overcrowded medieval towns put emphasis on establishing hygiene as a good smell. Soap came in two kinds - black and white, coral and cuttlebones were used for teeth, shampoo was made from fern-ash, vine stalks & egg-white





History of aromatic Scents

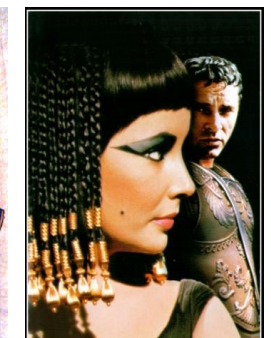
Mesopotamia 4000 a ago. Fragrance of *Cedrus Libani* from the forests of Marduk, also pine, cypress resins, myrtle & **gum galbanum** – a green odorant from a *Ferula* species + fragrant cedar wood for palaces: hanging gardens of Babylon



Egypt: Hatshepsut 1558-1485 BC botanical garden with plants from Punt (Erithrea): *Boswellia parpyrifera* (frankincense), *Commiphora erithrea* (myrrh). Ancient Egyptians **burned frankincense as incense** & ground charred resin into a powder called → **Kohl** was used to make **distinctive black eyeliner** seen on figures in Egyptian art. Imported oakmoss (*Pseudoevernia* & *Evernia*) and labdanum from Greece; loved **Egyptian lotos** *Nymphaea coerulea* – the blue water lily = Sun in blue sky – symbol of Ra, the Sun God



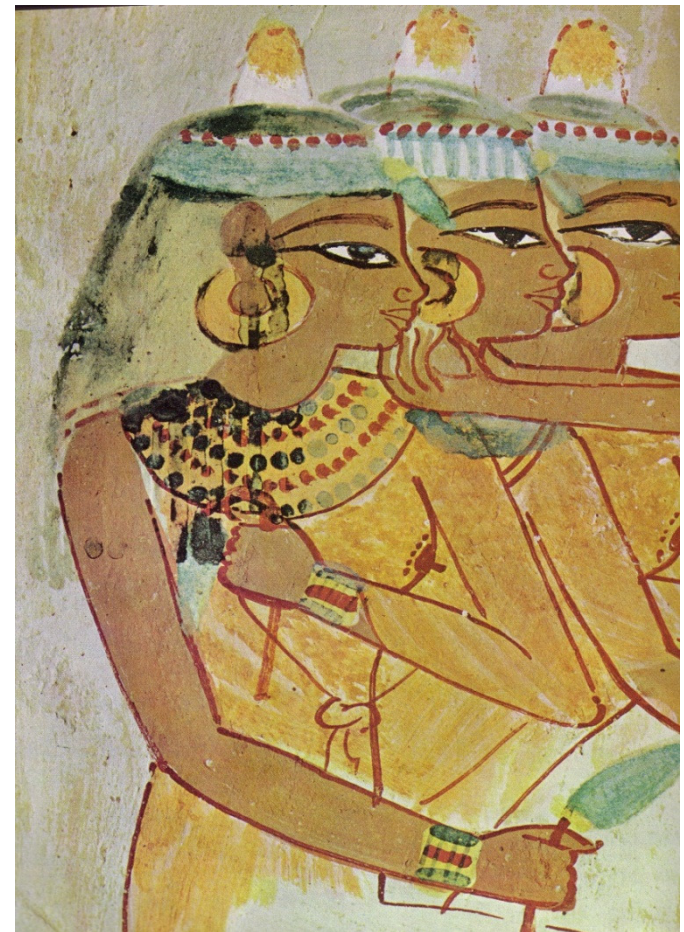
With Greek establishment at Alexandria **Egypt became the world center of perfume trade.** Alexander became a great user of aromatics. **Cleopatra was the last of her kind as symbol of fashion teaching the rest of the world.**



Pharaomones are worn on top

In ancient Near Eastern cultures fragrances and spices were used to preserve meat including human corpses.

Also **Egyptian girls used fragrant perfume cones (animal grease)** to have a short-distance effect on the Old Egyptian male. Together with the dress it was devastating.



Egypt – where the first fine perfumes were made



Until and during the first few centuries of the Common Era, Egypt was the prestigious center of an international perfume industry. Egypt was so well known for its perfume that during Julius Caesar's Roman triumphs, perfume bottles were tossed to the crowd to demonstrate his mastery over Egypt.

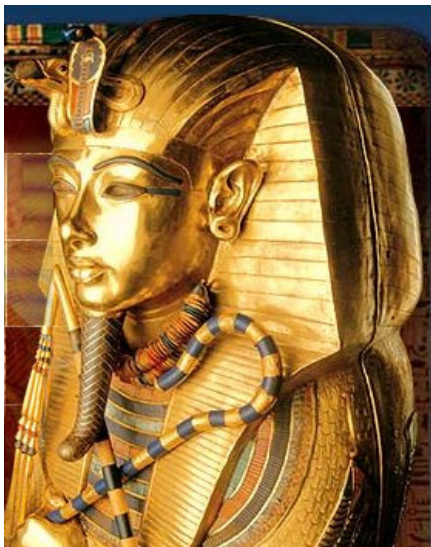


2003 Oldest Perfumes Found on "Aphrodite's Island" Jugs used to make and store ancient perfumes lie at an excavation site on the Mediterranean island of Cyprus. The 4,000-year-old fragrances—the world's oldest known perfumes. Remnants of the perfumes were found inside an ancient 3,230-square-foot (300-square-meter) factory that was part of a larger industrial complex at Pyrgos.



Flowers to Perfumes → Labdanum

Labdanum is a sticky brown resin obtained from the shrubs *Cistus ladanifer* (western Mediterranean) and *Cistus creticus* (eastern Mediterranean), species of rockrose. It has a long history of use in herbal medicine and as a perfume ingredient.



In ancient times, resin was scraped from fur of goats and sheep that grazed on the cistus shrubs. The false beards worn by the pharaohs were actually the labdanum soaked hair of these goats. Labdanum is produced today for the **perfume industry**: The raw resin is usually extracted by boiling the leaves and twigs. The raw gum is a dark brown, fragrant mass. It resembles **ambergris**, which has been banned because its precursor originates from the sperm whale,

Cistus creticus rockrose



rockrose harvest in
Crete



History of aromatic Scents

Greece. roses *Rosa phoenicia* *Rosa gallica* 1700 BC in Knossos Minoan civilization in Crete. Greeks cultivated olive oil, almond oil, sesame oil, flax oil as the carriers for perfumes. Orientalization under Alex the Great Theophrastus



Rosa gallica

Arabia felix: Yemen was the original country of Frankincense *Boswellia carteri* and Myrrh otanical Arabs never saw dark ages like Christian Europe. Musk and attar of roses *Rosa damascena* & *Rosa alba* developed in Persia (rose water is special since some of the rose oil mixes with water). polite to sprinkle guest with rose water, Arabian eye liners or mascara (**kohl**) made from antimony sulfide ground to fine powder.



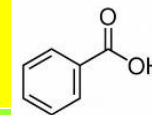
Rosa phoenicia

India: Had resin-based mascara, jasmine was enfleuraged in warm sesame seeds, later sandalwood, khus khus grass Vetiveria zizanioides, Styrax benzoin, Indian basil Ocimum sanctum or tulsi, lemongrass Cymbopogon, lotus flower Nelumbo nucifera. Muslim Moghuls combined with Arab traditions





Benzoic acid in perfumes



Benzoin resin = styrax resin = benzoin is obtained from the bark of trees in the genus *Styrax*. Benzoin Sumatra is obtained from *Styrax benzoin* grown on the island of Sumatra. Both varieties are pathogenic resins, which are exuded from the tree when it is damaged.

Its principle component is benzoic acid.

In perfumery, benzoin is used as a **fixative**, slowing the dispersion of essential oils & other fragrances into the air. It is also used in medicine. **Tincture of benzoin** has two main medical uses: aseptic treatment for blisters damaged skin, and as an inhalant in case of bronchitis & asthma.



Leukotape +
TOB treats
blisters on trips



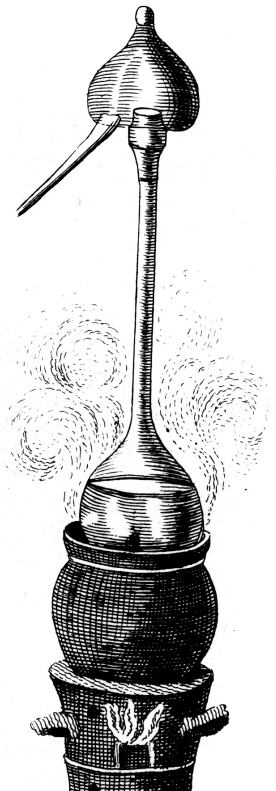
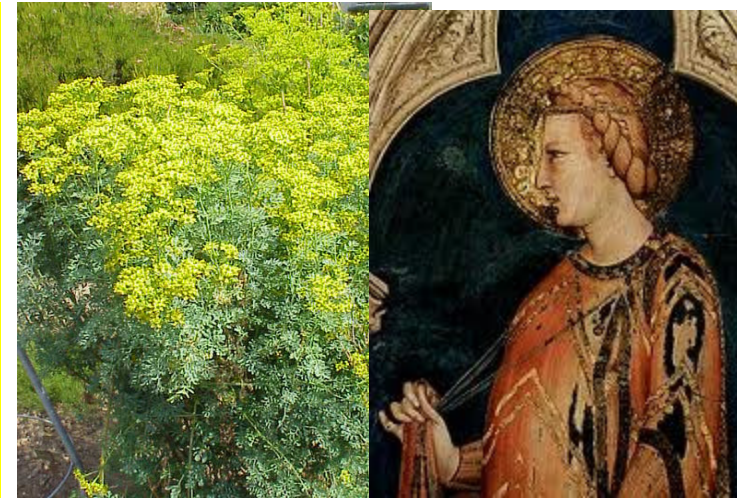
Benzoin resin is **important aroma** in incenses: major comp. of incense of *Russian Orthodox Christians* also in *Japanese incense*, *Indian incense*, *Chinese incense*, and *Papier d'Arménie*. *Sambrani* is a popular *Indian incense* used to scent hair and prevent infections.

Early Perfumes in Europe

Hungary water after Queen Elizabeth of Hungary, it worked → got marriage proposal with age 72. Based upon oil of rosemary and lavender.

Eau de Carmes or Carmelite Water
1379 named after the nunnery of Carmes. Based upon *Melissa officinalis* bee balm, angelica and other herbal notes.

Glass making learned from old Egypt via the Arabs via Venice allowed rapid progress in distillation learned from the Arabs. .
Distillation of rue *Ruta graveolens* with pungent cat spray odor, cinnamon, pine, frankincense, sweet flag *Acorus calamus*, costus rhizome, thyme, asafoetida, benzoin etc



Distillation of the essential oils, and their packaging were dependent on the development of the glass-maker's craft. In the Renaissance, the most advanced lab-ware was to be found in Italy, where the Venetians had something of a monopoly on the trade. However, as individual craftsmen escaped their virtual prison on the island of Murano, advanced techniques appeared in Bohemia, France, and England. A glass still from Poncelet's Chymie du Goût et de l'Odorat, 1766. From the Collection of Florence Wall

Early Perfumes in Europe

Hungary water after Queen Elizabeth of Hungary, it worked → got marriage proposal with age 72. Based upon oil of rosemary and lavender.

This wonderful astringent lotion has been hailed as the first herbal product to ever be produced and marketed. Legend has it the early Gypsies formulated it and claimed it **to be a cure-all**.

Modernized Recipe that could be real

6 parts lemon balm

4 parts chamomile

3 parts calendula

1 part lemon peel

1 part rosemary

4 parts roses

1 part sage

vinegar to cover (apple cider or wine vinegar ok.) rose or witch hazel extract



How to make a Perfume (step 1)

Perfume is simple to make. To put the essential oils together to create a smell you like is the essence of it.

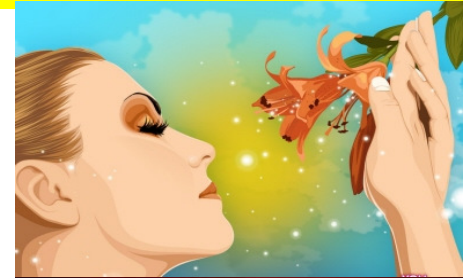
Simple ingredients: (1) essential oil (2) water
(3) pure grain alcohol (4) fixative
Fragrance oils may replace essential oils for cheaper version

A good fragrance formula should consist of

(1) **25% fragrances &**

(2) **75% dilutants such as vodka.**

(3) **Glycerin is a *good fixative* added to perfumes to help it retain its scents.** Others are **gum benzoin** which is also slowing the dispersion of the volatile oils.



Alternative to fixatives is a Carrier oil:

- **jojoba**, (which is actually not an oil, but a wax liquid at room temp), recommended since it has a very long shelf life, **won't go rancid**, has no smell of its own, blends into the skin without leaving a greasy feel.

The notes of a Perfume (step 2)

The Notes

Because the oils all evaporate at different rates perfumes smell different over time. **Base notes** are the smell staying the longest, middle notes, bridge notes bringing base & top together and **top notes** as the smell that evaporates first.



Base note ingredients:

cedar wood, cinnamon, patchouli, sandalwood, vanilla,
long-lasting resins like benzoin in Old Chinese perfumes, myrrh and other resins in Oriental perfumes

Middle note ingredients:

clove, geranium, lemongrass, nutmeg, neroli, ylang-ylang

Top notes: bergamot, lavender, lemon, lime, neroli

Bridge notes: vanilla, lavender (add a few drops to join base, middle and top)

To make perfume, mix 25 drops total of essential oils divided evenly between base, middle and top notes. Start with them base notes....

Fast & Slowly evaporating essential oils = Notes

Top Notes

The majority of essential oils are classified as top notes. they evaporate fast, are fresh & uplifting

Bergamot Clary Sage Eucalyptus Grapefruit, Lemon, Lemongrass Orange Peppermint Sage Tangerine Tea Tree



Middle Notes

Middle notes normally give that extra punch to the blend & have a balancing effect.

Chamomile Cedarwood Juniper Lavender, Rose
Melissa (Middle to Top) Palmarosa **Pine Rosemary**



Base Notes

Base notes are very heavy, the scent is very solid, & will linger for a long time.

Cinnamon **Frankincense Ginger Neroli**

Patchouli Rose Rosewood Sandalwood Ylang Ylang
Ambrette Seed, Atlas Cedarwood, **Benzoin**



Highly volatile essential oils ➔ **Top Notes**

Esters

Benzyl benzoate – gum benzoin, tincture of benzoin

Methyl salicylate - Oil of wintergreen ester of .

, salicylic acid + methanol

Geranylacetate – geranium, lemon grass, melissa, ..



Phenoles :

anethole – characterisitic constituent in fennel

eugenol – main constituent in clove, cinnamon, pepper

Thymol - - in thyme & oregano

methyl-chavicol – in thyme and basil

cavracol - in thyme, oregano, peppermint



Ketones

carvone caraway, **mint** – major constituent in

fenchone – in fennel together with limonene

jasmone – major constituent in jasmin oil

menthone – in peppermint, pennryoal,



The secrets of Scents - coumarin

1881 perfume **Fougere's Royal** was created with freshly available synthetic coumarin with a hay-like smell. Coumarins can be extracted from tonka beans. The **tonka bean** is the seed of *Dipteryx odorata*, a legume tree.

The seed is black and wrinkled in appearance with a great fragrance, which is reminiscent of vanilla, almonds, cinnamon, and cloves: a once suggested substitute for vanilla used in perfume and was commonly used in tobacco.

Seed contains coumarin which can be lethal in large doses.

Coumarines can be extracted by water from these beans
They can be used for perfumes not for consumption.

Luca Turin (2006): The secret of Scent. Adventures in perfume and the science of smell. Faber Ltd., London



Phenolic odors

Coumarin benzopyrone;

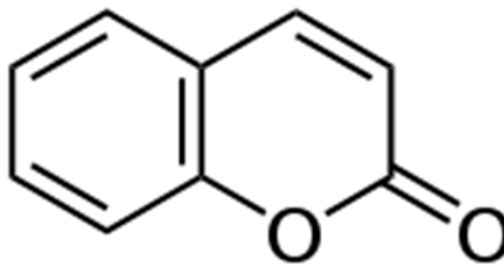
toxin found in many plants,
notably in tonka bean,
vanilla leaf, vanilla grass
woodruff *Galium odoratum*,
mullein *Verbascum*, bison
grass, sweet clover *Melilotus*

cassia bark, one of the
cinnamon species:

1 teaspoon of cinnamon
powder contains 5.8 to
12.1 mg of coumarin,

a sweet scent of newly-
mown hay, has been used in
perfumes since 1882.

Banned in foods, not drinks

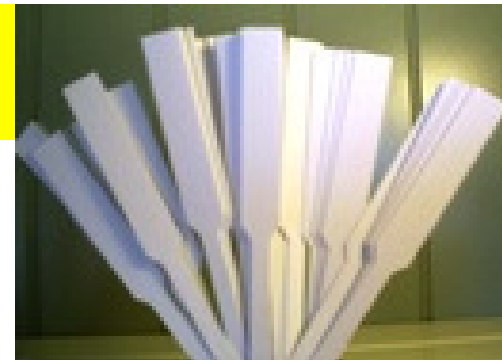


How to make a Perfume (step 3)

To make perfume, **mix at least 9-12 drops total of essential oils divided evenly between base, middle & top notes. Start with the base notes**, then middle, then top, testing the smell as you go. When done, add 2-3 drops of a bridge oil. Add 10 ml of alcohol, shake for a few minutes, then let it sit for 48 hours (up to 6 weeks → the longer it sits, the stronger the smell). Add 3 ml spring water, stir, (if necessary filter it) & store in 15 ml bottle

Recipes are a great way to get you started. Later you will want to create your own scents for your unique personality.

When experimenting with essential oils, make sure to understand the potency & health risks some oils can cause if not used properly. Some – like **thujon** – are neurotoxic – and would be a bad choice, others are caustic and may damage your clothing or skin.



the seductive power of
food & fragrance

If it's true that the way to a man's heart is through his stomach, then fragrances with gourmet notes are certain to be doubly seductive. Watermelon and vanilla, tangerine and caramel, chocolate and honey—today's perfumers are finding endless inspiration in the pastry chef's kitchen. Now Macy's has commissioned renowned pastry chefs Johnny Iuzzini and Bill Yosses to lovingly "return the favor".

Chefs Iuzzini and Yosses marry the sensual experiences of smelling a seductive fragrance and tasting an intoxicating dessert, by turning to the latest fragrances for inspiration. These chefs uniquely understand scent's integral role in the culinary experience, and are employing their masterful scent palates to translate a perfume's singular notes into tastes equally inspired.

The result? Recipes that reveal the sensory passion these chefs bring to their kitchens (and they just may inspire passionate moments of your own).

View recipes inspired by these fragrances:

- [Miss Dior Chérie](#)
- [Vera Wang Princess](#)
- [Angel by Thierry Mugler](#)
- [Juicy Couture](#)



Basic Perfume Recipe (4)

Take 1 cup of water & 1 cup fresh chopped flower blossoms

1. In a bowl place a cheesecloth with the edges are hanging over. Fill with 1 cup of flower blossoms of your choice. Pour warm water** over the flowers & weigh them down until completely covered. Cover & let sit overnight.

Suggestions for flowers: Lavender, Lilac, Orange Blossoms or even Honeysuckle. Anything that is highly fragrant works best.

2. The next day using the edges of cheesecloth pull it out of the bowl and gently squeeze the scented water into a small beaker. Cool and place into a small bottle. This water-based perfume has a shelf life of only 1 month.

**** 1. Nothing stops you from extending the shelf-life of your perfume from following the basic concept of having 75 % ethanol poured over the flowers.** This will also speed up the extraction considerably.

**** 2.** After 30 – 60 min you use the edges of the cheesecloth to pull it out of the bowl and gently squeeze the scented water into a small bottle. Add glycerin to keep the oils from dispersing too rapidly.

Perfume Recipe “1001 Oriental Nights”

- 4 drops sandalwood essential/fragrance oil
4 drops musk essential/fragrance oil
3 drops frankincense essential/fragrance oil
2 teaspoons jojoba oil
- Mix all the ingredients together, shake well. Place in a dark color bottle. Then allow the perfume to settle for at least 12 hours.



Perfume recipe “ Love Tonic “ – an eau de cologne

- 3 drops sandalwood essential/fragrance oil
- 2 drops vanilla essential/fragrance oil
- 3 drops cedarwood essential/fragrance oil
- 15 drops bergamot essential/fragrance oil
- 1/2 pt (300ml) 70 percent alcohol or vodka



Pour the alcohol into a bottle. Add the oils and shake well. Leave for 1 week. Easy now. You can always make more!

Famous Perfumes

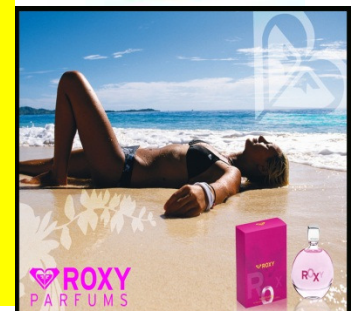
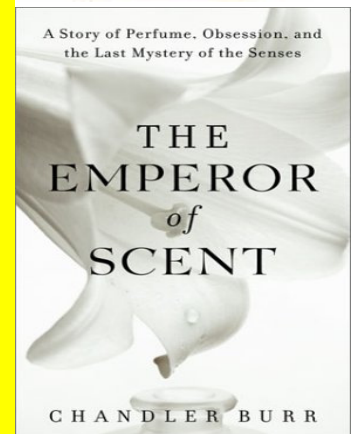
Ernest Beaux created **Chanel No. 5** for Coco Chanel in 1921. It has a floral top note of ylang-ylang and neroli, with a heart of blends of jasmine and rose all above a woody base of sandalwood and vetiver.

Guerlain's **Shalimar** launched first in 1925 & relaunched in 2001. It's a refined oriental feminine fragrance with *iris, vanilla, and rose* - a truly sense hitting perfume

1944 saw the introduction of **Femme** by Rochas. In 1947 Dior launched the ever popular **Miss Dior**. Max Factor's **Hypnotique** and **Primitif** were popular in 1950s **4711 Eau de Cologne**, with its 4711 roll on stick was especially popular for summer heat perspiration

1977 Yves St. Laurent put '**Opium**' perfume in production huge success with women- a perfume for sultry evenings.

in the 80s blatant erotic advertising led to the success of the 1985 **Obsession** from Calvin Klein. Obsession with its heavy smell of vanilla was dominant in the market.



How to combine hydrophilic extracts with carrier oils in one delightful crème?

Hydrophilic substances like phenyl salicylate, titanium dioxide and flavonoids like quercetine, aesculin etc. are good natural protectants against UV damage to your skin. The only problem is that they are *hydrophilic and as such hard to get into a sun screening crème or oil!*



You use detergents like stearic acid or borax.



Moisturizing vanishing cream (high content of **lanolin = a wax**, that is a mixture of esters of fatty acids with high molecular weight alcohols . The melting point is about 40°C. Insoluble in water but forms very stable emulsions with it.)

Recipe:

0.25 cup of stearic acid, ½ teaspoon of potassium carbonate, 3 1/2 tablespoons , glycerin, 1 cup of of distilled water. Melt stearic acid over hot water, carbonate glycerin + water will be brought to a boil & pour in thin stream into melted stearic acid while vigorously stirring. Stir slowly until CO₂ bubbles stop rising. Add perfume at 57 C. Stir until cool.

Emulsions → lotions and creams

Chemically, emulsions are colloids, heterogeneous mixtures composed of tiny particles suspended in another immiscible (unmixable) material

Lotions and creams are emulsions. An emulsion is a mixture of two liquids **that normally can't be combined**, e.g. oil and water. Emulsifying is done by slowly adding one ingredient to another while simultaneously mixing rapidly. This disperses and suspends tiny droplets of one liquid through another. **The two liquids quickly separate again if an emulsifier were not added.**

Emulsifiers are liaisons between the two liquids and serve to stabilize the mixture. In mayonnaise, the emulsifier is egg yolk, which contains lecithin, a fat emulsifier. Other emulsifiers are detergents, em

Mayonnaise is made by combining lemon juice or vinegar with egg yolks. Eggs (containing the emulsifier lecithin) bind the ingredients together and prevent separation. Oil is added drop by drop as mixture is rapidly whisked.

In lotions and creams you often want to combine a herbal extract (let us say UV reflecting flavins/coumarins for suntan lotion) with an oil that sticks to the skin. All you need to add is a fitting emulsifier and you get anny kind of emulsion you want: milk, lotion, cream, mavo, butter, latex,

Soaps – a luxury appearing late in human history

Although Egyptians, Greeks & Romans bathed regularly, they had no soap. Our ancestors knew, however, about **plants that gave them saponins for lather**: Agave (root, leaves, stems), Jujuba Zizyphus (fruit), Morning glory Ipomea (ashes), Chenopodium pigweed (root), Poke Phytolacca (berries), Soap berry Sapindus (berries), soap root Camas Camassia (bulb), Soap wort Saponaria (root), Yucca (root), Cucurbita wild gourd (fruit)



N. Leblanc found that caustic soda is needed for saponification; replaced wood ash by making NaOH more effectively than from trees. M E Chevreul analyzed animal & plant fats 1811-23. Import of tropical palm and coconut oil allowed
→ manufacturing of soaps for everybody in Europe by 1850.

This meant huge increase in demand for fragrances

Krochmal Connie: A guide to natural Cosmetics. New York Times Book Company 1973

Soaps recipes!



Liquid Soap:

use 3 Tablespoons Soap flakes, ethanol 1 Teaspoon, 1 cup (200 ml) of hot water, some drops of oil of strawberry or something else

Dissolve soap in water, dissolve oil in ethanol. Combine !

Liquid Glycerin Soap:

2 Tablespoons Soap flakes, Glycerin 50 ml, ethanol 2 Tablespoons, 1/2 cup (100 ml) of hot water, Talc

Combine soap and water, combine talc and alcohol and stir to smooth paste. Add the glycerin to the paste and then combine with water mixture.

Medicated soap:

100 ml soap flakes, 35 ml hot water, 100 ml ethanol and 100 ml Na or K carbonate.

Dissolve the carbonate in water, then the soap . Add ethanol.

Al Cohol versus the US regulations



A note on alcohol -- the odorless alcohol used in perfumery is ethanol. This is the same as **grain alcohol**, the same type as in booze, → **strictly regulated & impossible to obtain.**

Sd (special denatured) alcohol has additives, which are odorless but render the alcohol undrinkable. but, this is still very difficult to get. "perfumers' alcohol" has started showing up on essential oil sites ... this is usually formula "40b", denatured ethanol with *added bitrex* - extremely bitter substance unpleasant to the taste to discourage the ingestion of the ethanol

A pure grain alcohol product called "**everclear**" (which is 95% alcohol). **restriction placed in certain states** (california, massachusetts, minnesota, ohio, oregon, pennsylvania, and *washington*) that restrict the sale of everclear. **It can be purchased in states like arizona**, colorado, illinois, indiana kentucky, louisiana, mississippi, nevada, new jersey, new york, north carolina, north dakota, oklahoma, texas virginia, washington dc, wisconsin, and wyoming.

Another alternative is 100 proof vodka (50% alcohol) which is not ideal, but can be used if no other alternatives are available.

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How to make Incense!

Making Incense needs four basic ingredients:

- **an aromatic substance: any herb with a pleasant smell**
- ***a bonding agent to hold cones and cylinders together* (base)**
- **a solvent for the bonding agent**
- **a substance that supports controlled burning of the cone**

Common raw incense making materials

Makko powder (*Machilus thunbergii*), Borneol
camphor(*Dryobalanops aromatica*), Sumatra
Benzoin (*Styrax benzoin*), Omani
frankincense (*Boswellia sacra*), Guggul
(*Commiphora wightii*), Golden
Frankincense (*Boswellia papyrifera*), Tolu
balsam (*Myroxylon toluifera*), Somalian myrrh
(*Commiphora myrrha*), Labdanum (*Cistus*
villosus), Opoponax (*Commiphora*
opoponax), white Indian sandalwood
powder (*Santalum album*)



How to make Incense!

Incense (incendere, "to burn") is releasing fragrant smoke when burned. Religious ceremonies employ incense to prepare a clean air for the gods.

Combustible base The combustible base of a incense allows the produced incense to burn with a self-sustained ember, which propagates evenly through an entire piece of incense with such regularity **that it can be used to mark time**. The base is chosen such that it does not produce a perceptible smell. *Two types of incense base predominate:*

Fuel and oxidizer mixtures: **Charcoal or wood powder** form the fuel for the combustion (1). Gums such as **Gum Arabic or Gum Tragacanth** are used to bind the mixture together (2) while an oxidizer such as **Sodium nitrate** or Potassium nitrate sustains the burning of the incense (3). The formula for the charcoal based incense is superficially similar to black powder, though it lacks the sulfur.

plant-based binders: Mucilaginous material, is mixed with fragrant materials and water. The mucilage from the wet binding powder holds the fragrant material together while the cellulose to form a stable ember when lit. **The binding powder makes about 10% of the dry weight in the finished incense.** Makko incense powder made from the bark of the tabu-no-ki tree (*Machilus thunbergii*), is perhaps the best known source of natural plant-based binder. In India a resin based binder called Jigit is used. In Nepal, Tibet, and other East Asian countries a bark based powder called Laha or Dar is used.

Basic Soap: Something later to be refined as hand-milled soaps

Lye or NaOH was once made by dripping water through wood ashes until 1805 N. Leblanc
There are some basic recipes for making basic soap (also called soap bases).
Small changes in the ingredients will result in completely different soaps. →

plain white soap (900g olive oil, 2000g tallow, 85g cocoa butter, 400g NaOH, 1150g H₂O)

vegetarian soap (1200g olive or vegetable oil, 850g coconut oil, 785g vegetable shortening, 250g castor/cocoa oil, 400g NaOH, 1150g H₂O)

Castile soap (1450g olive oil, 200g NaOH, 560g H₂O)

Here is still another classical recipe for use in farms

1. 56 grams of beef tallow, 22 g palm oil, 28 g olive oil in one beaker

In another 500 ml beaker: 15 g of lye (NaOH) + 41 g cold water: → approximately 150 g or ml, (same thing but X3 → 162 g beef tallow, 66 g palm oil, 84 g olive oil, 45 g of NaOH, 123 g of water → 500 ml mixture; use a 1 l beaker).

Put the fats into another beaker and slowly heat them while stirring. You have to watch the oils since they constitute a self-igniting system & can burn. Heat them until all pieces have melted and then let the pot cool down to → 105-100° F = 38-41° C. C. When you put the water to the lye, stir to prevent lye from making a cake at the bottom. Dissolving of NaOH is an **exothermic reaction that generates a lot of heat. Never add the lye to the water; it is a no-no.** You can do it in a water bath to keep temperatures down or use the emerging heat to bring the lye solution to the same temperature as fat mixture → 105-100° F = 38-41° C.

Basic Soap: Something later to be refined as hand-milled soaps (2)

2. Put both lye solution & fat mixture in the same water bath of 38° C so that both have identical temperatures. **Now wear rubber gloves and glasses and pour the lye solution in a steady stream into the fat mixture**, which must be continuously stirred during the procedure (magnetic stirrer). If lye floats on top of the solution hold back with pouring. After the fat mixture has absorbed all the lye continue stirring in a smooth motion so that the mixture has a chance to thicken, turn opaque and grainy. The stirring can last from 15 to 45 min and best sign of success is the **appearance of trailings**. These are distinct lines of soap on the top of the mixture. Now pour the soap into the primary mold!
3. You poured the soap but you should let it cool very slowly by either wrapping the mold in insulation material or in slowly cooling it in a warm water bath! After 48 hours your soap should be ok. Test the surface with your finger; it should be soft enough to leave an imprint. There should be no soft or liquid area left. **Now get the block of soap out of the plastic mold**. Wear gloves since the soap is still caustic.
4. *After a few more days* the soap block should have the consistency of Swiss cheese. Now it is time to cut the block with a warmed knife into pieces of soap bars (consider that these will continue to shrink). Let them sit on air *for another few days* and they will cure; i.e. they will become **smaller and lighter and less caustic**.
5. The blocks of soap that you have you can later melt and refine. **Follow recipes for making hand-milled soaps**.

Castile soap – the Soap of the Vegetarians

Castile soap = vegetarian soap is made exclusively from vegetable oil (as opposed to animal fat), although some hold that to be "Castile" soap it must be made exclusively or predominantly **from olive oil**. (coconut, almond, hemp, and jojoba).

Castile soap originated in the Kingdom of Castile, where it was made from olive oil in the following way.

Barilla (an impure form of sodium carbonate obtained from plant ashes) was boiled with locally available olive oil, instead of tallow. By adding brine to the boiled liquor, the soap was made to float to the surface, where it could be skimmed off by the soap-boiler, leaving the excess lye and impurities to settle out. This produced what was probably **the first white hard soap**, which hardened further with age without losing whiteness, forming *jabón de Castilla*, which eventually became the generic name.

