Action mechanisms of herbicides and natural products

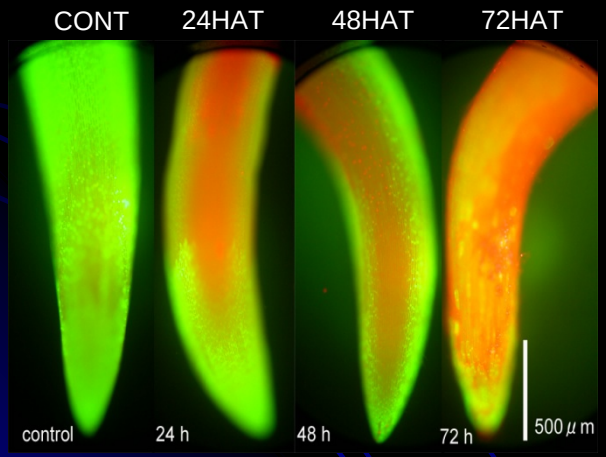
Antioxidative responses of plant cells to photooxidative stresses

Molecular mechanisms of herbicide resistance

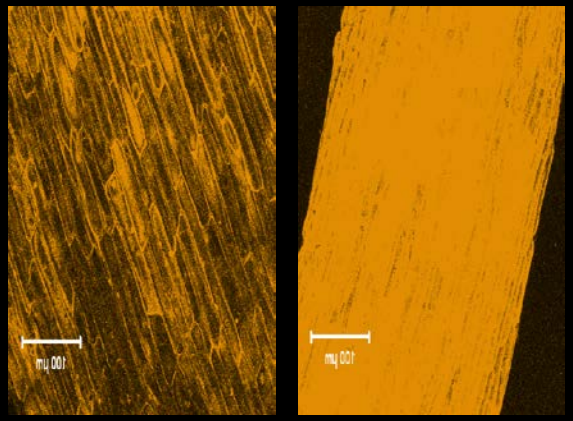
Hiroshi Matsumoto

Yukari Sunohara

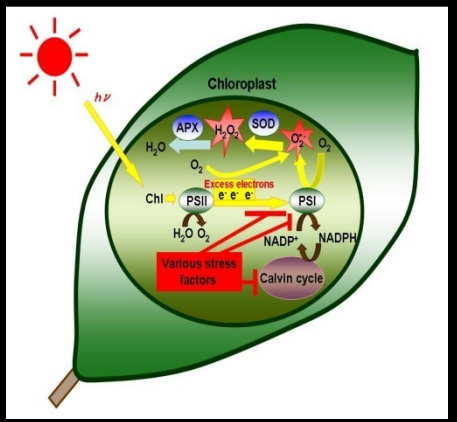
- Mode of action of natural and synthetic bioactive compounds in plants
- Antioxidative responses in plants to photooxidative stresses



Onion roots treated with crude extract from *Hapalosiphon* sp.
Green：Viable cells
Red　：Dead cells



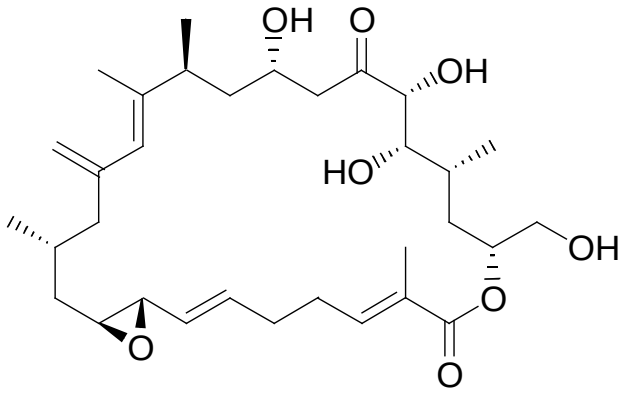
Detection of ROS generation in maize root with fluorescent dye.
Left　：Control
Right：Herbicide treatment



Generation of ROS in photosynthesis and defensive measures in plants

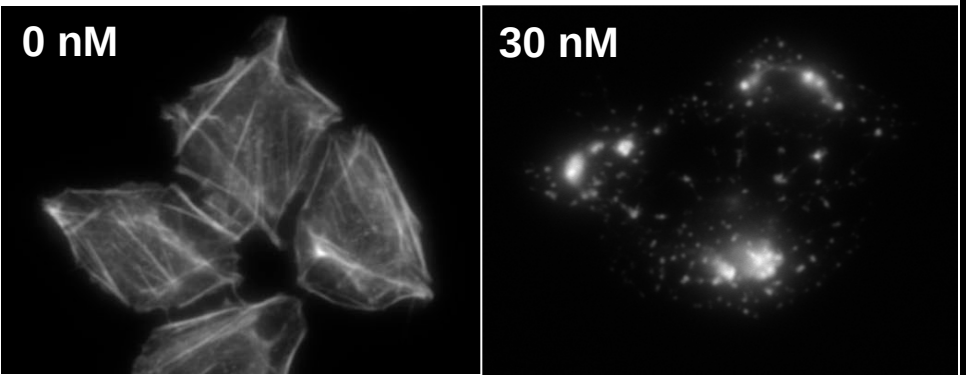
Target identification of natural products by forward chemical genetics

Naturally occurring small molecules are like a treasure box containing interesting lead compounds with novel structures and useful biological activities. Some of them have a great influence on the basic sciences and the pharmaceutical industry. We focus on natural products possessing unique biological functions (for examples; pironetin, terpendole E, brasilicardin A, and so on), and aim to discover the new biological aspect by revealing their target molecules, binding sites, and inhibitory mechanisms.

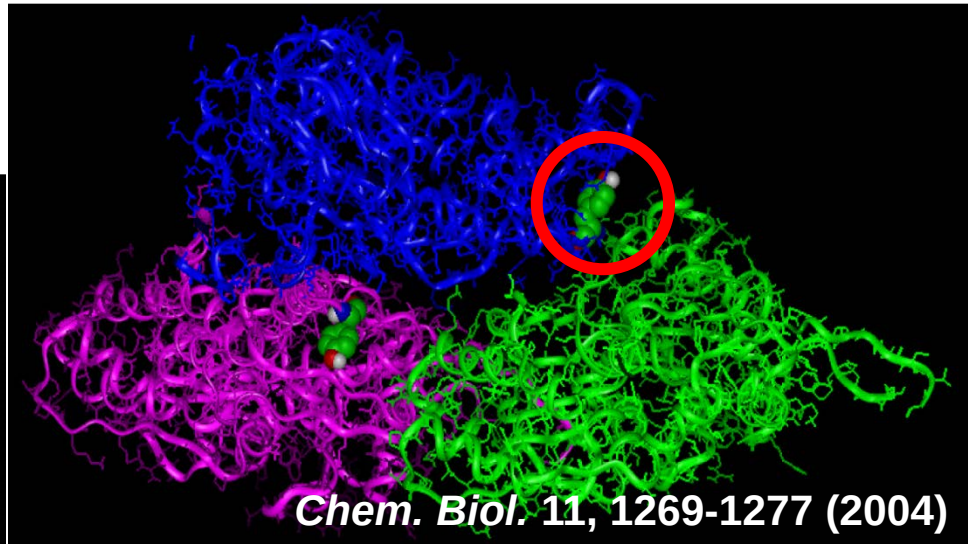


Amphidinolide H (AmpH), isolated from *Amphidinium* sp., showed potent cytotoxic activity, but its molecular target remained to be determined. We identified the molecular target of AmpH as actin by several methods.

Observation of effects on living cells



Molecular target/binding site Identification



Flavor Research

Osamu Negishi

1. Biosynthesis of Vanillin

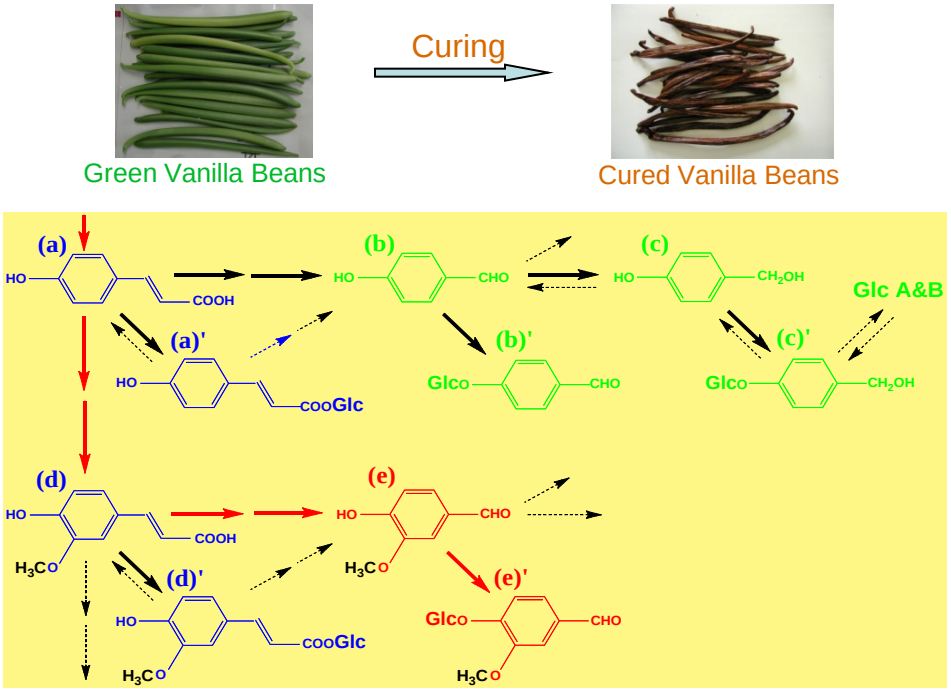


Figure 1. Proposed biosynthetic pathway for vanillin and related compounds from phenylpropanoids, and formation of their glucosides and glucose esters in green vanilla beans (*Vanilla planifolia).*

(a) 4-coumaric acid; (b) 4-hydroxybenzaldehyde; (c) 4-hydroxybenzyl alcohol; (d) ferulic acid; (e) vanillin; and (a)'(b)'(c)'(d)'(e)' show the respective glucose esters or glucosides. Glc A&B are esters of tartaric acid and 2 molecules of (c)'. During the curing process (e)' is hydrolyzed by glucosidase in vanilla beans.

2. Enzymatic Deodorization with Foods

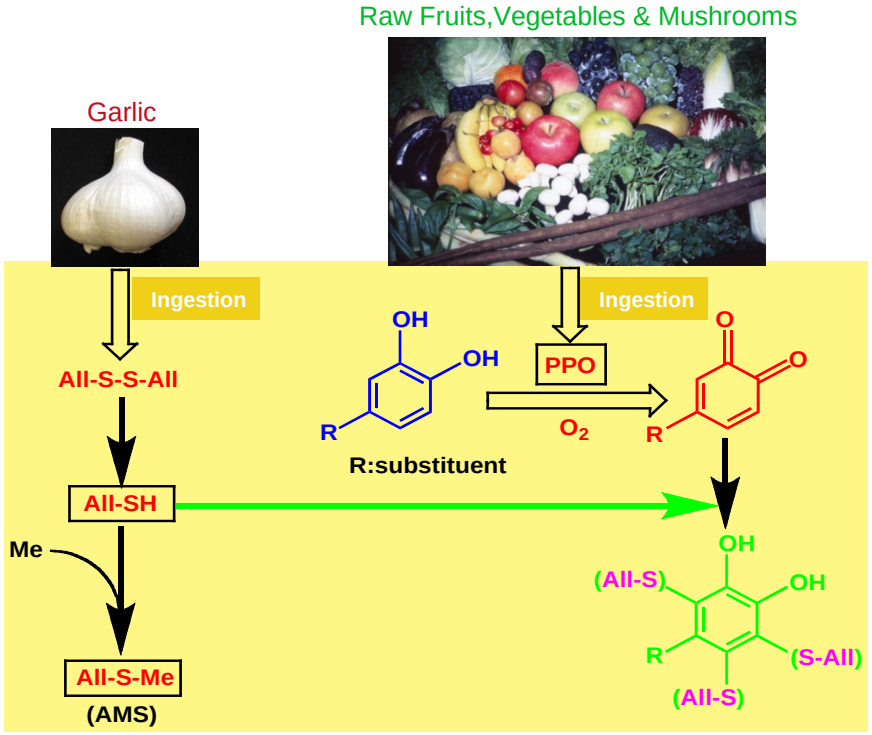
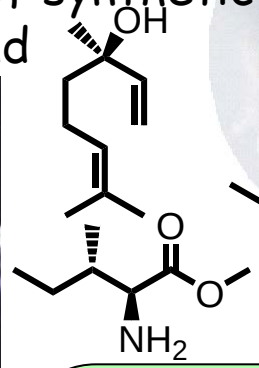


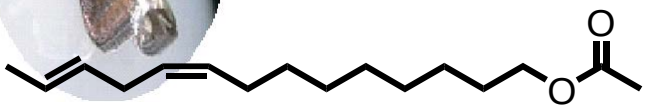
Figure 2. Formation of volatile sulfur compounds and enzymatic deodorization.

Bad odors of the mouth and body after garlic ingestion can be decreased by eating raw fruits, vegetables and mushrooms containing large amounts of polyphenolic compounds (PPs) and polyphenol oxidases (PPOs) .
The *o*-quinones produced from PPs by PPOs bind 2-propenethiols (AllSH) and then the bad odors are removed from the reaction system.

Holotrichia parallela
Field bioassay of synthetic pheromone blend



A calling female of Plodia interpunctella



Zizeeria maha agria, a gravid female lays eggs in response to chemicals in the host plant

Chemical ecology: Structure elucidations and functional analyses of naturally occurring chemicals that mediate interactions between organisms and their environment lead to the better understanding of nature and to the exploitation of the chemicals.

Apis cerana worker, indicating the nest entrance by the chemicals released from 7th tergite

Dinarmus basalis, a parasitic wasp recognizes host by chemicals left on the surface of Azuki bean

Camponotus japonicus
Male alate inspecting the weather at the entrance

Camponotus japonicus
Female alate ready to fly for her nuptial flight

Apis mellifera queen; Chemical communications between workers in the colony