Illustration:

Morning Glories, *Ipomoea* spp.
Illustration:

TR: Alfalfa, Medicago sativa [NGS/SWSBM]
BR: Biochanin A, one isoflavone found in Alfalfa leaves; genistein & daidzein are also present.

Isoflavones are a type of polyphenol.
Saponins are classified as triterpenoids.
For more information on phytoestrogens, see:
http://www.herbalchem.net/phytoestrogens_and_human_health.htm
Illustrations:

L: Bilberry, *Vaccinium myrtillus* [Thomé/Stueber], is closely related to Blueberry.

M: Procyanidin B3 is one kind of proanthocyanidin, which is a kind of flavonoid, which is a kind of polyphenol. Proanthocyanidins are also known as condensed tannins.

TR: Cyanidin, then delphinidin: two common anthocyanidin aglycones; anthocyanidins are a type of flavonoid, which is a type of polyphenolic compound.
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Illustrations:

L: Black Cohosh (*Actea racemosa*) leaf (Appalachian Mountains, Asheville, North Carolina, USA)

R: Cimicifugoside, a triterpene glycoside; it is a type of terpenoid compound.

Black Cohosh reduces LH (luteinizing hormone) activity which is associated with hot flashes.
The plant was traditionally used as an antispasmodic anodyne.
See:
http://www.herbalchem.net/phytoestrogens_and_human_health.htm#Black%20cohosh
Black Walnut

- Black walnut contains naphthoquinones including juglone
- Antibacterial
- Antifungal
- Antiparasitic
- Use topically for fingernail fungus
- Leaf high in tannins & used for eczema

Illustrations:

TR: Juglone, a naphthoquinone, which is a type of quinone, which is a polyphenolic compound.

R: Black Walnut, Juglans nigra, tree & immature nuts (Asheville, North Carolina, USA)

Juglone is responsible for the dark brown stain from Walnut hulls; it is also allelopathic (discourages the growth of competing plants).

Illustrations:
TL: Burdock leaf, *Arctium lappa* (Boulder County, CO, USA)
BL: Burdock seeds

Oligo = short; oligosaccharides are short chains of monosaccharide (simple sugar) units. Some oligosaccharides occur free & others act as the sugar components of glycosides (a glycoside is a molecule with sugar unit(s) attached.

Relative inulin content: Chicory > Burdock > Sunflower roots (Jerusalem Artichoke) > Dandelion > Garlic > Leek, Artichoke > Onion

Lignans in Burdock include arctiin & arctigenin.
Polyacetylenes are related to the tingly isobutylamides in Echinacea, & have activity in the immune system.
Cascara Sagrada

- Aged bark is a mild stimulant laxative
- Cascarosides are one of many anthraquinone glycosides; some of these are also anticarcinogenic
- Excessive use can cause pathological changes in colon mucosa

Illustrations:

L: Cascara sagrada, *Rhamnus purshiana* [Köhler/Stueber]
R: Cascaroside A, one of the anthraquinones in Cascara; it is a type of quinone, which is a type of polyphenol.

The anthraquinone glycosides in Cascara are responsible for the laxative effect.
Cayenne Peppers

- Capsaicin & relatives are powerful topical analgesics: herpetic neuralgia, arthritis
- Diaphoretic, stimulant, rubefacient, antiseptic
- Capsanthin & capsorubin, the red pigments, are powerful antioxidants
- Herb is beneficial to the cardiovascular system

Illustrations:

TR: Cayenne peppers, *Capsicum frutescens* (Boulder County, CO, USA)
BR 1: Capsaicin
BR 2: Capsanthin

Capsaicin, the spicy compound in Cayenne, is sometimes classified as an alkaloid because of its nitrogen atom & its origin from amino acids. Other systems classify it as a phenylpropanoid derivative rather than as an alkaloid. Capsorubin & capsanthin are types of xanthophylls, which are a kind of carotenoid (aka tetraterpene), which is a kind of terpenoid compound.
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Cranberry

- Cranberries are rich in anthocyanins:
  - Cyanidin glycosides
  - Delphinidin glycosides
  - Peonidin glycosides
- Contain glycosides of quercetin
- Lignans also present
- Proanthocyanidins inhibit binding of bacteria to urinary tract epithelium
- Flavonoid extracts inhibit the growth of prostate cancer cells
- Many constituents are antioxidant

Illustrations:
- Background: Dried Cranberries, *Vaccinium oxycoccus* or *V. macrocarpon*
  - TR: Cranberry plant [NGS/SWSBM]

Cranberry contains unique proanthocyanidins that have been demonstrated to inhibit bacterial binding to urinary tract epithelium. Many of these are based on linked epicatechin units.
Illustrations:

TR: Dandelion, *Taraxacum officinale* [NGS/SWSBM]
B: Dandelion blossoms (Boulder County, CO, USA)

Inulin is an oligosaccharide (a type of polysaccharide).
Sesquiterpene lactones – bitter principles – are a subtype of sesquiterpenes, which are a kind of terpene.

Oligo = short; oligosaccharides are short chains of monosaccharide units. Some kinds occur free & others act as the sugar components of glycosides.

Relative inulin content: Chicory > Burdock > Sunflower roots (Jerusalem Artichoke) > Dandelion > Garlic > Leek, Artichoke > Onion
Illustrations:

L: *Echinacea angustifolia* (Gaia Herb Farm, Brevard, North Carolina, USA)

R: *Echinacea purpurea* (Gaia Herb Farm, Brevard, North Carolina, USA)

Immunomodulating polysaccharides are special kinds of polysaccharides, which are long chains of simple sugar units. They are a type of carbohydrate.
Echinacea: Isobutylamides

- Isobutylamides are the ‘tingly’ compounds
- Echinacea purpurea & E. angustifolia have the highest concentrations
- Contribute to immunomodulating effect
- Stimulate phagocytosis
- COX-2 inhibitors (anti-inflammatory)

Illustrations:

M: An isobutylamide from Echinacea; this is a special type of lipid (oil-soluble compound) known as an alkylamide or alkamide. The straight part of the molecule, consisting of consecutive triple C-C bonds, is very unusual in plant chemistry.

TR: *Echinacea purpurea*, full bloom [NGS/SWSBM]
BR: *Echinacea purpurea* flower bud (Gaia Herb Farm, Brevard, North Carolina, USA)

Echinacea has ~12 different alkylamides kinds of (isobutylamides are one type of alkylamide).
High levels of alkylamides accumulate in the roots & flowers of *E. purpurea* & *E. angustifolia*. *E. pallida* has very little; it is sometimes found as an adulterant in commercial Echinacea supplies.

See: http://www.thorne.com/altmedrev/fulltext/ech.html (Kerry Bone)
See: http://www.naturalproducts.org/inpr/mono_html/echin_html/echin_chem1.html
Echinacea: Phenylpropanoids

- Cichoric acid is a derivative of caffeic acid: antioxidant
- Contributes to the immunostimulating effects of Echinacea purpurea

Illustrations:

T: *Echinacea purpurea* (Gaia Herb Farm, Brevard, North Carolina, USA)

B: Cichoric acid

Cichoric acid is a caffeic acid derivative (a type of phenylpropanoid, which is a type of polyphenol), found as a major constituent of *E. purpurea* & a minor constituent of *E. angustifolia*. It contributes to the immunostimulant properties.

See:
http://www.naturalproducts.org/inpr/mono_html/echin_html/echin_chem1.html
Elder

- Anthocyanins (cyanidin, delphinidin), proanthocyanidins & other flavonoids
- Strengthens venous & lymphatic vessels
- Antioxidant
- Antiviral
- Carcinostatic

Illustrations:

L: Elderberries, *Sambucus canadensis* (Louisville, CO, USA)
R: Elder bush laden with berries in the late summer. (Louisville, CO, USA)

Cyanin is a glycoside of cyanidin, delphinin is a glycoside of delphinidin. They are found in Bilberries, Blueberries, Elderberries, Black Cherries, etc. All of these are types of anthocyanins, which are types of flavonoids, which are types of polyphenols.
Feverfew

- Parthenolides are a kind of sesquiterpene lactone
- Inhibit prostaglandin synthesis
- Antispasmodic
- Anti-inflammatory
- Inhibit platelet aggregation
- Feverfew can reduce frequency & severity of migraine attacks

Illustrations:

TR: Parthenolide, a sesquiterpene lactone (a subtype of sesquiterpene, which is a type of terpenoid compound; they are found in essential oils).

BR: Feverfew, *Tanacetum parthenium* (Denver Botanic Gardens, Denver, CO, USA)
Flax Oil

- Essential fatty acid: Alpha-linolenic (ALA), 52 – 60% [Omega 3]
- Essential fatty acid: linoleic (LA), 16 – 18% [Omega 6]
- Oleic acid (monounsaturated), 18 – 20% [Omega 9]
- Saturated: stearic, palmitic, & lauric acids ~ 3% total
- Tocopherols, tocotrienols, phytosterols

Illustrations:

Flax (*Linum usitatissimum*) oil & seeds

Flax is the best source of the essential fatty acid, ALA. Our bodies cannot make this substance, so we must obtain it from the diet. It is important for the production of anti-inflammatory prostaglandins.

See: [http://www.nhir.com/tests/FlaxSeedOil.pdf](http://www.nhir.com/tests/FlaxSeedOil.pdf) (a continuing ed module on Flax)


See: [http://www.ourfood.com/Food_what_is_it.html#SECTION001000100000000000000](http://www.ourfood.com/Food_what_is_it.html#SECTION001000100000000000000) (phytosterol information)
Flaxseed: Lignans

- Flax meal (& high-lignan flax oils) are rich sources of cancer-preventative & hormone-balancing lignans:

Illustrations:

L: Secoisolariciresinol, a lignan, is a type of polyphenol made up of two phenylpropanoid units.

R: Matairesinol is closely related to secoisolariciresinol, but occurs in smaller amounts.

Flax is also the best dietary source of these two lignans. They have a mild phytoestrogenic effect & can help prevent cancers.
Garlic

- Fresh Garlic is a powerful antimicrobial
- Strengthens immune system
- Helps lower blood pressure
- Normalizes blood lipid profiles
- Inhibits platelet aggregation
- Antioxidant
- Antifungal
- Anticarcinogenic
- Anti-inflammatory

Illustrations:

TR: Allicin, the antimicrobial sulfur compound in Garlic.
BR: Garlic, *Allium sativum*

The sulfur compounds in Garlic are all derived from the amino acid, cysteine. Sulfur gives them their spiciness & pungent smell. These compounds are classified as amino acid derivatives.

See: www.herbalchem.net (Garlic pages are in the archives) for detailed information on Garlic chemistry.
Garlic: Sulfur Compounds

- Alliin (stable compound in Garlic) +
- Alliinase (an enzyme in fresh, whole Garlic or correctly dried Garlic powders)
- Crushing cells mixes these, & → allicin, the active antimicrobial compound
- Allicin → sulfides, ajoene, dithiins, etc.

Illustrations:

L: Alliin, a precursor of allicin.
M: Alliinase, the enzyme which mixes with alliin when Garlic is crushed, & transforms it into allicin.
R: Allicin, the spicy, pungent antimicrobial compound. Allicin is rather unstable, & transforms itself into sulfides (if in air or water) & if in oil, ajoenes & dithiins.

See: www.herbalchem.net (Garlic pages are in the archives) for detailed information on Garlic chemistry.
Illustrations:

TL: Alliin: a cysteine sulfoxide, parent of allicin
TM: Allicin: an antimicrobial compound; breaks down over time
TR: Diallyl disulfide: cardiovascular benefits; sulfides are formed in water & air

BL: Garlic, *Allium sativum*
BR: Vinyl dithiins, formed when Garlic is macerated in oil (ajoenes are also formed in oil)

See: www.herbalchem.net (Garlic pages are in the archives) for detailed information on Garlic chemistry.
Ginger

- Gingerols make up the resinous fraction – the main pungent constituents of Ginger
- Anti-inflammatory
- COX-2 inhibitors
- Antiemetic
- Antioxidant

Illustrations:
- L: Ginger (Zingiber officinalis) root
- R: Ginger plant [Köhler/Stueber]
  Structure: [6]-gingerol; it occurs with many other similar compounds.

Gingerols are not volatile (not part of the essential oil). When Ginger is dried, they transform into shogaols.

Many other compounds in Ginger contribute to its medicinal actions, including monoterpenes & sesquiterpenes in the essential oil.

COX-2 stands for cyclo-oxygenase 2, an enzyme that mediates the inflammatory process; so COX-2 inhibitors are anti-inflammatory.
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Ginkgo

- Neuroprotective
- Aids circulation in extremities
- Enhances memory
- Antioxidant
- For cerebral insufficiency
- For intermittent claudication
- Standardized extract best
- Flavonoids & diterpenes work synergistically

Illustration:
Ginkgo biloba [Photo © Martin Wall, http://www.herbslides.com/]
Illustration:  

\begin{center}
\textit{Ginkgo biloba} leaves
\end{center}

Besides flavonols, Ginkgo contains proanthocyanidins (a type of flavonoid, which is a type of polyphenol).

Diterpenes in Ginkgo

- Ginkgolides A, B, C, J, & M are diterpene lactones
- Compounds unique to Ginkgo biloba
- Synergistic with the flavonoids (flavonols, proanthocyanidins) for anti-inflammatory effect
- Bronchodilators; used for asthma

Illustration:
Ginkgolide A, one of the diterpene lactones in Ginkgo. It is a type of terpenoid.

Illustration:

Asian Ginseng, *Panax ginseng*. American Ginseng is *Panax quinquefolius*.

Ginsenosides & quinquesosides are types of steroidal saponins. They are ‘steroidal’ because they are based on a steroid nucleus that is very similar to the nucleus of steroidal hormones in humans. They are quite similar to triterpenoid saponins, a type of terpenoid glycoside.

‘Panax’ comes from Greek, pan (all) & akos (cure).
Illustrations:

L: Goldenseal plants, *Hydrastis canadensis* (Eagle Feather Farm, Madison County, NC, USA)
R: Oregon Grape berries, *Mahonia aquifolium* (Denver Botanic Gardens, Denver, CO, USA)

The roots of both of these plants are bright yellow because of berberine-type alkaloids. These alkaloids are a subtype of the isoquinoline alkaloids.
Alkaloids in Goldenseal

- Berberine (yellow, bitter)
- Berberastine
- Hydrastine

Illustrations:

L: Hydrastine, an alkaloid from Goldenseal (*Hydrastis canadensis*)

Berberine is a water-soluble alkaloid, which will extract in water infusions. Hydrastine is soluble in alcohol/water, so it extracts in tinctures. Both of these yellow alkaloids are bitter, antimicrobial compounds.
Alkaloids in Mahonia

- Berberine & relatives predominate
- Some hydrastine
- Actions very similar to Goldenseal

Illustrations:

L: Berberine, a water-soluble yellow alkaloid
R: Oregon Grape (*Mahonia repens*) flowers (Boulder County, CO, USA)

Oregon Grape root can be used instead of Goldenseal, which has been over-harvested & is becoming very rare.
Grape seed extract is quite similar to Pycnogenol®; both contain mainly OPCs. There are many different kinds of OPC’s; the illustration is just one type. These molecules are made up of linked units of catechin or epicatechin, which are flavonols, which are a type of flavonoid. All of these are polyphenolic compounds. OPCs are also known as condensed tannins.
Illustrations:

TR: Hawthorne (Crataegus spp.) [NGS/SWSBM]
BR: Hawthorne berries (Denver Botanic Gardens, Denver, CO, USA)

Hyperin (aka hyperoside; quercetin-3-galactoside) is also found in St. Johnswort (Hypericum perforatum). It is a type of flavonol glycoside, which is a type of flavonoid, which is a type of polyphenol.
Kava Kava

- Kavapyrones (aka kavalactones)
- Contribute to the relaxant, antispasmodic, analgesic & anxiolytic properties of Kava

Illustrations:

R: Kava Kava, Piper methysticum [Photo © Martin Wall, http://www.herbslides.com/]

L: Methysticin, a kavalactone, is a type of styrylpyrone, which is a type of polyphenolic compound; other kavalactones include yangonin & kavain.
Licorice

- Contains chalcones, relatives of flavonoids
- Licochalcones: anti-parasitic: leishmania, malaria...
- A glycoside of isoliquiritigenin inhibits aldose reductase & MAO
- Butein & isoliquiritigenin stop growth of melanoma cells in vitro

Illustrations:

TR: Licorice, *Glycyrrhiza glabra* [Thomé/Stueber]
BR: Isoliquiritigenin, a chalcone, which is a type of polyphenolic compound.

See:
Licorice

- Liquiritigenin (a flavonoid) & its glycoside, liquiritin, contribute to the anti-inflammatory & antispasmodic action of Licorice
- May also be involved in ulcer-healing properties
- Antimicrobial
- MAO inhibitor

Illustrations:

TR: Liquiritigenin, a flavanone, which is a type of flavonoid, which is a type of polyphenol.

BR: Candy made with Licorice (Glycyrrhiza glabra) extract.

The yellow color of Licorice root is due to its flavonoids.
Illustrations:

TR: The Moon, which may have nothing to do with Licorice, but looks pretty there.

BR: Licorice, *Glycyrrhiza glabra* [Köhler/Stueber].

Triterpenoid saponins are usually anti-inflammatory compounds, & are found in most herbs used for arthritis, joint inflammation, etc. They are a type of terpenoid.
Lobeline & its relatives (lobelanine & lobelanidine) are found in Lobelia (*Lobelia inflata*). Lobeline is a respiratory stimulant acting on the brain centers & carotid chemoreceptors that regulate breathing; also a bronchodilator & antispasmodic for asthma & bronchitis. It stimulates nicotinic receptor sites, so the herb is traditionally used to help reduce nicotine cravings. Large doses are emetic & toxic. For Éclectic usage see: http://www.ibiblio.org/herbmed/eclectic/kings/lobelia.html
Illustrations:

L: Marsh Mallow, *Althea officinalis* [SWSBM]

R: Other Mallow species (T, from the Southern California desert; B, from the Front Range in Colorado) are also mucilaginous.

Mucilage is a type of heteropolysaccharide, which is a type of carbohydrate. The original "marshmallows" were actually made by boiling down the sweet mucilage of the Marsh Mallow. Okra is a mallow.
Lignans in Milk Thistle

- Silymarin is a mixture of several flavonolignans – hybrid molecules made of a flavonoid + a lignan
- Silybin, silydianin, silychristin
- Hepatoprotective, antioxidant, protects cell membranes
- Regenerative tonic for the liver

Illustrations:

TL: Milk Thistle (*Silybum marianum*) flower (Denver Botanic Gardens, Denver, CO, USA)

BL: Silybin, one component of silymarin; silydianin & silychristin are others. Technically, these molecules are made of a phenylpropanoid unit bonded to a flavonol unit; both of these are types of polyphenols.
Illustrations:

Background: Nettles, *Urtica dioica* (Marmaton River, Fort Scott, KS, USA)

Insets: Formic acid, Histamine, & Nettle stingers.

Formic acid is an organic acid that is also found in ant stings. Histamine is a mediator of the inflammatory process; in the human body, it is released during allergic reactions & causes itching, swelling, redness, etc. Nettle stingers are hollow tubes made from silica; they release their chemicals when brushed against. Fresh Nettle stings are an effective palliative treatment for arthralgia.
Illustrations:

L: Plantain, *Plantago major* [Thomé/Stueber]
R: Aucubin, an iridoid, which is a subtype of monoterpene, which is a type of terpenoid compound)

Plantain poultice or salve is remarkably effective as a topical antiseptic.
Psyllium seed – bulk fiber – not digested or degraded by colon bacteria; has a moderate cholesterol-lowering effect; helps prevent colon cancer

Plantain leaf – heteroxylans type mucilage is emollient, soothing; excellent for wounds & burns

Illustrations:
TR: Seed capsules of Plantain (Louisville, CO, USA)
BR: Broad-leaf Plantain, *Plantago major* (Asheville, NC, USA)

Psyllium seed (from *Plantago* spp.) contains mucilage (a type of dietary fiber) that is not degraded by the digestive process or by colon bacteria; hence it survives to have a mechanical effect on intestinal motility. It also brings about a modest decrease in serum cholesterol levels, perhaps by increasing fecal elimination & decreasing intestinal resorption of bile acids & cholesterol.

Plantain leaf is soothing, mildly astringent, & antiseptic.

Plantain leaves also contain a type of mucilage known as heteroxylans, which contains units of the simple sugar, xylose, along with other simple sugars.
Polyvalent Plantain

- Antiseptic: aucubin
- Astringent, drawing: tannins
- Anti-inflammatory: flavonoids, iridoids

Skin healing: mucilage, allantoin, tannins, sorbitol

Illustrations:
L: English or Narrow-leaf Plantain, *Plantago lanceolata* (Asheville, NC, USA)
TR: Aucubin, an antiseptic iridoid glycoside.
BR: Broad-leaf Plantain, *Plantago major* (Asheville, NC, USA)

Polyvalent: having multiple modes of action.
*Plantago major* & *P. lanceolata* contain:
Iridoids: aucubin [0.3-2.5%], catalpol [0.3-2.1%], asperuloside; these are subtypes of monoterpenes, which are types of terpenoids.
Flavonoids, which are polyphenols.
Phenolic acids, another kind of polyphenol.
Phenylpropanoid glycosides, another kind of polyphenol.
Tannins are also known as proanthocyanidins, & are a kind of flavonoid, which is a kind of polyphenol.
Mucilage is a type of heteropolysaccharides containing many linked sugar units.

References:

Red Clover Blossoms

- Nourishing hormone balancer
- Has been used as an anticancer herb for generations
- Blood purifier for chronic skin disease; alterative
- Mineral tonic; may help prevent osteoporosis
- Flowers contain flavonoids

Illustration:

Red Clover, *Trifolium pratense* [Lindman/Stueber]
Red Clover: Isoflavones

- Biochanin A
- Formononetin
- Concentrated in the leaves; very little in flowers
- Biochanin A is metabolized to genistein
- Formononetin is metabolized to daidzein
- Genistein & daidzein are the isoflavones in Soy

Illustrations:
R: Red Clover, *Trifolium pratense* (Asheville, NC, USA)

Structures:
L: Biochanin A, an isoflavone from Red Clover leaves.
R: Formononetin, another isoflavone from Red Clover leaves.

The isoflavones are a type of polyphenol.
Red Clover: Isoflavones

- Biochanin A
- Formononetin
- Concentrated in the leaves; very little in flowers

Isoflavones are hormonally active communications molecules; cardioprotective

Illustrations:
R: Red Clover, *Trifolium pratense* (Asheville, NC, USA)

Structures:
L: Biochanin A, an isoflavone from Red Clover leaves.
R: Formononetin, another isoflavone from Red Clover leaves.

The isoflavones are a type of polyphenol.
Illustrations:

L: Rosemary, *Rosmarinus officinalis* [Köhler/Stueber]

M: Carnosol, a phenolic diterpene. Diterpenes are a type of terpenoid compound.

R: Sage, *Salvia officinalis* [Köhler/Stueber]
Rosemary: Monoterpenes

- Cineole, a monoterpane, can represent up to 60% of the essential oil
- Strong antiseptic, anthelmintic, & expectorant

Illustrations:

L: Cineole, a bicyclic monoterpane, which is a type of terpenoid found in essential oils.
R: Rosemary, *Rosmarinus officinalis* (Asheville, NC, USA)
Phenylpropanoids in Rosemary

is also found in Peppermint, Sage, Thyme, Oregano, Lemon Balm, Basil, Borage, & Comfrey

Illustrations:

TL: Rosemary (*Rosmarinus officinalis*) flower [Köhler/Stueber]
BL: Rosemary sprig
R: Rosmarinic acid, a dimeric phenylpropanoid
   Spotlight 1: Phenolic rings
   Labels: Propanoid region (3 carbons)
   Spotlight 2: Carboxylic acid moieties

See:
Phenylpropanoids in Rosemary

- Rosmarinic acid
- Chlorogenic acid
- Caffeic acid

- Extracts used in many antioxidant formulas
- Food preservation
- Powerful antioxidant constituents

Illustrations:
TL: Rosemary (*Rosmarinus officinalis*) flower [Köhler/Stueber]
BL: Rosemary sprig
R: Rosmarinic acid, a dimeric phenylpropanoid
   - Spotlight 1: Phenolic rings
   - Labels: Propanoid region (3 carbons)
   - Spotlight 2: Carboxylic acid moieties

See:
Phenylpropanoids in Rosemary

Rosmarinic acid

• Antioxidant
• Anti-inflammatory
• Antiviral (herpes)

Illustrations:
TL: Rosemary (*Rosmarinus officinalis*) flower [Köhler/Stueber]
BL: Rosemary sprig
R: Rosmarinic acid, a dimeric phenylpropanoid
   Spotlight 1: Phenolic rings
   Labels: Propanoid region (3 carbons)
   Spotlight 2: Carboxylic acid moieties

See:
Illustration:

Background: Sage, *Salvia officinalis*
R: Thujone, a monoterpane found in Sage, is also in Wormwood (*Artemisia absinthium)*.

Phenylpropanoids are a type of polyphenolic compound.
Diterpenes are a type of terpenoid compound.
Thujone is a monoterpane, which is a type of terpenoid.
Cineole is also a monoterpane.
Proanthocyanidins are a type of flavonoid, which is a type of polyphenolic compound.
St. Johnswort

- Antiviral
- Liver tonic
- Detoxifying
- Increases drug clearance from liver
- Antidepressant, anti-anxiety
- ‘Arnica for the nerves’
- Oil is used for burns

Illustration:

R: St. Johnswort, *Hypericum perforatum* [NGS/SWSBM]
St. Johnswort: Synergy

- St. Johnswort extracts were originally standardized to hypericin content
- Later, hyperforin was correlated to antidepressant activity
- Latest research shows flavonoids are important synergists

Illustrations:

L: Hypericin, a type of anthraquinone derivative known as a bianthraquinone or naphthodianthrone (which are types of polyphenols); this is the compound that makes *Hypericum* oil red.

M: Hyperforin, a type of phloroglucinol derivative, which is an unusual type of polyphenolic compound.

R: St. Johnswort, *Hypericum perforatum* [NGS/SWSBM]
Illustrations:

TR: Norathyriol, a type of xanthone, which is a type of polyphenol.
BR: St. Johnswort, *Hypericum perforatum* (Boulder County, CO, USA)
Saw Palmetto Berries

- Lipidosterolic extract: 85 – 95% fatty acids & phytosterols
- Activity in total oil-soluble fraction: synergistic
- BPH, has anti-androgenic effect
- Anti-inflammatory effect may be due to inhibition of local prostaglandins

Illustration:


Lipidosterolic means that the extracts contains both lipids (fatty acids) & phytosterols or plant steroidal compounds. The concentrated extract of these oil-soluble substances is best. A CO$_2$ extract will not have traces of potentially harmful solvents.

No one constituent has been singled out as the ‘active ingredient.’
Illustrations:

- Background: Turmeric powder
- TL: Turmeric, *Curcuma longa* [Raimondi]

Curcuminoids are a special class of polyphenols found in Turmeric.
Turmeric: Curcuminoids

Curcumin, from Turmeric, is a type of polyphenol; it is responsible for many of the herb’s healing properties.

Illustration:

Curcumin, one of the curcuminoids. It is a type of polyphenol known as a ‘diarylheptanoid.’
Illustrations:

L: Valtrate (valtratum), a free (non-glycoside) iridoid. Iridoids are a special type of monoterpenes, which are a type of terpenoid compound.

R: Valerian, *Valeriana officinalis* [NGS/SWSBM]

The sedative sesquiterpenes in Valerian include valerinic acids. Sesquiterpenes are another kind of terpenoid compound.

No one constituent has been identified as the ‘active ingredient’ of Valerian.
Valerian: Sesquiterpenes

Valerenic acid: an antispasmodic sesquiterpene in the volatile oil that contributes to the relaxant effect

Illustrations:

L: Valerenic acid, a bicyclic sesquiterpene. Sesquiterpenes are a kind of volatile terpenoid compound.

R: Valerian, Valeriana officinalis (Denver Botanic Garden, Denver, CO, USA)