

SPICES and HERBS

Spices and Herbs - Plant Chemistry

- Secondary plant molecules
- Essential oils
 - Terpenes
- Discourage herbivores (insects)
- Inhibit fungal and bacterial pathogens
- Attract pollinators

Spices and Herbs - Uses


- No caloric value
- Flavor foods
- Mask odor of unpleasant foods
- Antibacterial agents (cloves, mace, and garlic)
- Nutritional components (vitamins)
- Health (garlic lowers blood pressure)
- Physiological high (hot peppers)
- Religious ceremonies and embalming

Ginger, Cloves and Nutmeg

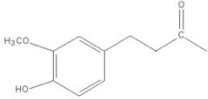
- Nutmeg isoeugenol
- Cloves eugenol
- Ginger zingerone

Ginger, Cloves and Nutmeg

Cloves eugenol ■ Nutmeg isoeugenol



Ginger zingerone



The image shows three chemical structures. The top left is Cloves eugenol, a benzene ring with a methoxy group (H3CO) at the 1-position, a hydroxyl group (HO) at the 3-position, and an allyl group (-CH2-CH=CH2) at the 4-position. The top right is Nutmeg isoeugenol, a benzene ring with a methoxy group (H3CO) at the 1-position, a hydroxyl group (HO) at the 3-position, and a propenyl group (-CH=CH-CH3) at the 4-position. The bottom structure is Ginger zingerone, a benzene ring with a methoxy group (H3CO) at the 1-position, a hydroxyl group (HO) at the 3-position, and a propyl chain with a ketone group (-CH2-CH2-C(=O)-CH3) at the 4-position.

History of the Spice Trade

- India
 - Pepper
 - Ginger
 - Cinnamon
 - Cardamom
- Spice Islands
 - Nutmeg
 - Mace
 - Cloves

History of the Spice Trade

- Greeks expanded trade routes
- Alexandria became the spice trade center
- Rome introduced them to Europe
- Arab control during European middle age
- Crusades and Venice as trade center
- Portuguese open sailing trade routes

History of the Spice Trade

- Clove and nutmeg trade dominated by Portuguese
- Spain conquers Portugal, control trade
- Dutch evicted Spanish and Portuguese from Moluccas
- Bandanese rebellion was crushed Dutch
- Treaty with England
 - Dutch control nutmeg trade Banda Island of Ran for Manhattan (New Amsterdam to New York)

Pepper?

- Black pepper *Piper nigrum*
 - Most widely used spice
 - India
 - Dried berries
 - Active chemical piperine

Pepper?


- Chili pepper *Capsicum sp.*
 - New World
 - Columbus to Spain
 - Portuguese to Africa, India and to Asia within 50 years
 - East to Europe
 - Never reached economic value as spices
 - Easy to grow

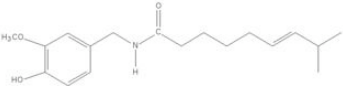
Chili Pepper

- More nutritious than black pepper (vitamin C)
- Capsaicin (cap sa i cin)
- Chemicals activate pain receptors

Pepper

- Piperine


- Capsaicin



Chili Peppers

Chili Pepper	Scoville Units
Sweet Bell	0
Poblano	1,000 - 2,000
Anaheim	500 - 2,500
Jalapeno	2,500 - 8,000
Chipolte	5,000 - 8,000
Serrano	8,000 - 22,000
Tabasco	30,000 - 50,000
Cayenne	30,000 - 50,000
Habanero	100,000 - 325,000
Naga Jolokia	800,000- 1,000,000
Pure capsaicin	15,000,000

Saffron - *Crocus sativum*

- Stigmas of fall crocus
- Most expensive spice
 - 9,000-12,000 flowers/ounce
 - \$240/ounce
- Propagated by corms
- Yellow dye
- Spice used in bouillabaisse, paella etc.

Vanilla *Vanilla planifolia*

- Tropical forests of Mexico and Central America
- Fruit pod (bean) of orchid vine
- Pollination
 - Bees and hummingbirds
 - Hand pollinated 1,500/day
- Aztec culture
- Madagascar major producer today

Vanilla *Vanilla planifolia*

- 250-500 molecules in vanilla bean
- Pollination to processing 18 months
- Most labor intensive spice
- Curing and drying in sun or ovens
- Turns brown and oily
- Vanilla extract
- Artificial vanilla
 - Polypropylene glycol, Coumarin

Herbs

- Leaves, flowers of herbaceous plants
- Flavor
- Teas
- Medicinal

Herbs

- Basil
- Mint
- Rosemary
- Thyme
- Cilantro
- Oregano
- Bay laurel
- Chamomile

Hydrogels, Latexes, & Resins

Sticky substances from various plants parts
Used for thousands of years

Hydrogels

- Solution thickens when mixed with water
- Gums (old world)
 - Polysaccharides of arabinose, galactose
 - Prevent ice crystal formation in frozen foods
 - Thicken sauces, toothpaste, textiles
 - Gum Arabic - Africa
- Starch
 - Gravies, creams, cardboard
- Pectin
 - Thicken jellies

Latexes

- New World
- A mixture of organic molecules
- Most have elastic properties
- Laticifers
 - Cells or tubes of cells

Rubber *Hevea brasiliensis*

- Rubber essential component in civilizations last 150 years
- Tires, waterproofed clothes, soles on shoes, rubber bands, etc.
- Fortunes have been made and lost
- Politics, thievery, poor working conditions

Hevea brasiliensis

- Euphorbiaceae Family
- Amazonian natives covered feet with latex or Caoutchouc
- Spanish in South America dipped cloaks and hats for waterproofing
- John Priestly in 1770 coined rubber for latex since it rubbed out pencil mistakes

Rubber *Hevea brasiliensis*

- 1783 an aristocrat ballooned across Paris with silk coated with rubber
- Garters, waistbands, gloves in Europe
- 1823 Charles Macintosh
 - Rubber soluble in Hexane
 - Could be shipped
 - Applied to fabric Macintosh or slicker
- Rubber decayed and smelled
- Stiff and inelastic when cold
- Smelly and sticky when warm

Charles Goodyear

- Inventor 1839
- Vulcanized rubber with heat and sulfur
- Tough elastic and stable
- Poor businessman
- Lost patents in England and France
- Bankrupted
- Changed world
- Wartime

Rubber *Hevea brasiliensis*

- Rubber barons in Amazon held monopoly on rubber 1870 -1920
 - Extravagant wealth mansions, opera house, fancy carriages
 - Indentured laborers (indebted bondage)
- Henry Wickham - British 1876
- 70,000 seeds from Amazon to England
- 2,000 seedlings to Sri Lanka
- South American Leaf Blight

Hevea brasiliensis

- Rubber plantations
- British in in Sri Lanka, Malaysia
- Dutch in Indonesia
- Belgian in Congo
- WW II Roosevelt synthetic rubber

Chewing gum

- Chicle from sapodilla tree
- Chicleros
- Santa Anna
- 2 tons to NY
- Thomas Adams 1867
- Chewing gum sweetened paraffin
- Chicle

Resins

- Resin ducts in plants
- Terpenes mixed with volatile oils
- Paints
- Incense (frankincense and myrrh)
- Embalming
- Lacquer
- Waterproofing sealant
- Turpentine and rosin
- Amber (fossilized resin)
