



# Outline

- 1 Herbs and spices
- 2 Natural product chemistry

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# Martenitsa on *Pittosporum* tree (La Jolla)



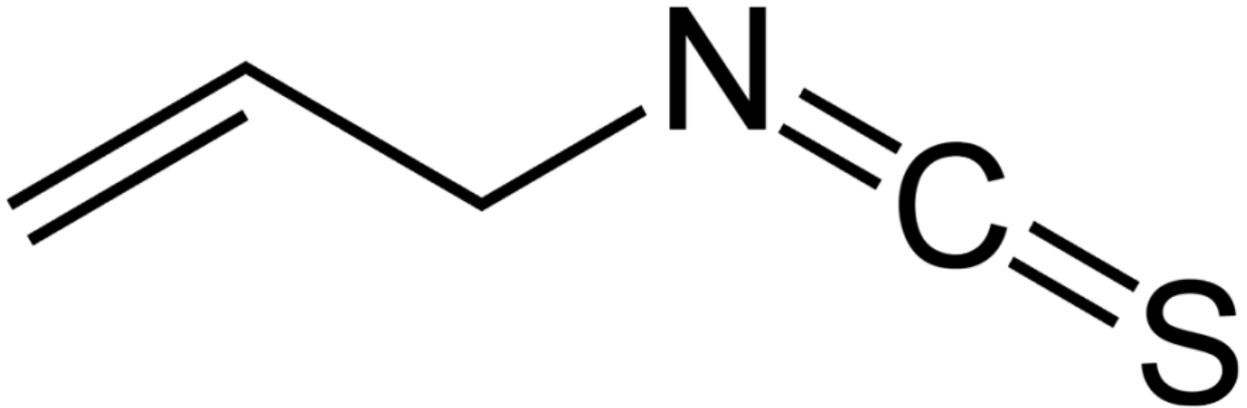
# Spicy hot taste

- Caused from several different secondary metabolites which make a burning sensation
- These metabolites work with pain receptors, nociceptors
- One of proposed effects is the stimulation of endorphin and serotonin production in brain

# Allyl isothiocyanate plants

- Main component of mustard oils, with formula  $\text{CH}_2\text{-CH-CH}_2\text{-NCS}$
- Anti-herbivore chemical, stored in glucosinolate form and released by myrosinase when cells are broken
- Toxic, strong lachrymator, stimulates nasal and eye receptors

# Allyl isothiocyanate



# Horseradish, *Armoracia rusticana*

- Perennial plant from cabbage family (Cruciferae) with European origin
- Roots are using as a spice

# Wasabi, *Wasabia japonica*

- Japanese perennial from same family
- Extremely strong flavor due to multiple isothiocyanates

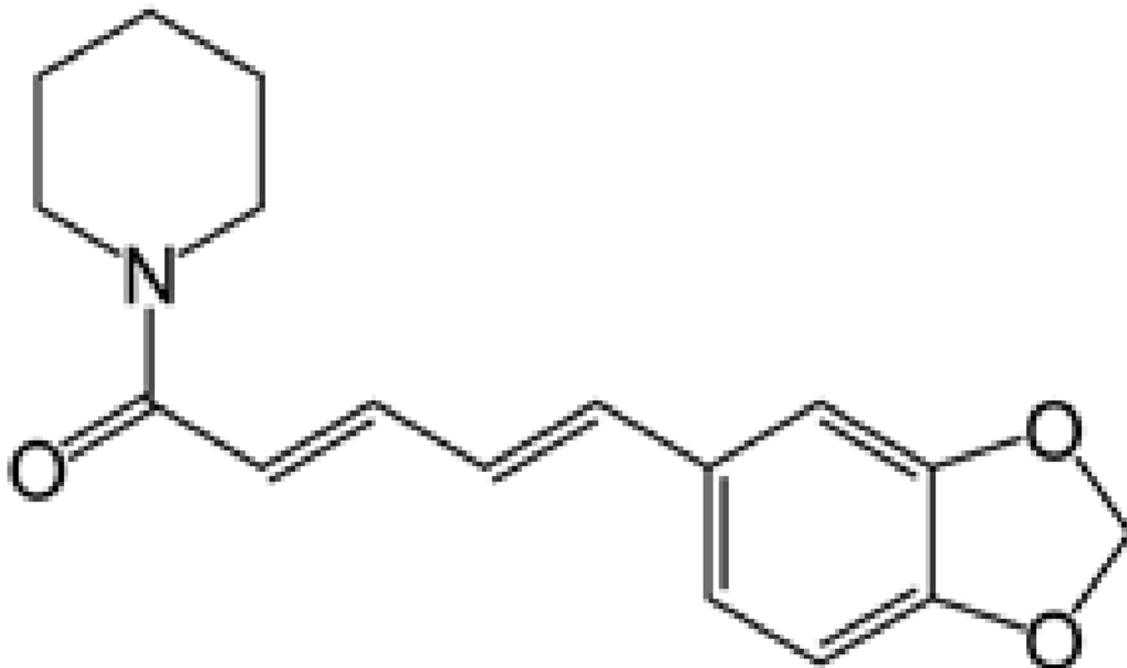
# Iwasaki (1828) paint of wasabi



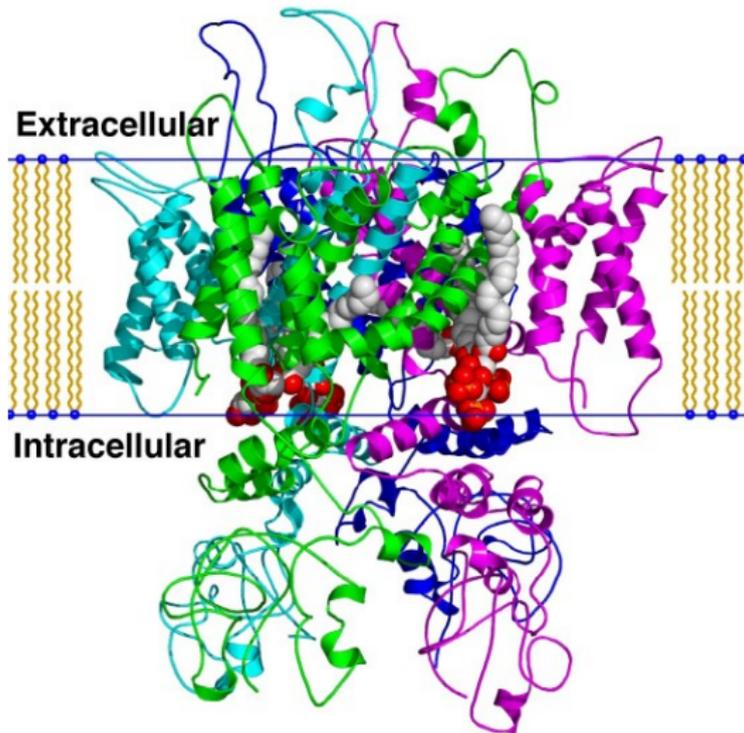
# Piperine

- Alkaloid
- Activates TRPV channels in nociceptors

# Piperine



# TRPV channel



# Black pepper, *Piper nigrum*

- Perennial vine from pepper family, Piperaceae
- Has the long and rich history: was one of primary causes of Exploration Age

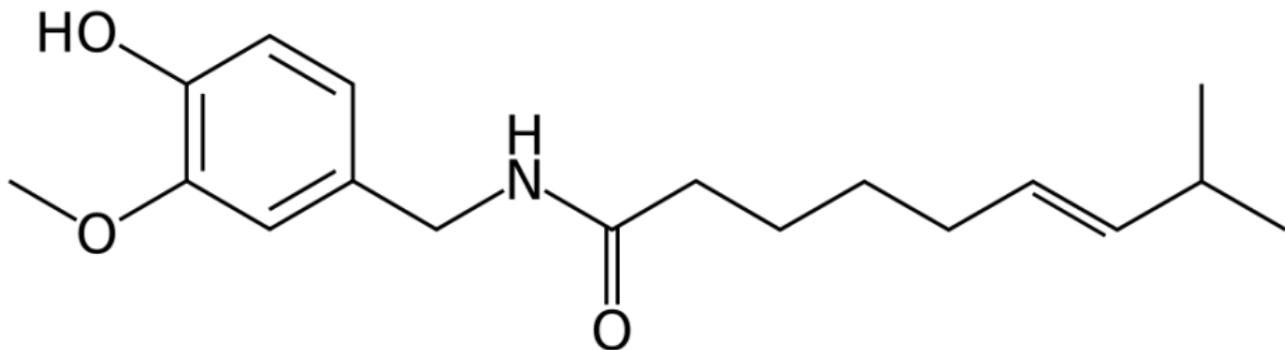
# *Piper nigrum*



# Capsaicin

- Amine, irritant for all mammals
- Binds to TRPV and provide sensation similar to burning of call damage

# Capsaicin



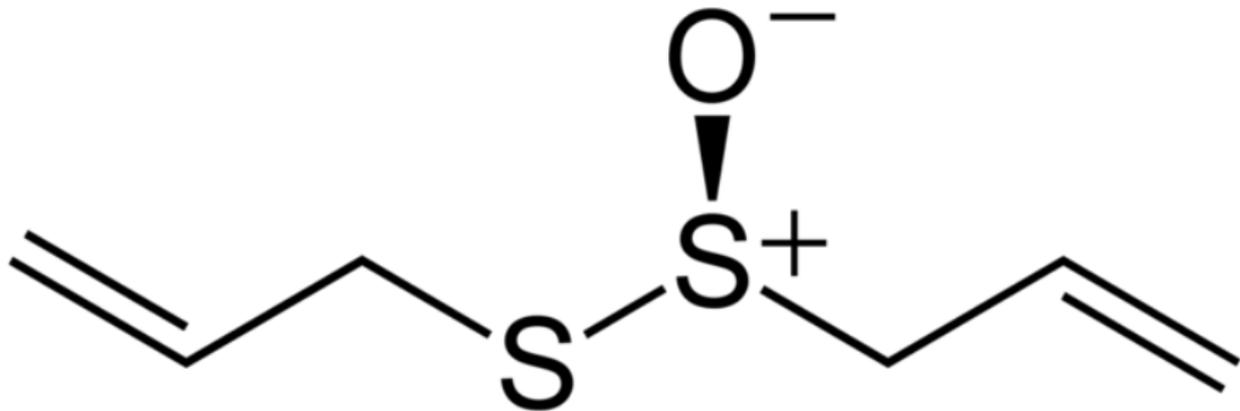
# Chili peppers, *Capsicum annuum* and other species

- Multiple species of *Capsicum*, genus of herbs or vines from Central America
- Important component of several tropical cuisines

# Allicin

- Organo-sulfur compound with anti-bacterial and anti-fungal effects
- Has multiple positive health effects

## Allicin



# Garlic, *Allium sativum*

- Cultivated species from onion family, Alliaceae
- Probably originated in West Asia from wild *Allium longicuspis*

# Essential oil plants from umbel family

- Coriander, *Coriandrum sativum* from West Asia, known from pre-historic times
- Dill, *Anethum graveolens* from Europe
- Cumin, *Cuminum cyminum* from Mediterranean
- ... and many others

# Cumin



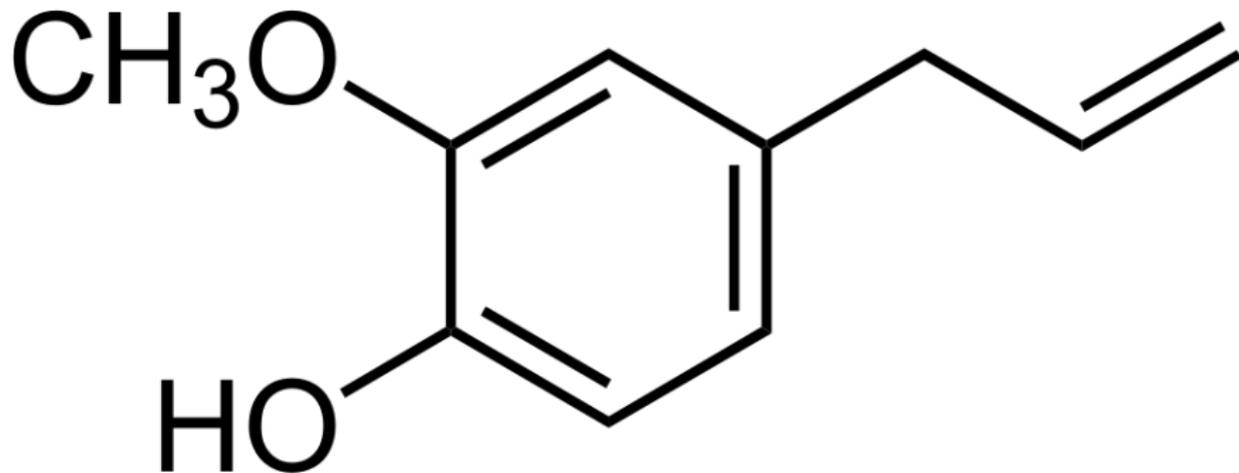
# Essential oil plants from mint family

- Peppermint, *Mentha piperita* from Europe
- Basil, *Ocimum basilicum* with wide Eurasian distribution
- ... and others

# Eugenol, zingerone and similar compounds

- Essential oils with phenol component
- Often provide a burning sensation similar to other spices

# Eugenol



# Plants with eugenol-like compounds

- Allspice, *Pimenta dioica* from Myrtaceae family, Caribbean origin
- Bay leaf, *Laurus nobilis* from Lauraceae, Mediterranean origin
- Nutmeg, *Myristica fragrans* from Myristicaceae, Indonesian origin
- Cinnamon, *Cinnamomum verum* from Lauraceae, Southwest Asian origin
- Ginger, *Zingiber officinale* from Zingiberaceae, South Asia
- Turmeric, *Curcuma longa*, South Asia
- Vanilla, *Vanilla planifolia*, Central America

# Bark of cinnamon



# Nutmeg



# Vanilla plantation



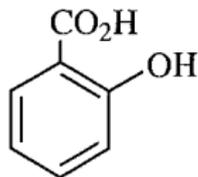
# Types of agents

- Fully natural
- Semisynthetic
- Fully synthetic

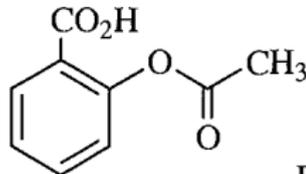
# Types of medicinal agents

## Medicinal agents from natural sources

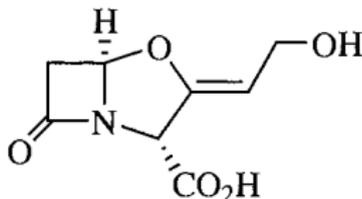
- (a) Fully natural
- (b) Semisynthetic
- (c) Fully synthetic



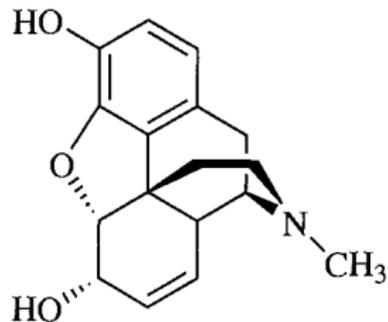
salicylic acid



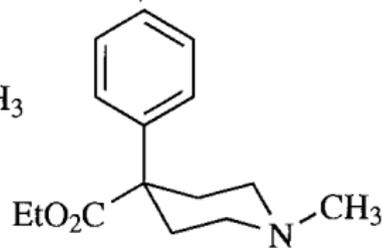
(b) aspirin



(a) clavulanic acid



morphine



(c) pethidine

# Drug discovery

- Extraction
- Bioassay screening
- Structure elucidation
- Chemical modification
- Clinical trials
- Drug

# Summary

- Most of spicy plants produce chemicals with nociceptive (pain) effect

# For Further Reading



## A. Shipunov.

*Ethnobotany* [Electronic resource]. 2011—onwards.

Mode of access:

[http://ashipunov.info/shipunov/school/biol\\_310](http://ashipunov.info/shipunov/school/biol_310)



## M. Heinrich and others.

*Fundamentals of pharmacognosy amd phytotherapy* (selected chapters). [Electronic resource].

Churchhill Livingstone, 2004.

Mode of access: [http://ashipunov.info/shipunov/school/biol\\_310/heinrich2004\\_fund\\_pharm\\_part.djvu](http://ashipunov.info/shipunov/school/biol_310/heinrich2004_fund_pharm_part.djvu)

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