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Regulation of life processes by chemicals

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Our life processes are regulated by relatively small-molecular-weight compounds in many situations. The "small molecules" like drugs and poisons act by modulating the functions of "big molecules" such as proteins and nucleic acids. In living organisms, there are many native "small molecules" playing an important role as signal mediators and growth regulators to maintain the normal and sound conditions. The questions we always are asking are: what kinds of compounds act as regulators of life, what are the mechanisms of regulation by the compounds, and what are the structures of the compounds that are responsible for their regulatory activity?

Naturally occurring insecticidal chemicals

Many toxic compounds occur in nature. Scorpions utilize their venom to capture prey insects. We could also utilize it for designing a new type of insecticide. We are now analyzing the components of venom produced by a scorpion indigenous to Yaeyama Islands for development of new neurotoxic compounds.

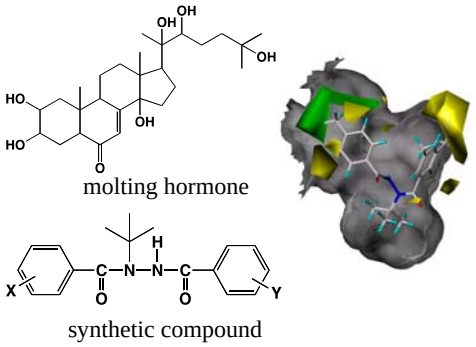
Scorpions in Japan

Chemicals that activate plant immune system

Plants induce various defense responses when attacked by pathogens. This defense mechanism has striking similarities to the innate immunity system in animals. Several compounds including peptides are known to induce those responses in plant. We are now trying to discover novel compounds which can activate the plant defense system.

Chemicals that regulate insect metamorphosis

Molting and metamorphosis in insects are regulated primarily by the molting hormone and a few juvenile hormones. The molting hormone is a steroid hormone, but certain non-steroidal compounds show molting hormone-like activity, some of which are practically utilized for insect pest control. We aim at obtaining new non-steroidal active compounds by the computer-based search for the molecules that fit the hormone biding pocket in the receptor protein.



Structures of compounds with molting hormonal activity and their interaction with the receptor protein

Chemicals that regulate plant growth

Indoleacetic acid (IAA) plays an important role, as a key member of plant hormone group generally referred to as auxin, in controlling the growth and development in many aspects. We are searching for new metabolites of IAA taking advantage of MS techniques, to uncover hitherto unknown metabolic pathways in plants.

Brassinolide (BL) is a plant steroid hormone and have characteristic regulatory activity associated with defense and/or stress responses in plants. Based on a strategy similar to the search for new molting hormonally-active compounds described above, new non-steroidal ligand molecules that well interact with BL receptor protein are searched for.

Key words

Biologically-active compound, pesticide, secondary metabolism, plant disease resistance, structure-activity relationship, drug design, insect metamorphosis, insect hormone, plant hormone, peptide, mass spectrometry

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