

Department of Pharmacognosy

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Research Projects:

We human beings have a long history of using various natural resources as plants and animals for curing disease and wounds. Natural medicines selected among those trials have been handed down to this century and still being used in our daily life. Also numerous pharmaceuticals have been developed from compounds of natural products which were isolated from plants and microbes. However, natural medicines still include mysteries to be uncovered and potentials for creation of another pharmaceuticals. Our studies on these mysteries and potentials are performed based on fieldworks and the following combination of lab-works.

1) Therapeutic use of incense and balm: "Kho-Doh", an incense ceremony, is one of the most elegant and traditional culture of Japanese; a small piece of agarwood of the highest quality is heated on a thin mica plate above charcoal, and a subtle fragrant arise from the piece is breathed in for tasting. Recent pharmacological studies indicate that the fragrant of agarwood might be a potent sedative, and which was experimentally exhibited using our new assay system. Further analyses on the active compounds and their mode of actions are under performance in the lab. Fragrant natural medicines other than agarwood, such as patchouli and spikenard that are often found in ingredients of Japanese sachet, are also analyzed for their potentials for therapeutic use.

2) Biosynthetic enzymes of secondary metabolism in medicinal plants: A large number of medicinal natural products are categorized as secondary metabolites, which differ from primary metabolites and are unique to plants. Among these we are focusing on fragrant volatiles which are mainly found in essential oil and resin of plants. Biosynthetic pathways and enzymes committed to them are studied through a combination of molecular biological techniques and conventional genetics. Agarwood, which was already mentioned in 1),

and perilla, a common Labiatae kitchen herb, are materials of recent topics.

3) Fieldwork: In order to understand mechanisms and functions of secondary metabolism in plants, it is essential for researchers to know and experience the target with their own five senses, we suppose. Therefore, we perform field surveys (= fieldworks) and cultivate plant materials (= works) in our experimental station (= field); collecting experimental materials is certainly an object of the fieldworks, however, new ideas might be generated as results of watching and touching the target in the fieldworks. An interview to old healer in village is a common means for collecting information of folk medicines, which sometimes seems unlikely to the pharmaceutical sciences; how one could make mutual understanding with interviewee would be a key for these interviews. Our recent field is Indochina (Viet Nam, Lao PDR, Thailand, etc.) for pursuing agarwood, perilla, and unknown folk medicines.

4) Regulatory sciences on natural medicines (crude drugs): Medicinal plants and other natural materials are used as Kampo medicines and ingredients of different natural medicines. Many of these are used not only as pharmaceuticals but also as spices and materials for health foods; they have both natures of medicines and foods. A natural medicine that has different names in different countries may make troubles when it is traded internationally; it may be used in a wrong way to evoke unexpected side effects. In order not to happen the negative events in use of natural medicines, and to secure the safe use of natural medicines and their products, proper identification methods and other techniques and knowledge that will be useful for regulation on natural medicines are required. These knowledge and techniques are another targets for our studies.



Recent publications

- Miho Hirai, Michiho Ito, Sedative effects of the essential oil and headspace air of *Ocimum basilicum* by inhalation in mice. *J. Natural Medicines*, **73**:283-288 (2019).
- Sakura Takamatsu, Michiho Ito, Agarotetrol: a source compound for low molecular weight aromatic compounds from agarwood heating. *J. Natural Medicines*, **72**, 537-541 (2018).
- Yumi Fujiwara, Michiho Ito, Molecular cloning and characterization of a *Perilla frutescens* cytochrome P450 enzyme that catalyzes the later steps of perillaldehyde biosynthesis. *Phytochemistry*, **134**, 26-37 (2017).