

Behind the Scenes in Pharmacognosy

The Asian Angel Demystified

In April of this year, the *Journal of Natural Products* published “Serotonergic activity-guided phytochemical investigation of the roots of *Angelica sinensis*”, authored by Dr. Shixin Deng and others in the laboratory of Dr. Guido Pauli. This article held the number 12 spot in the list of the 15 most accessed articles in the *Journal* during the April through June quarter of publication. Dr. Pauli graciously answered our questions regarding this powerful plant and intriguing study.

How did you become interested in *Angelica sinensis*, or Dang Gui as it is known in China?

Briefly, because it is a very prominent Traditional Chinese Medicine (TCM) herb for treatment of female conditions. Also, the University of Illinois at Chicago (UIC) pharmacognosy group has a history of studying TCM herbals and Shixin Deng, a recent Ph.D. graduate and native of China with a strong background in TCM, was highly motivated to study the phytochemistry and pharmacology of TCM herbals.

A. sinensis, also called Dang Gui or Dong Quai, is one of the most popular traditional herbs in Asia. It has a nickname meaning “female ginseng” or “lady’s ginseng”, which indicates its importance and popularity. The common name, Dang Gui, in Chinese literally means “recovery to normal conditions”, suggesting its function of helping the body to recover

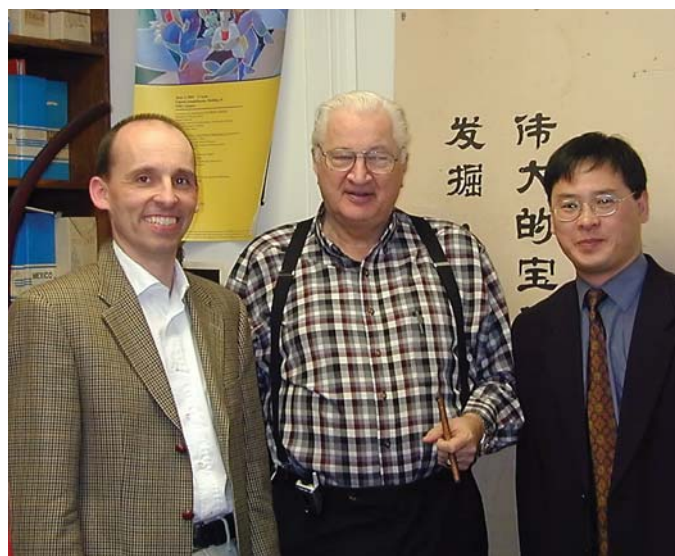
from weakness or illness and return to a normal condition of well-being. The UIC/National Institutes of Health (NIH) Center for Botanical Dietary Supplements Research is one of the six national Botanical Centers, and has particularly specialized on studying plants with benefits for women’s health. When the Center started in 1999, one of the 10 plants selected for study was, of course, *A. sinensis* due to its strong literature and TCM track record.

Who in your laboratory carried out the research?

This project was performed by a collaborative team, reflected by the list of authors of the paper. The core team consisted of pharmacognosists, phytochemists, biologists, pharmacologists, and analytical chemists. Advice from the environment also came from botanists.

The main work was done by Ph.D. student, Shixin Deng, as part of his dissertation project. His focus was the phytochemical work, performing bioassay-guided fractionation and isolation, and identification of the bioactive compounds from *A. sinensis*. Shixin Deng also interpreted the analytical data.

Shixin’s major advisors were myself, Project Leader in the Botanical Center Project 1, and Dr. Norman Farnsworth, Director of the Botanical Center. Important components for his research came from Botanical Center Project 1 post-doctoral researcher Dr. Shao-Nong Chen. Biological evaluation was done in collaboration with Botanical Center Project 2, headed by Dr. Judy Bolton, and MS expertise was contributed by Core B, namely Drs. Dejan Nikolic and Richard van Breemen.



Angelica authors (from left) Drs. Guido Pauli, Norman Farnsworth, and Shixin Deng.

DANIEL FABRICANT

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Could you provide a brief explanation of the phytochemical work on this plant and the results in your own words? In what way are the data in your paper new?

The phytochemical work resulted in the findings of a structurally diverse portfolio of compounds present in *A. sinensis*. Compounds include polyynes, monomeric and dimeric phthalides, and lignans. In particular, the finding of new dimeric phthalides expands the diversity with new alicyclic ring systems and skeletons.

An elaborate phytochemical isolation scheme was used, parallel to biological (serotonergic) evaluation, involving various chromatographic techniques such as CC, VLC, DCCC, MPLC, HPLC, and PTLC.

Over 20 compounds were isolated and their structures were elucidated by modern spectroscopic methods, including detailed analyses of ^1H spin patterns of all isolated compounds.

Overall, as part of his dissertation work, Shixing isolated five novel compounds, including a structurally unique symmetrical phthalide dimer. Four other compounds were isolated for the first time from *A. sinensis*. Interestingly, in addition to the new structure skeleton, a sulphonamide was isolated. However, its presence as a "native compound" needs further confirmation. Some of the isolates are potential new bioactive marker compounds for the quality control and standardization of *A. sinensis* preparation, and are potential lead structures for further pharmacological studies in the future.

What impact does this research have?

Besides the new phytochemical findings mentioned above, the study also discovered new biological activities of *A. sinensis*. The effects observed in 5-HT and GABA α receptor assays indicate that *A. sinensis* phytochemicals have previously unknown neurotransmitter-like activity (serotonergic and GABAergic). This could account for its traditional use for pre-menstrual or menopausal symptoms, and improve menopausal women's mood symptoms such as anxiety, depression, and irritation. Although these activities, as typical for many herbal preparations, cannot be attributed to a single active compound, active principles for these biochemical targets are now known.

Finally, the dissertation project also discovered that *A. sinensis* contains polyynes which exhibited potent and selective anti-TB activities *in vitro* (paper submitted). This suggests other potential uses for *A. sinensis*.



Botanical illustration of *Angelica sinensis* or Dang Gui.