2011

National Center for Pharmaceutical Crops

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WHY PHARMACEUTICAL CROPS?

1. Plants Save Lives

- Medicinal plants have been and will continue to be the primary solution for human diseases. >75% of the world populations continue to rely on traditional plant medicines.
- Approximately 40-50% of all currently used drugs have an origin in natural products.
- Cancer is the biggest killer of Americans and causes one out of every four deaths in the U.S. Approximately 65% of FDA-approved cancer drugs are derived from plants.
- Infectious diseases cost the U.S. economy at least $20 billion per year. Approximately 75% of FDA-approved anti-infective drugs are of natural origin.

2. Security of U.S. Strategic Pharmaceuticals

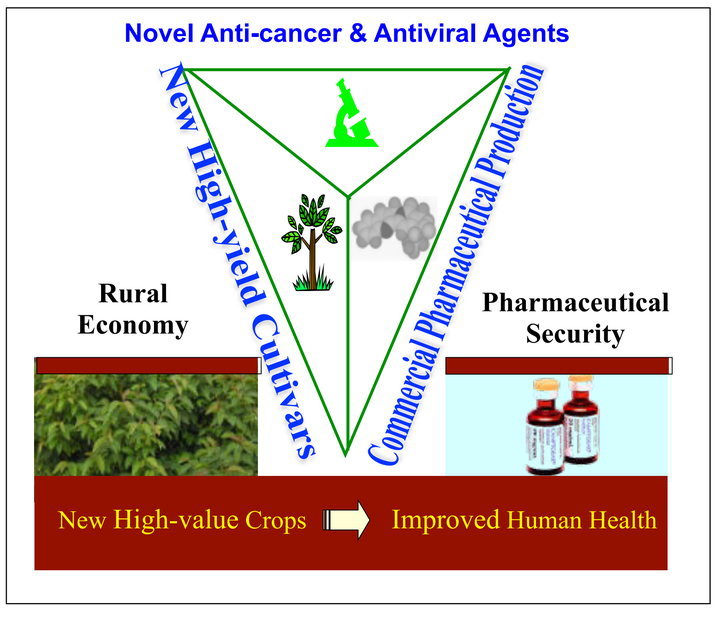
- Plant-based pharmaceuticals generate $30 billion in annual sales.
- Many plant-derived pharmaceuticals have complex structures that cannot be commercially synthesized.
- Current supplies of many critical pharmaceuticals rely on natural resources.
- Due to a lack of sustainable use and conservation, genetic biodiversity of medicinal plants is continuously under the threat of extinction.
- The U.S. depends on other countries for many valuable pharmaceuticals, but these foreign supplies are uncertain.
- U.S. research is critically limited in development and use of crops for pharmaceutical production although U.S. agriculture is well developed for economical mass production of food and fiber crops.
- U.S. farmers urgently need high added-value alternative crops.
- Bioprospecting becomes imperative: at least 1/4 of the flora will be extinct in the next 50 years while only <1% of the world's flora (>310,000 species) has been extensively investigated for medicinal uses.

SFA is a pioneer in pharmaceutical crop research in the United States. The National Center for Pharmaceutical Crops (NCPC) was established in 2004 through U.S. Congressional Appropriations with the effort of **U.S. Senator Kay Bailey Hutchison.** The Center has received great supports from **Senator Hutchison**, **Congressman Louie Gohmert**, SFA Administration, and local communities in the last several years.

MISSION

The mission of the National Center for Pharmaceutical Crops is to develop crops for the production of pharmaceutical and other bioactive compounds. The Center is the only one of its kind in the U.S. and seeks to:

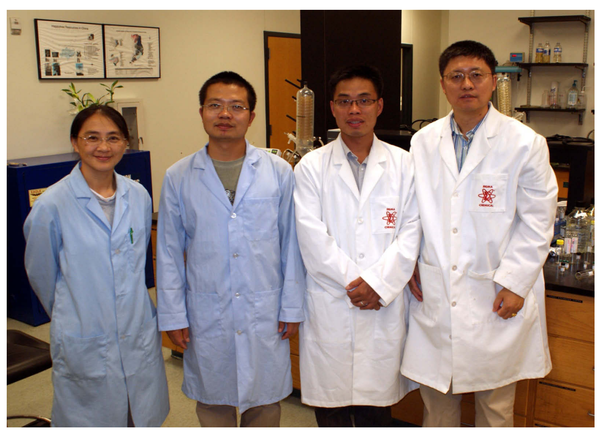
- ❖Improve human health by discovering novel anti-tumor and antiviral agents from native and invasive plant species
- ❖Revitalize the U.S. and Texas rural economy by developing high-value pharmaceutical crops
- ❖Enhance U.S. security in strategic pharmaceuticals, by reducing dependency and vulnerability on foreign supply of active pharmaceutical ingredients .



FACILITIES

Laboratories: The Center has a 3,000 ft^2 analytical lab, a 3,500 ft^2 pilot production facility for large-scale extractions, a NMR lab (with Department of Chemistry), and a 2,500 ft^2 greenhouse for plant propagation, germplasm preservation, and development.

Experimental Sites and Garden: The Center has two experimental field sites and is constructing a Medicinal Fern Garden at SFA in collaboration with the SFA Mast Arboretum and the Pineywoods Native Plant Center.



Dr. Ping Wang, Dr. Wei Yuan, Dr. Zushang Su, and Dr. Shiyou Li

CURRENT KEY INVESTIGATORS

Shiyou Li, Ph.D., Director and Research Professor
Dr. Li has 26 years of research experience in medicinal plants specializing in the development of new pharmaceutical crops and strategies for induced production of targeted natural compounds. He is the author or co-author of four books and 65 peer-reviewed articles. He has established research collaboration with over 20 institutions. Dr. Li is also author of 10 new plant species/ varieties and inventor of 6 high-yielding pharmaceutical crop cultivars. He discovered "*induced endogenous autotoxicity*" in plants and developed novel "*Trichome Management*" techniques to induce production and diversity of target secondary metabolites in pharmaceutical crops (patent issued). He is the founding editor-in-chief of the peer-review journal *Pharmaceutical Crops*.

Ping Wang, Ph.D., Research Scientist
Dr. Wang has isolated and identified 120 compounds from medicinal plants including six new compound and is the author of 21 peer-reviewed articles. She is a co-inventor on one U.S. patent application.

Wei Yuan, Ph.D., Research Scientist
Dr. Yuan has 10 years of experience in natural products chemistry. He has isolated and identified over 100 compounds from plants and fungi including 40 new compounds. He is the author of 23 peer-reviewed articles and is a co-inventor on one U.S. patent application.

Zushang Su, Ph.D., Research Associate
Dr. Su has several years of research experience in natural products chemistry and ethnobotany.

Collaborators: Dr. Bharat B. Aggarwal (M.D. Anderson Cancer Center), Dr. David Creech (SFA Gardens), Dr. Jason Fritzler (SFA Dept of Biology), and Dr. Josephine Taylor (SFA Dept of Biology).

ACHIEVEMENTS

1. **Security of National Strategic Pharmaceuticals:**
   Anti-cancer Camptothecins: Since1993, SFA scientists have been conducting extensive research on *Camptotheca*, the major source of promising anti-cancer camptothecin drugs. Results include the development of high-yield cultivars and patented techniques that further increase camptothecin yields by 20-fold and that can be widely applied to many medicinal plants.

   Production of Shikimic Acid from Native Plants: Recently, SFA has discovered the leaves of sweetgum *(Liquidambar styraciflua*) as a new source of shikimic acid, the bottleneck material for producing the anti-influenza drug Tamiflu®. With our technology, current natural resources in East Texas alone would produce a sufficient quantity of shikimic acid to meet the global Tamiflu® demand (patent allowed).

2. **Identification of Novel Bioactive Agents:** To date, over 1,200 species of vascular plants representing 138 families found in Texas have been collected and screening for bioactivities. Over ***750 compounds, including 115 new compounds***, have been successfully isolated and identified from 36 species of native plants such as buttonbush (*Cephalanthus occidentalis*) and buckeye (*Aesculus pavia*), the promising exotic *Camptotheca*, and invasive species (*Salvinia molesta*).

   Anti-cancer Compounds: Through cytotoxicity assays and DNA Topoisomerase I & II activity screenings, six novel anti-tumor compounds have been identified.

   Antiviral Compounds: In cooperation with the National Institute of Allergy and Infectious Diseases (NIAID) and Camptotech, Inc., 24 new compounds have been screened for respiratory, herpes, hepatitis C, West Nile, and Yellow Fever viruses. The projects entitled, "Identification of Antiviral Agents from Plants" funded by the U.S. Centers for Disease Control and Prevention (CDC) and "Identification of antiviral compounds from native pteridophytes (ferns) of North America" funded by SFA are currently underway.

   Antifungal Compounds: We have found that trifolin, hyperoside, and camptothecin have potent antifungal activity against *Fusarium* and other important agricultural pathogens (patent pending).

MAJOR SPONSORS

U.S. Centers for Disease Control and Prevention
Stephen F. Austin State University
U.S. Department of Agriculture
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