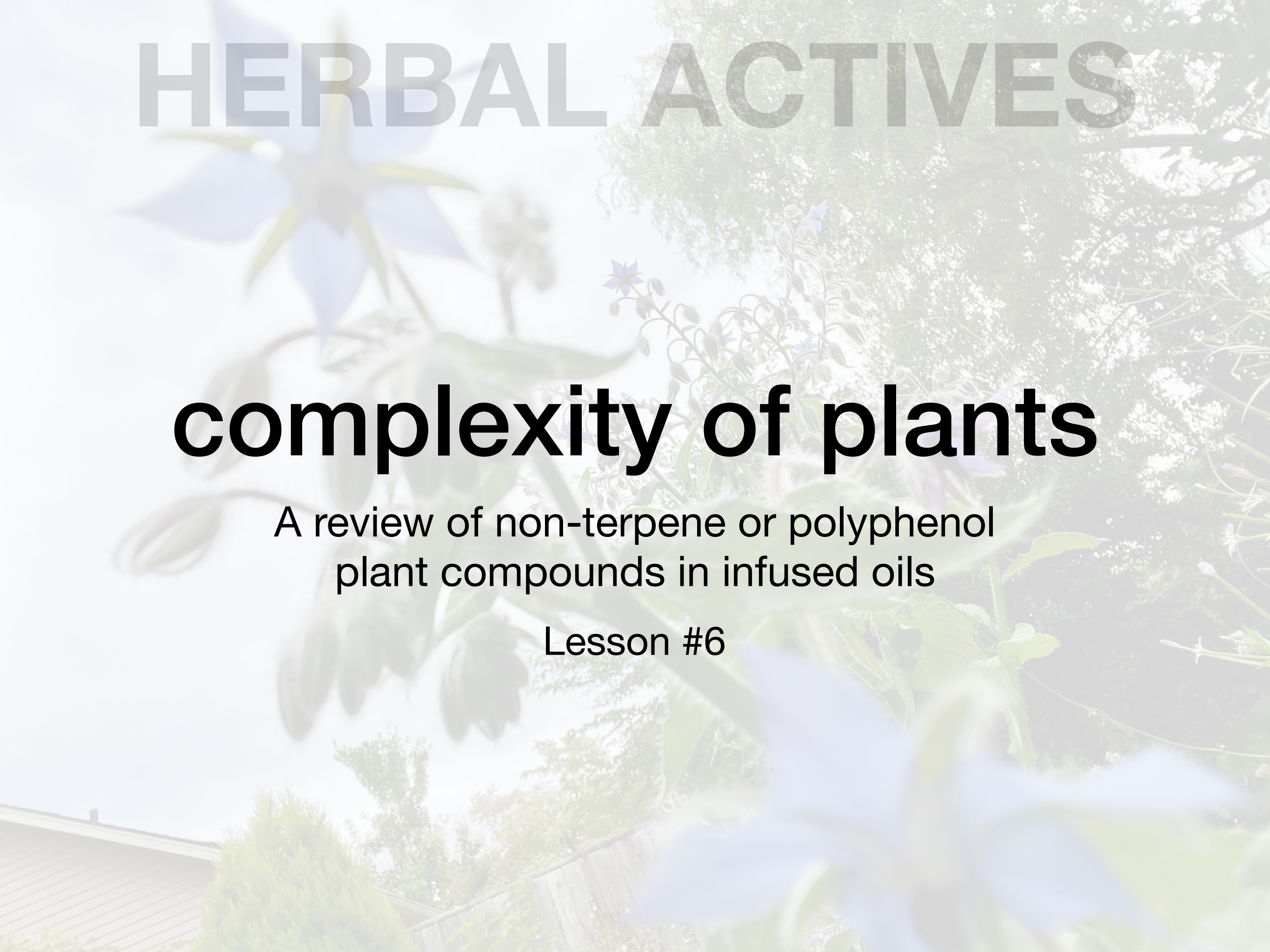


HERBAL ACTIVES

The background of the slide is a soft-focus photograph of a garden. In the foreground, there are large, light blue flowers with five petals. Behind them, there are green leaves and stems of various plants. In the distance, a wooden fence and more trees are visible under a bright, slightly overcast sky.

complexity of plants

A review of non-terpene or polyphenol
plant compounds in infused oils

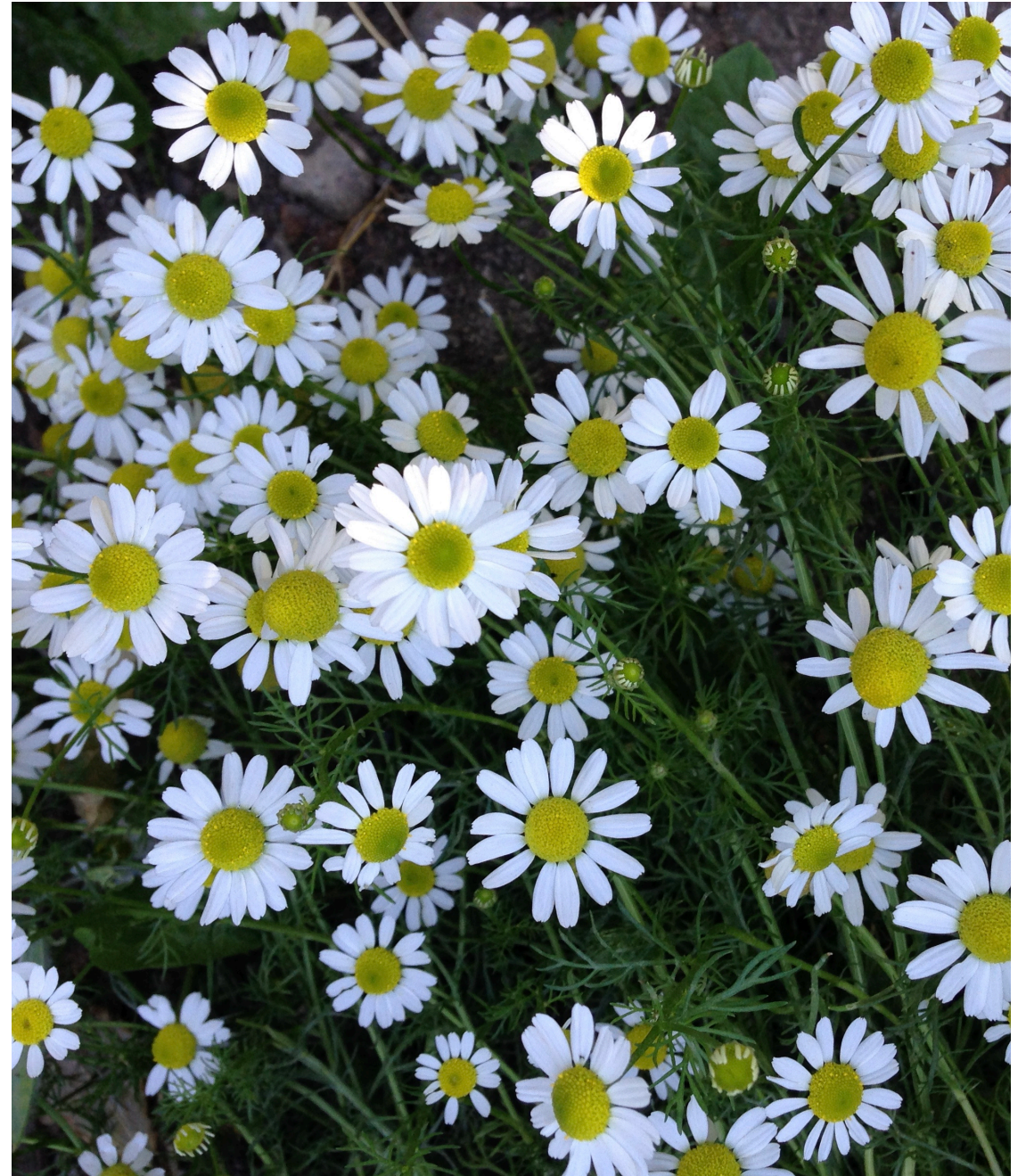
Lesson #6

plants are complex!

We have looked at the readily oil-soluble terpene and terpenoid group of compounds, along with the less oil-soluble group of polyphenols.

But plants are so much more complex than to keep their active compounds in two simple groups that aren't simple at all.

In this lesson, we can get to know some of the other compounds, like chlorophyll, that do not fall within the two groups of active compounds we have covered.



- **Chlorophyll**, the green of the plant world
- **Polysaccharides**, the sugars and carbohydrates
- **Volatile compounds**, the aromatic compounds in plants distilled for essential oils
- **Coumarins**, aromatic organic chemical compounds
- **Cuticular Waxes**, the water repelling wax film that protects plants from the environment
- **Hypericin, hyperforin**, both compounds are specific to the Hypericum (St. John's wort) species.
- **Allantoin**, found in comfrey, known for cell proliferation, wound healing

in this lesson



We can begin with chlorophyll, as nearly every plant has a fair measure of the compound.

Chlorophyll is the green pigment found in nearly all plants, and lucky for us, it is indeed oil-soluble in its native form (chlorophyll a and b).

Chlorophyll can migrate into lipid-based carriers during oil infusions and will color the oil various shades of green depending on the plant.

The migration of the green compounds is most pronounced when using fresh plant material.

So, while the chlorophyll is the lifeblood of the plant, and its ability to process sunlight, the compound and its derivatives have many benefits for our skin health.

chlorophyll



phytol, a diterpene

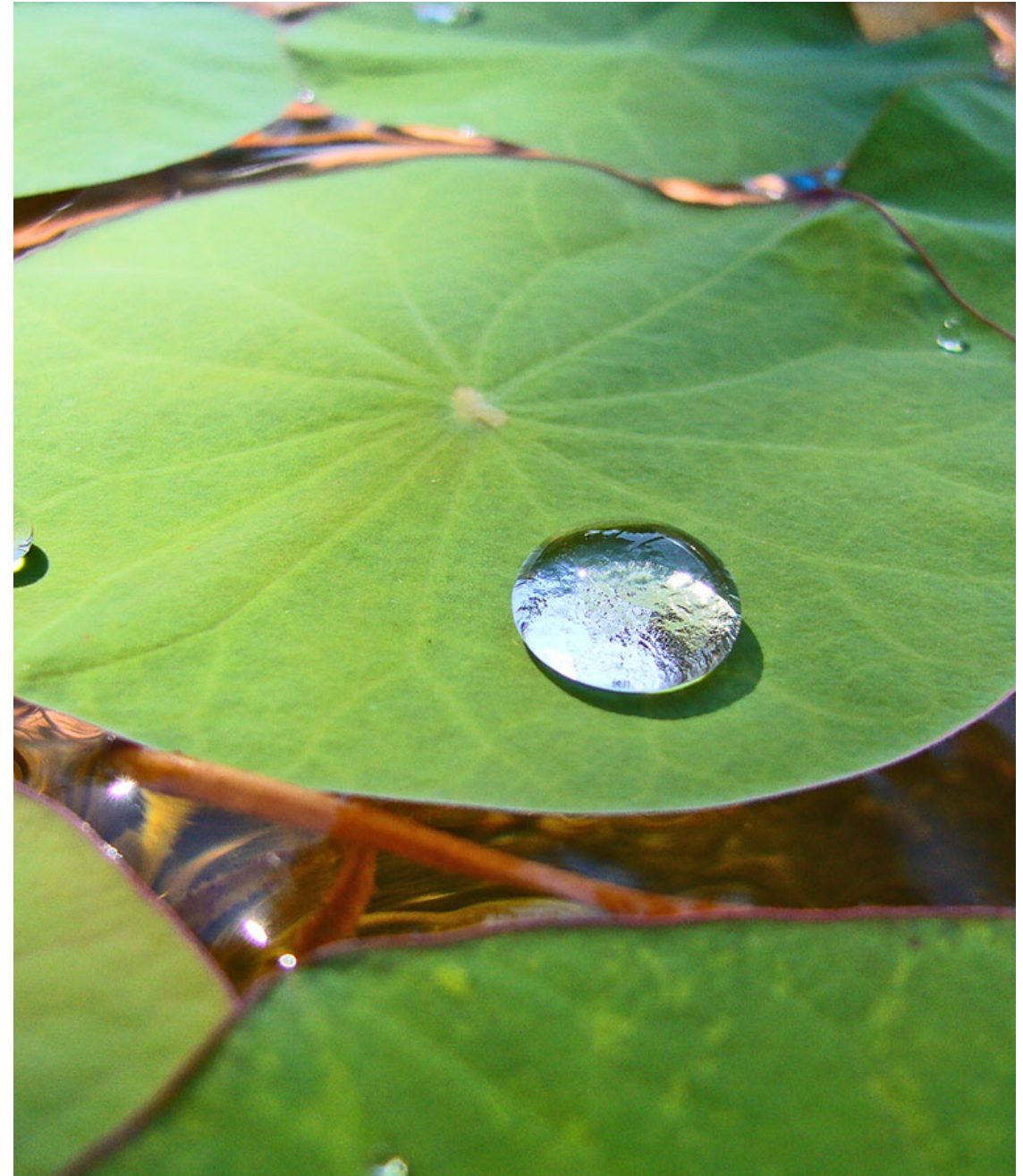
Chlorophyll is a porphyrin-based pigment with a long phytol tail.

This phytol tail happens to be a diterpene, a diterpenoid alcohol, which makes it fat-soluble and so will migrate into the infusing oil.

There are chlorophyll a. and b., with slightly different properties, and deliver the bright green pigment we see in leaves and green plant parts.

The phytol tail, the diterpene alcohol, has antimicrobial & antioxidant properties that aid the healing process.

Chlorophyll b. is somewhat less oil-soluble than a. but contributes similar properties.



color

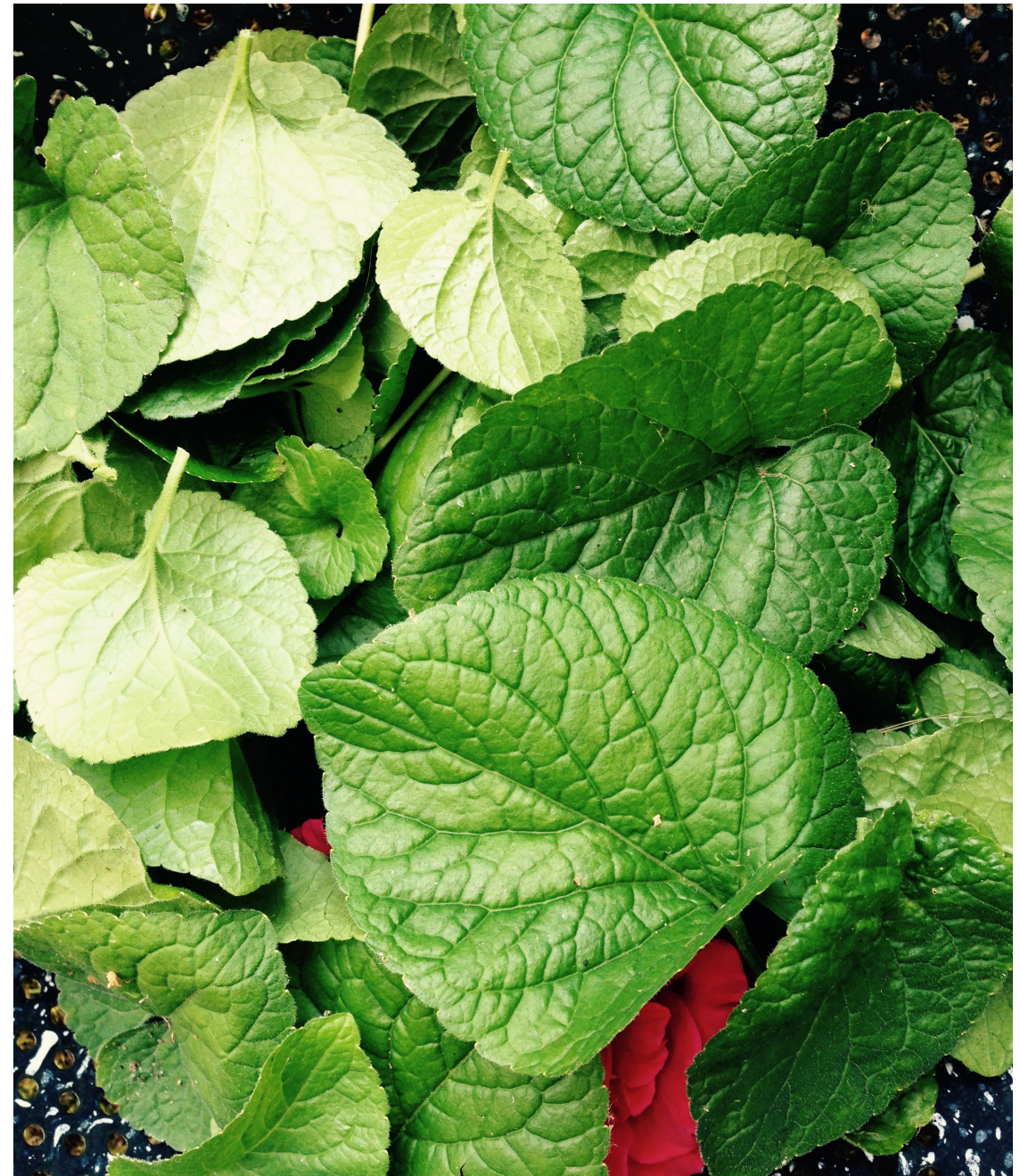
The deep green tint of many infused oils is directly the result of the chlorophyll and pheophytin content.

But there are many greens, from springtime, bright apple green to deep olive and even a blue-tinted dark green, just a few.

The color variations are due to the loss of magnesium as the plant compound degrades by heat or acid, but the chlorophyll retains its antioxidant activity.

Pheophytin is an altered chlorophyll-derived compound that forms when chlorophyll loses its central magnesium ion (Mg^{2+}) as it degrades over time.

It is still oil-soluble and bioactive, and it often appears as a slightly more olive or brownish-green pigment in infused oils.



active properties

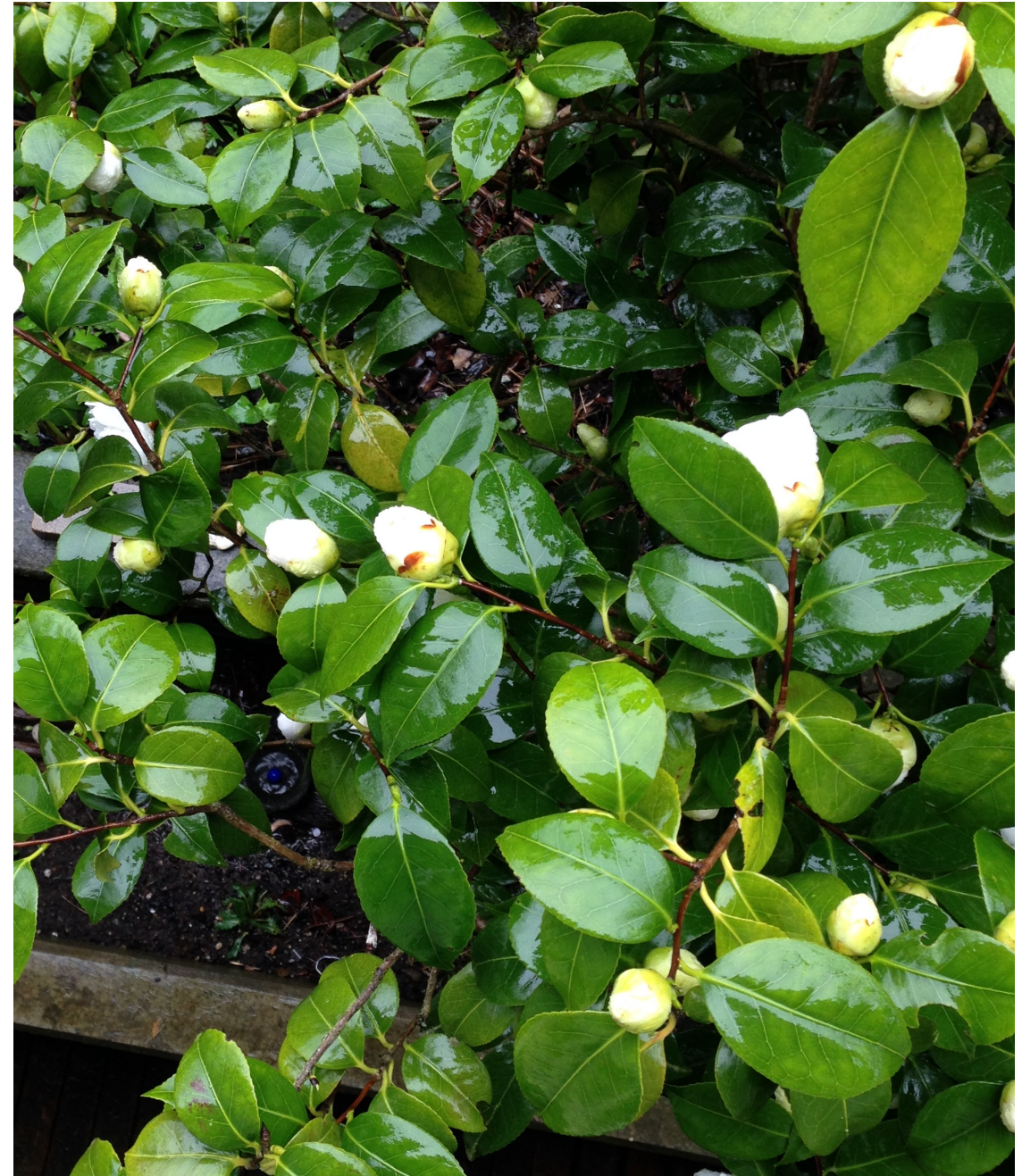
The active properties of chlorophyll include antioxidant activity and scavenging free radicals. In addition, it can help protect the infusing oil from oxidation..

It is antimicrobial, which is an action of pheophytin and phytol compounds, inhibiting bacterial growth on the skin.

Considered to be purifying and cleansing, chlorophyll helps reduce odors and cleans the skin.

Its photo effects include absorbing light and may improve the skin's response to light, but it is not a sunscreen.

It is wound healing and anti-inflammatory, reducing redness and promoting tissue repair.



polysaccharides, sugars

Polysaccharides are the various sugars and mucilages present in plants that offer soothing properties for the skin.

They have a range of beneficial effects for the skin, especially when infused into oils.

Polysaccharides help to moisturize and hydrate the skin, support the skin's barrier function, and improve its resilience, promoting long-lasting hydration.

They are generally water-soluble, but migrate into oil infusions due to their ability to interact with oils in certain conditions.



cellulose

Polysaccharides are complex carbohydrates made up of long chains of monosaccharides (simple sugars) linked together and include related substances like mucilage, cellulose, and other sugar polymers.

While cellulose is not soluble in oils or water, it is an essential structural polysaccharide in plants' cell walls, as it is in calendula flowers.

While the polysaccharides do not dissolve directly in the oil, they can diffuse into the oil.

Their presence in the oil is not one of dissolving but a form of cohabiting with the lipid compounds.



particle suspension

Flowers are permeable, so the mucilage and other water-soluble plant compounds leach out from the plant cells and into the oil.

This migration happens because of the difference in solubility.

While mucilage doesn't dissolve in the oil, it can still be released from the plant cells and live suspended in the oil, able to deliver its benefits for the skin.

Mucilage and other polysaccharides end up as small suspended particles in the oil, giving the oil a slightly viscous, moisturizing, and smooth feel.

In the infused oil, the various forms of polysaccharides are soothing, healing, anti-inflammatory, and retain moisture in the skin, protecting the skin barrier function.



enhancing migration

Enhancing migration of the water-soluble polysaccharides, using solvents like ethanol or glycerin, can help.

Solvents can dissolve or disperse the polysaccharides, making them easier to integrate into the oil-based infusion.

Ethanol is often used in herbal extractions because it can dissolve both water-soluble and oil-soluble compounds, helping move compounds that may not dissolve, but remain suspended in the oil.

Glycerin is another solvent, and it has a strong affinity for polysaccharides.

When used in small amounts during the infusion process, it can help draw the polysaccharides into the oil.

And using heat during the extraction process can also help with the migration of polysaccharides.



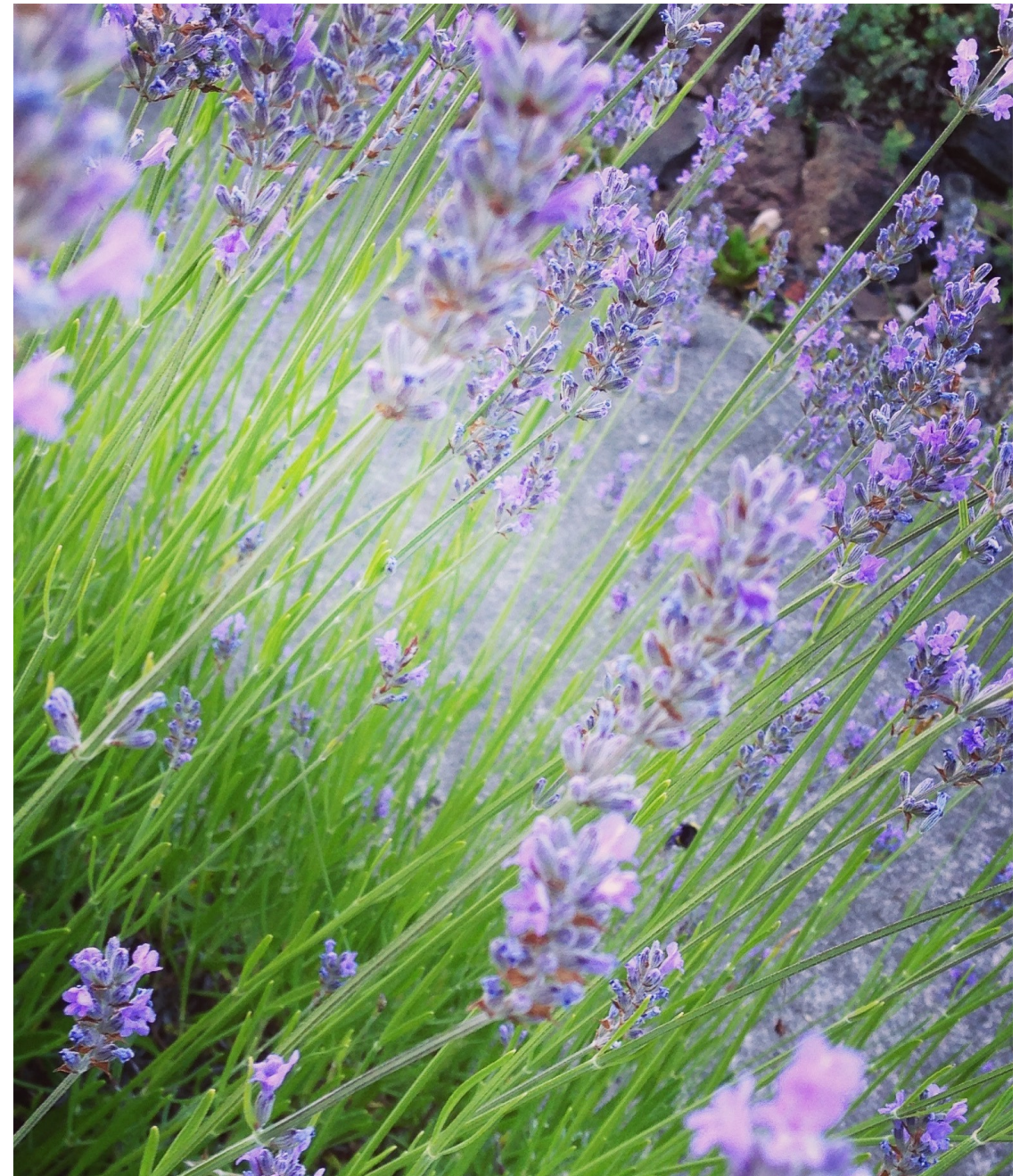
volatile compounds

Volatile compounds of the plants - those compounds that, when distilled, would be essential oils - are also part of the healing properties of the oil infusing process.

If not separated from the plant by distillation, these are volatile compounds, with a wide range of compounds that contribute to the process of healing.

Monoterpenes and sesquiterpenes, citral, geranial and neral, citronellal, limonene, α -pinene, β -caryophyllene, linalool, and linalyl acetate are just a few of what we find in the plant's leaves, flowers, and other parts.

This is too large a subject for this study, and is covered in essential oil chemistry. We can acknowledge these compounds as they occur in plants that we infuse into oils.



Coumarins are the scent of freshly mowed grass and sweet grass, aromatic compounds widely found in plants, where they act as UV-absorbing agents and fragrance compounds.

Umbelliferone, found in lavender, chamomile, and citrus peels, is mildly UV-absorbing and an antioxidant.

Herniarin, found in chamomile and lavender, It is anti-inflammatory and less reactive than furano-coumarins.

Psoralen / Bergapten, this group also includes compounds that require caution in use due to their photo-toxicity.

Citrus oils like bergamot and psoralen of bakuchi seed oil, *Psoralea corylifolia* can be photo toxic.

Chamomile flowers

coumarins



coumarins

Coumarins are not common compounds in the plants we are covering, but they are phenolic compounds with notable effects on the skin and body. Coumarins help calm itching and may support skin in healing processes

Umbelliferone is antioxidant, absorbs UV light, especially UVB, and supports cell protection. - can absorb UVB wavelengths (~300 nm) and may help shield cells from UV-induced damage. It's not a sunscreen, but contributes to photostability in infused oils

Herniarin Methoxylated coumarin, is anti-inflammatory, mildly antimicrobial, and softens the skin. reduces inflammatory mediators in irritated or sensitized skin.



cuticular waxes

Cuticular waxes are a complex mixture of compounds found on the surface of plant tissues, primarily acting as a protective barrier against water loss, pathogens, and environmental stresses.

The cuticle is the outermost layer of a plant, and its waxes help the plant retain moisture and protect it from harmful agents. These are, for the most part, lipophilic and migrate into the infusing oil.

Triterpenoids, ursolic acid, oleanolic acid

Phyto sterols, β -sitosterol, campesterol

Fatty acids & esters, jojoba is an ester

Flavonoids-wax-associated - luteolin, apigenin

Long-chain alcohols



herbs with cuticular waxes

Many, if not all, plants possess cuticular waxes that contribute lipid-soluble compounds that migrate into the infused oil.

These are a few common herbs that have a significant volume of primarily triterpenoid compounds like lupeol and oleanolic acid in their cuticular waxes.

Chamomiles, *Matricaria chamomilla*, German chamomile
Chamaemelum nobile, Roman chamomile

Calendula, *Calendula officinalis*

Plantain, *Plantago major*

Violet leaves *Viola odorata*

Lamiaceae, mint botanical family

Lavender, *Lavandula spp.*

Lemon Balm, *Melissa officinalis*

Rosemary, *Rosmarinus officinalis*

Sage, *Salvia officinalis*



Hypericin is a naphthodianthrone pigment that gives St John's wort oil its distinctive deep red color.

Found in the tiny glands on the leaf and flower margins, it is better extracted into alcohol but migrates into the infusing oil with a slow sun infusion.

The hypericin in St John's wort is an antiviral, able to slow the spread of viral conditions and minimize painful sores.

Hypericin absorbs UV light and generates reactive oxygen species (ROS) to kill microbes and viruses on the skin, thereby helping to sterilize wounds and infections.

It is anti-inflammatory and helps reduce inflammation of the nerves, which is why it helps alleviate conditions like sciatica and shingles.

St. John's wort infusing

hypericin



hyperforin

Hyperforin functions as an antibacterial, anti-inflammatory, and wound-healing agent, able to modulate inflammation by reducing pro-inflammatory cytokines.

Hyperforin also stimulates keratinocyte differentiation, facilitating skin barrier repair, and supports lipid production in the skin, thereby improving moisture retention and resilience.

Supports wound healing by stimulating re-epithelialization to close wounds more quickly, promoting the migration and proliferation of skin cells.

Antibacterial activity: prevents secondary infections, particularly against Gram-positive bacteria.

St. John's wort



allantoin

Allantoin, known for its cell proliferation and wound healing, is a derivative of uric acid.

It is water-soluble and slightly amphiphilic, meaning it can migrate in small but functional amounts into carrier oils when using fresh or wilted plant material.

Also found in chamomile, wheat germ, plantain leaf, and aloe vera, though it is most often associated with comfrey, *Symphytum officinale*, a plant also known as kintbone.

Allantoin stimulates cell turnover, wound healing, and scar remediation.

It has moisture-retaining actions, helping the skin retain water, working as a mild humectant.

It is soothing and anti-irritant, calming tissues and irritations, and is a great healing compound.

Comfrey flowers



for now...

This course survey is by no means the end of plant compounds that migrate into the oils we infuse into.

But we will take a breath and come back later to add to this study of plants for use on the skin.

There is far more chemistry to master and compounds that interact to make even more complex actions.

This is a project that could take several lifetimes to complete, but we want to use the information, so we begin now, and can add more in time.



