



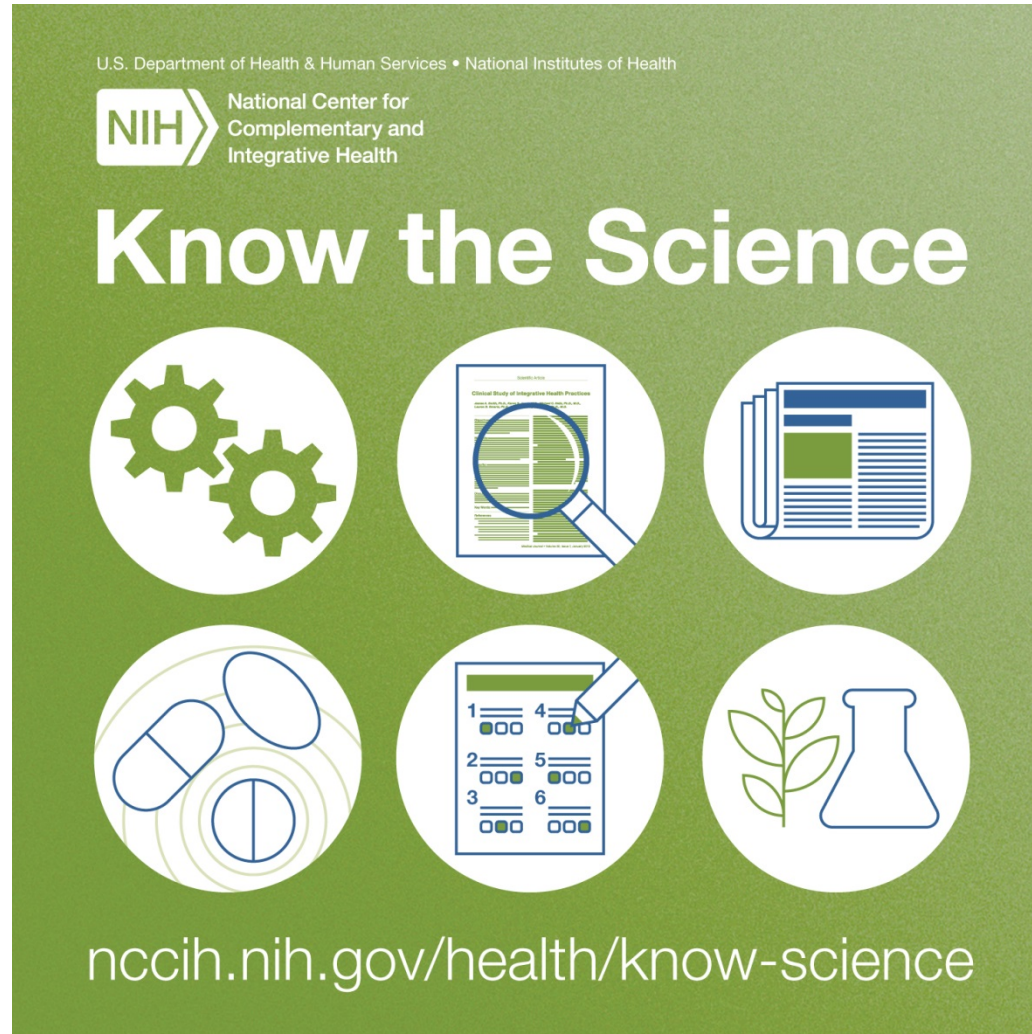
From Dioscorides's pharmacopoeia, 1224

Broad Definitions

- A botanical is a plant or plant part valued for its medicinal or therapeutic properties, flavor, and/or scent.
- Herbs are a subset of botanicals.
- Products made from botanicals that are used to maintain or improve health may be called herbal products, botanical products, or phytomedicines.



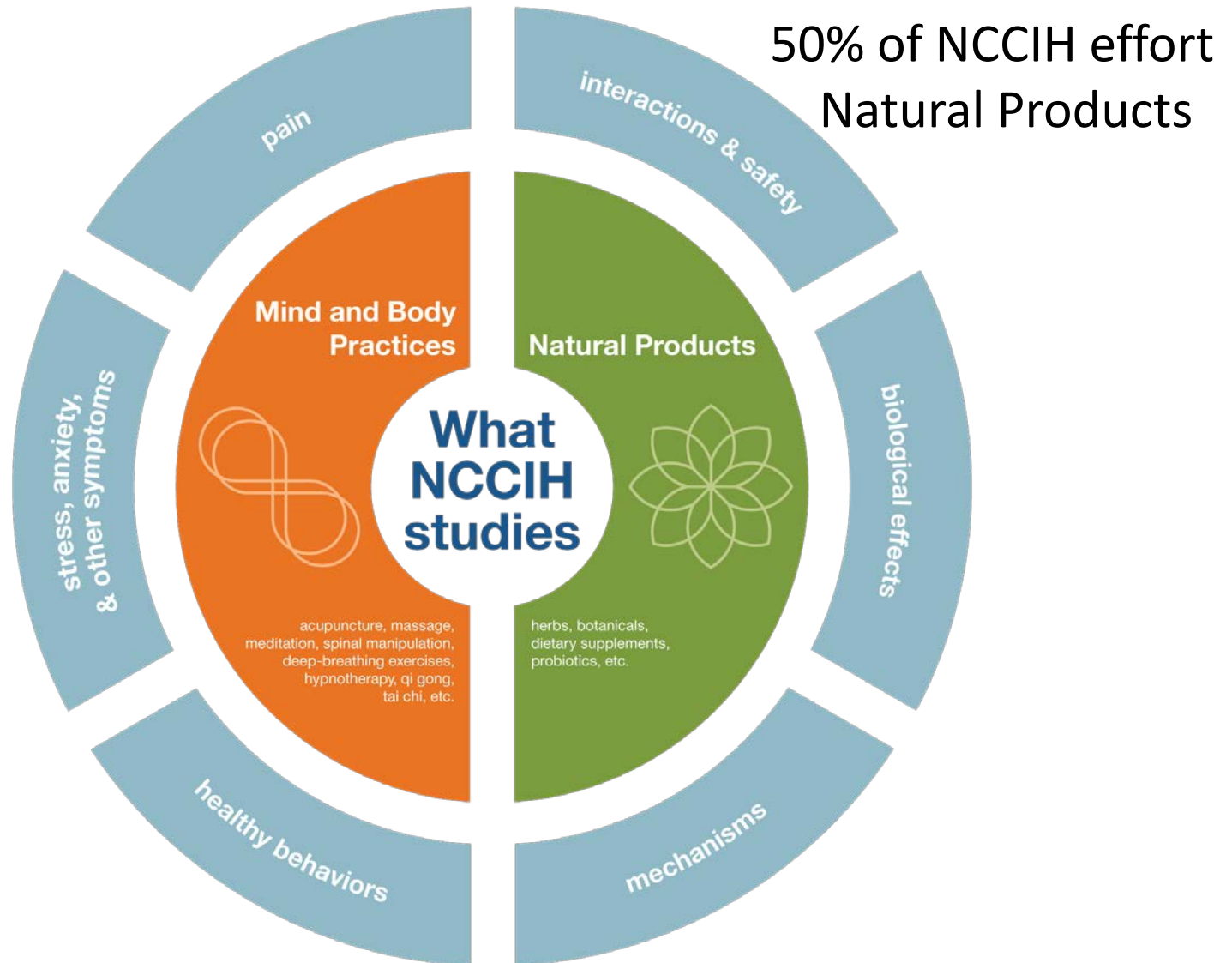
National Center for Complementary and Integrative Health Formed in 1998 by Congressional Mandate



<https://nccih.nih.gov/health/know-science>

National Center for Complementary and Integrative Health

NCCIH



National Center for Complementary and Integrative Health



U.S. Department of Health and Human Services

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Integrative Health

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Dietary and Herbal Supplements

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A dietary supplement, as defined by the Dietary Supplement Health and Education Act (DSHEA), is a product that:

- Is intended to supplement the diet
- Contains one or more dietary ingredients (including vitamins, minerals, herbs or other botanicals, amino acids, and certain other substances) or their constituents
- Is intended to be taken by mouth, in forms such as tablet, capsule, powder, softgel, gelcap, or liquid
- Is labeled as being a dietary supplement.



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NIH Office of Dietary Supplements



U.S. Department of Health & Human Services

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Strengthening Knowledge and
Understanding of Dietary Supplements

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DIETARY SUPPLEMENTS: WHAT YOU NEED TO KNOW

ODS experts are featured in this 2-minute video introduction to the Office of Dietary Supplements.

1 2 3 4 5

Health Information

- > Frequently Asked Questions (FAQ)
 - > Dietary Supplements: What You Need to Know
 - > Dictionary
 - > Información en español
- [more](#)

Dietary Supplement Fact Sheets

The Office of Dietary Supplements (ODS) fact sheets give a current overview of individual vitamins, minerals and other dietary supplements. ODS has fact sheets in two versions—Health Professional and Consumer. Both versions provide the same types of information but vary in the level of detail. Consumer versions are also [available in Spanish](#). [more](#)

News & Events

HEADLINES

- > Executive Summary of Analytical Methods and Reference Materials External

<https://ods.od.nih.gov/>

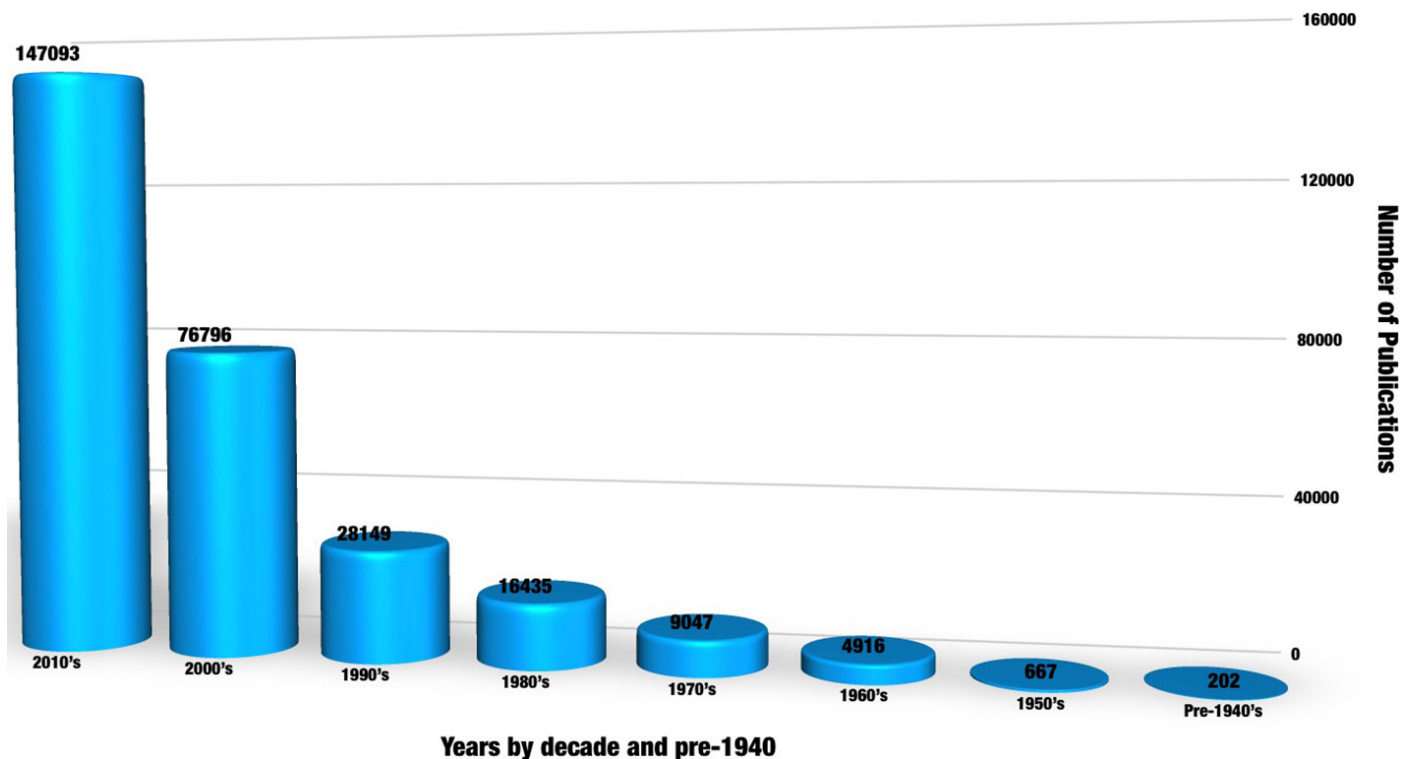
Botanical-based Dietary Supplementation: Who is taking dietary supplements?

Table 1. Prevalence of Dietary Supplement Use by Demographic, Anthropometric, Socioeconomic, and Lifestyle Characteristics Among Adults (≥ 20 Years) in the United States, 2007-2010^{1,2}

Characteristic	No.	% (SE)
Total	11 956	48.8 (1.1)
Sex		
Men	5911	43.1 (1.4) ^a
Women	6045	54.4 (1.1) ^b
Age range, y		
20-39	3809	34.2 (1.5) ^a
40-59	3925	50.8 (1.6) ^b
≥ 60	4222	67.4 (1.4) ^c
BMI		
<18.5	730	44.1 (2.2) ^a
18.5-24.9	3074	52.8 (1.6) ^b
25.0-29.9	3897	49.1 (1.6) ^c
≥ 30	4255	45.9 (1.2) ^a
Current health status (n = 10 417)		
Excellent or very good	3670	54.8 (1.2) ^a
Good	4130	47.1 (1.6) ^b
Fair or poor	2617	43.7 (1.4) ^b

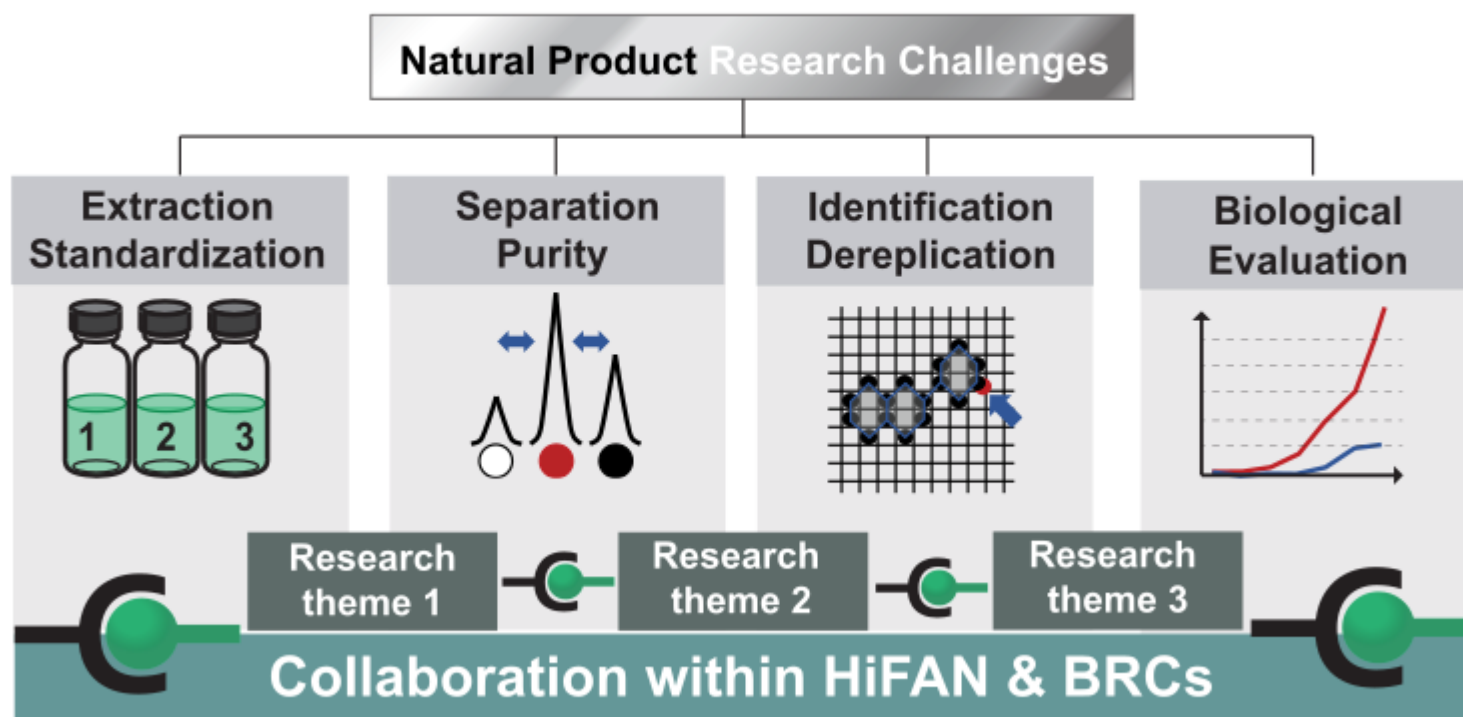


Increasing Interest in Medicinal Properties of Natural Products/Botanicals



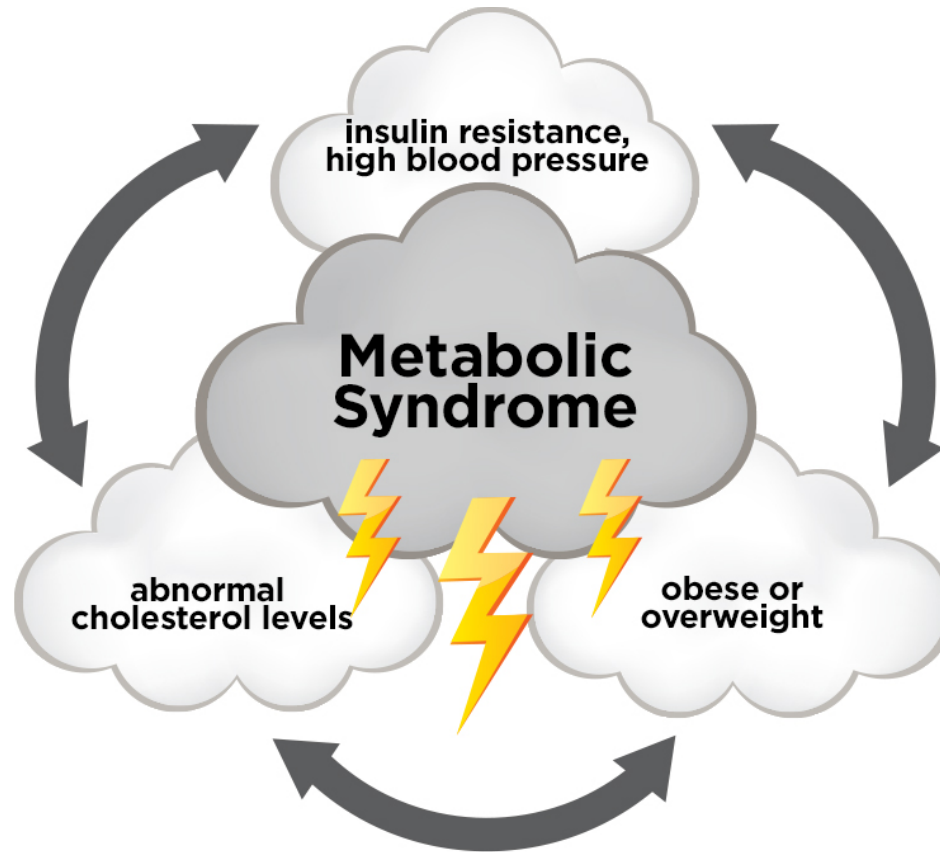
Scientific publications related to natural products/botanicals

Challenges in Natural Products Research



CENAPT: Center for Natural Product Technologies at University of Illinois Chicago

Metabolic Syndrome is a Precursor of Type 2 Diabetes



Can botanical extracts affect development of Metabolic Syndrome?

Botanicals in the Treatment of Diabetes

“Goat’s Rue” ; French Lilac



Metformin in the Treatment of Diabetes

Galega officinalis L.



- Extracts from French Lilac were used in the middle ages (500-1500 AD) to treat symptoms typical of type 2 diabetes.
- Accounts of using “goat’s rue” or French lilac reappeared in the 17 century
- French lilac was found to contain guanidine in the late 1800s. Lowered glucose, but was toxic.
- A less toxic form was synthesized in the 1920s.
- A clinically useful form was developed in the late 1950s.

Metformin in the Treatment of Diabetes

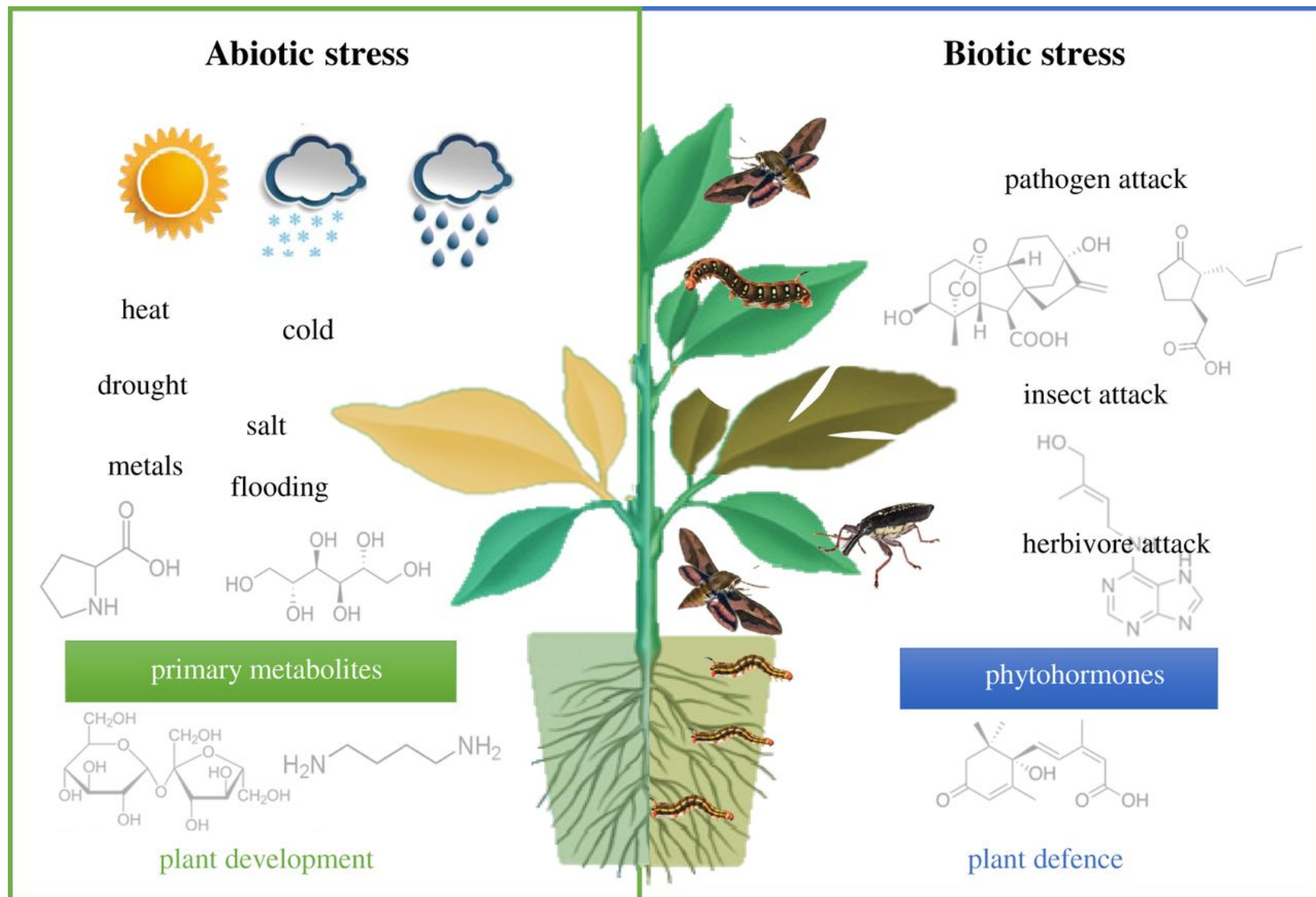


Most widely prescribed antidiabetic drug in the world.

One of the five most prescribed drugs in the United States.

U. S. > 83 million prescriptions filled in 2018.

Why are Plants a Great Source of Medicinal Compounds?



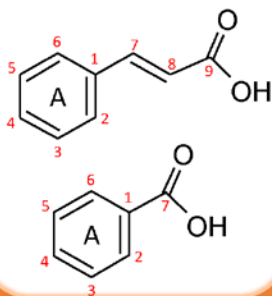
Why are Plants a Great Source of Medicinal Compounds?

The Complex Mixture of Constituent Compounds

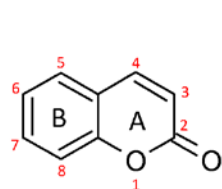
PLANT POLYPHENOLS



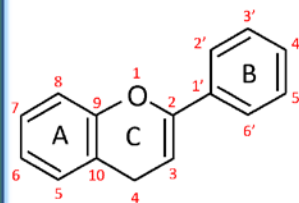
PHENOLIC ACIDS



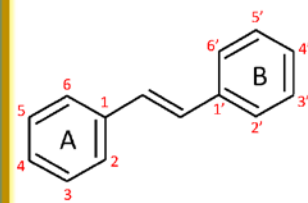
COUMARINS



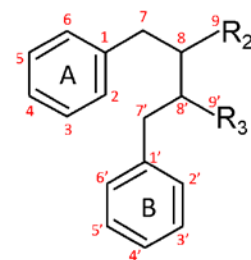
FLAVONOIDS



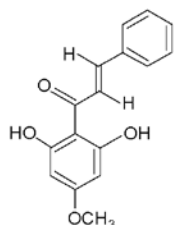
STILBENES



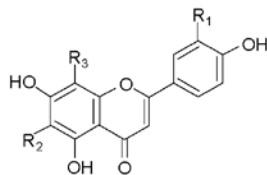
LIGNANS



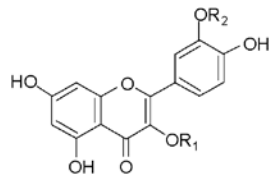
CHALONES



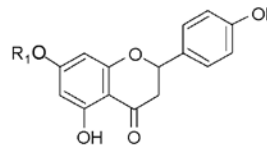
FLAVONES



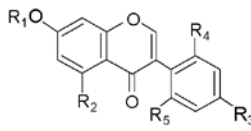
FLAVONOLS



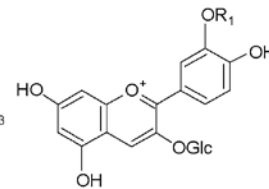
FLAVANONES



ISOFLAVONOIDS

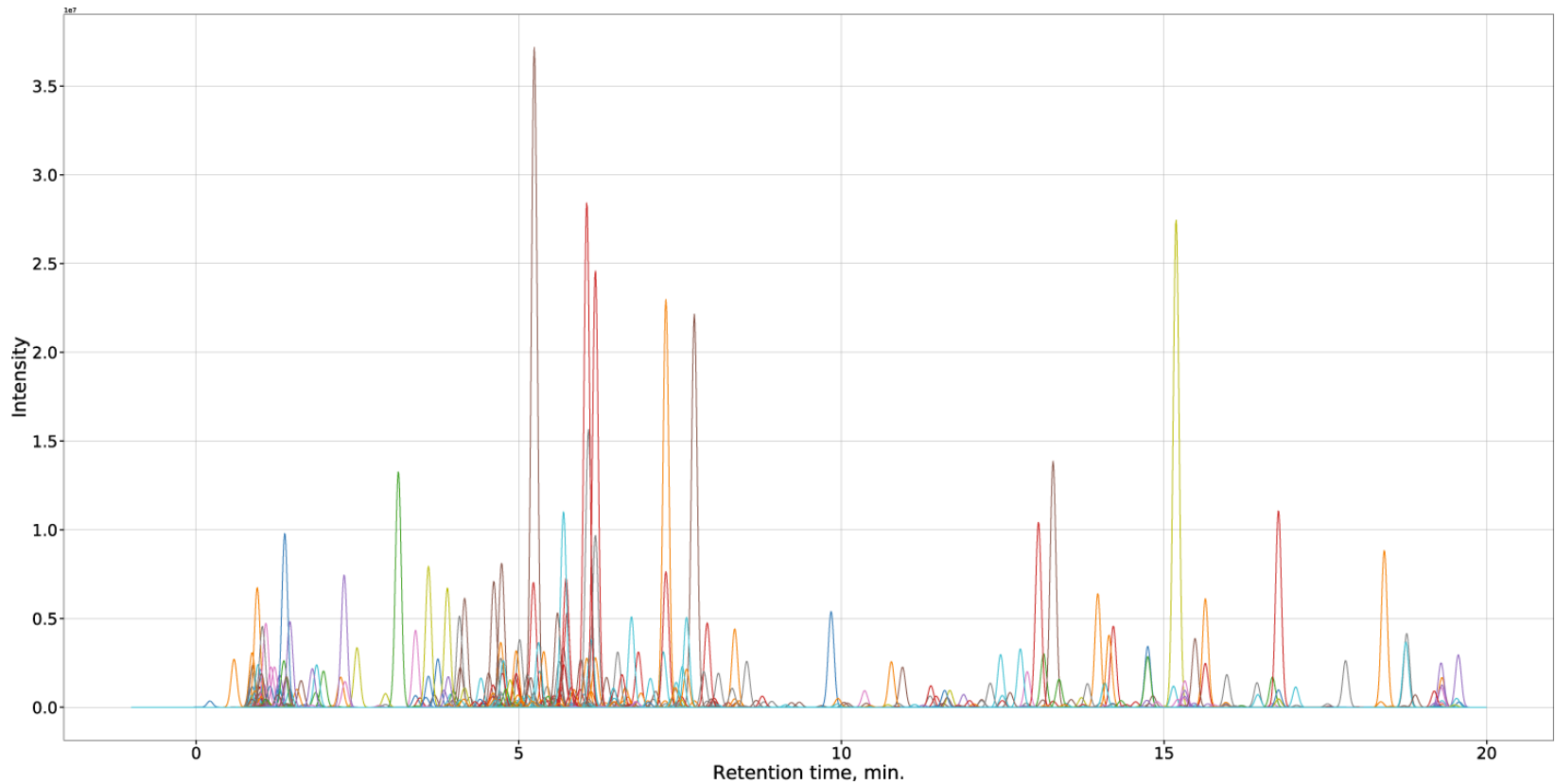


ANTHOCYANINS



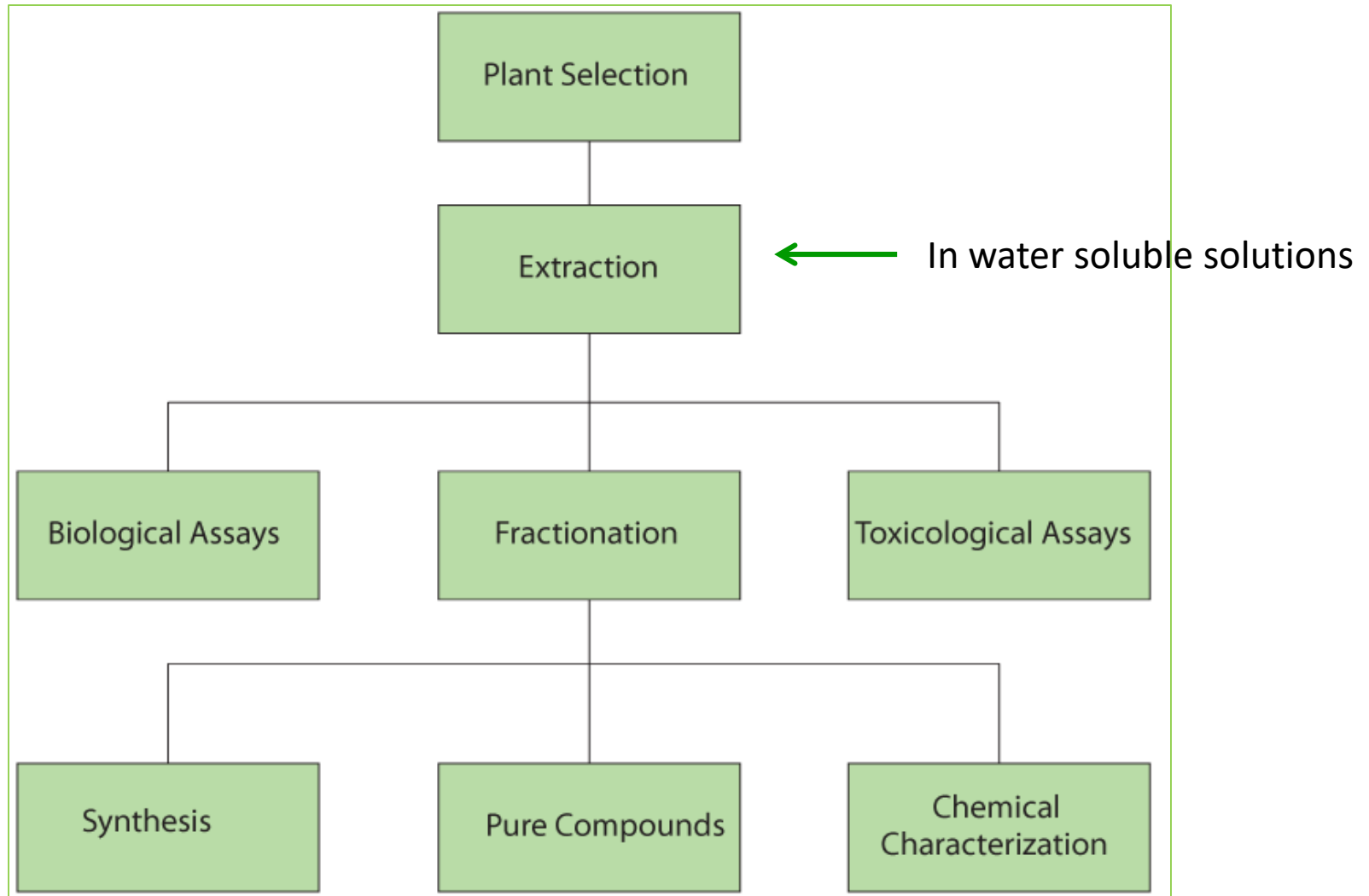
Why are Plants a Great Source of Medicinal Compounds?

Analysis of the complex mixture of plant compounds
using the unique signature of each compound



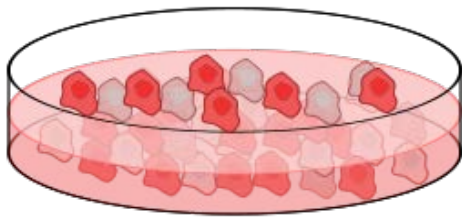
The Mass Spectrum of the mixture of compounds in a plant

Screening Botanical Extracts, beginning in 2005



Screening Botanical Extracts

Cell Culture



Animal Model of Disease

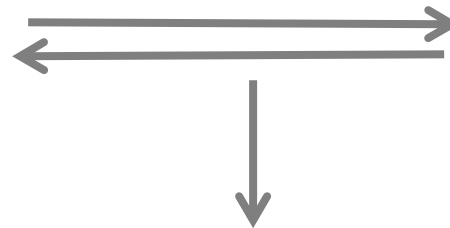
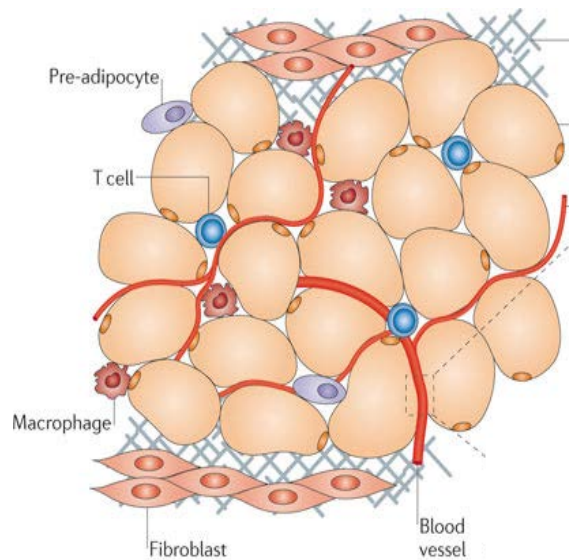


Clinical Trials

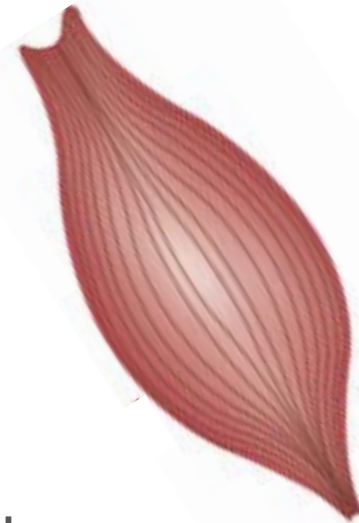


Screening Botanicals for Bioactivity: Focus on Muscle and Fat

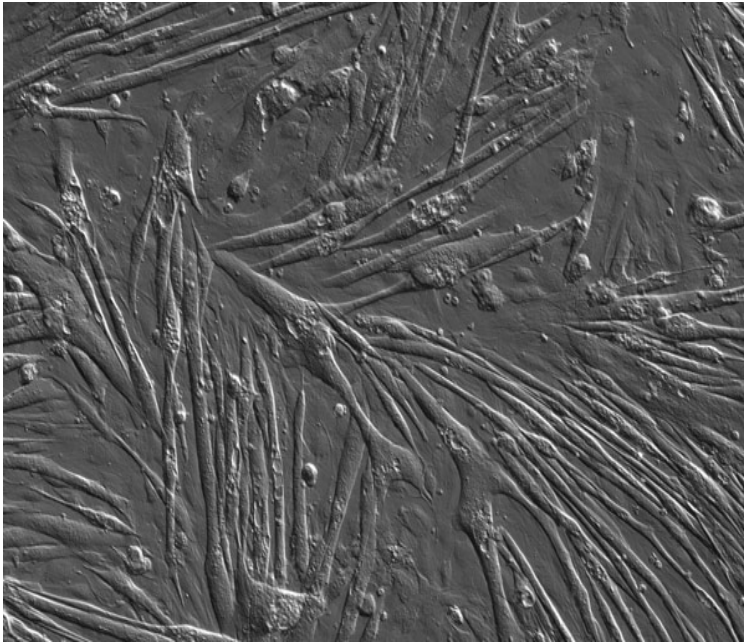
Fat tissue and skeletal muscle are important organs in determining blood glucose levels



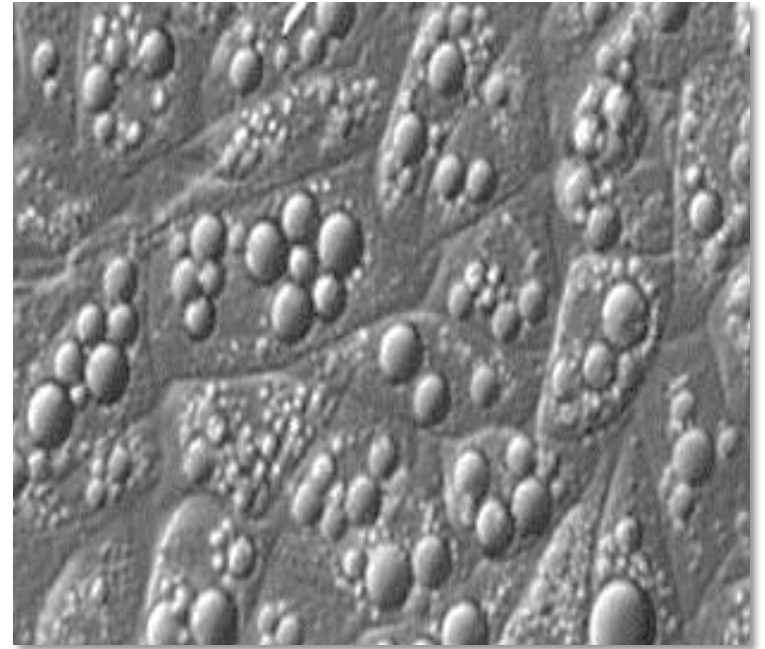
Maintaining blood glucose levels



Screening Botanicals for Bioactivity: Muscle and Fat Cells in a Culture Dish



Skeletal muscle cells



Fat cells with lipid droplets

Exploring the Use of Botanicals in Treating or Preventing Obesity-related Diabetes

Lizard's Tail



Chinaberry



Groundsel Bush



Bristle Mallow



Elderberry



Black Nightshade



Red Bay



Botanical Extracts Currently Being Tested

Bitter Melon



Moringa



Artemisia scoparia



Fenugreek seeds



Russian Tarragon

Artemesia dracunculus L



- Perennial Herb
- Asteraceae Family
- Native-Northern Hemisphere
- Genus Artemisia-1500 diverse species
- Rich source of herbal remedies/conventional drugs.
- Ethanolic Extract-
termed PMI 5011

Russian Tarragon

Artemesia dracunculus L



We harvest at the flowering stage



Ethanollic extract from Russian Tarragon (PMI5011): Reporting Our Findings to the Scientific Community

To Date: 35 publications on PMI5011, over 200 publications from the BRC

[Food Chem Toxicol](#). 2004 Apr;42(4):585-98.

Toxicological evaluation of the ethanollic extract of *Artemisia dracunculus* L. for use as a dietary supplement and in functional foods.

[Ribnicky DM](#)¹, [Poulev A](#), [O'Neal J](#), [Wnorowski G](#), [Malek DE](#), [Jäger R](#), [Raskin I](#).

[Phytomedicine](#). 2006 Sep;13(8):550-7. Epub 2005 Nov 2.

Antihyperglycemic activity of Tarralin, an ethanollic extract of *Artemisia dracunculus* L.

[Ribnicky DM](#)¹, [Poulev A](#), [Watford M](#), [Cefalu WT](#), [Raskin I](#).

[Metabolism](#). 2008 Jul;57(7 Suppl 1):S58-64. doi: 10.1016/j.metabol.2008.04.003.

Bioactives of *Artemisia dracunculus* L enhance cellular insulin signaling in primary human skeletal muscle culture.

[Wang ZQ](#)¹, [Ribnicky D](#), [Zhang XH](#), [Raskin I](#), [Yu Y](#), [Cefalu WT](#).

[J Nutr Biochem](#). 2011 Jan;22(1):71-8. doi: 10.1016/j.jnutbio.2009.11.015. Epub 2010 May 5.

An extract of *Artemisia dracunculus* L. enhances insulin receptor signaling and modulates gene expression in skeletal muscle in KK-A(y) mice.

[Wang ZQ](#)¹, [Ribnicky D](#), [Zhang XH](#), [Zuberi A](#), [Raskin I](#), [Yu Y](#), [Cefalu WT](#).

[PLoS One](#). 2013;8(2):e57112. doi: 10.1371/journal.pone.0057112. Epub 2013 Feb 20.

An extract of *Artemisia dracunculus* L. inhibits ubiquitin-proteasome activity and preserves skeletal muscle mass in a murine model of diabetes.

[Kirk-Ballard H](#)¹, [Wang ZQ](#), [Acharya P](#), [Zhang XH](#), [Yu Y](#), [Kilroy G](#), [Ribnicky D](#), [Cefalu WT](#), [Floyd ZE](#).

[Nutrition](#). 2014 Jul-Aug;30(7-8 Suppl):S4-10. doi: 10.1016/j.nut.2014.03.009. Epub 2014 Mar 28.

***Artemisia dracunculus* L. polyphenols complexed to soy protein show enhanced bioavailability and hypoglycemic activity in C57BL/6 mice.**

[Ribnicky DM](#)¹, [Roopchand DE](#)², [Poulev A](#)², [Kuhn P](#)², [Oren A](#)², [Cefalu WT](#)³, [Raskin I](#)².

PMI5011: From Isolating the Extract to Clinical Trial

Screen 100s of botanical ethanolic extracts
for activity in skeletal muscle in cell culture

Artemisia species selected
dracunculus, *scoparia*, *santolinifolia*

Ethanol extract of *A. dracunculus*
Designated PMI5011

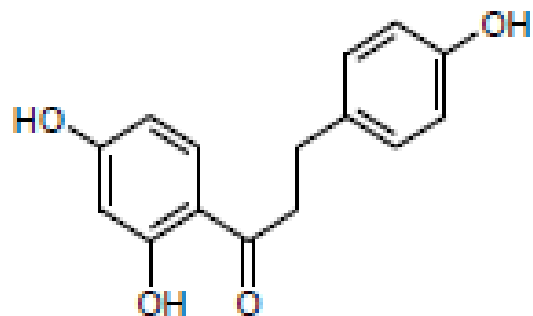
Test biological activity: muscle, fat, liver, pancreas
Bioactivity guided fractionation, toxicology
Testing in cell culture and in rodents

Ongoing Human Trials using Nutrasorb
Testing doses, safety

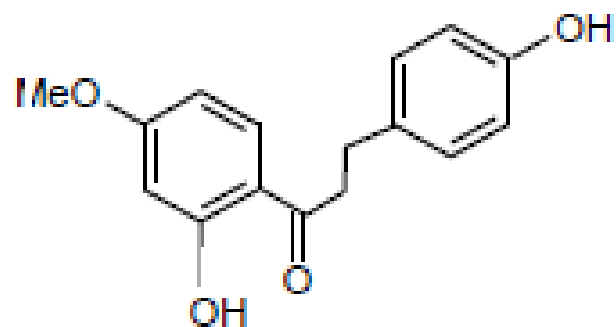
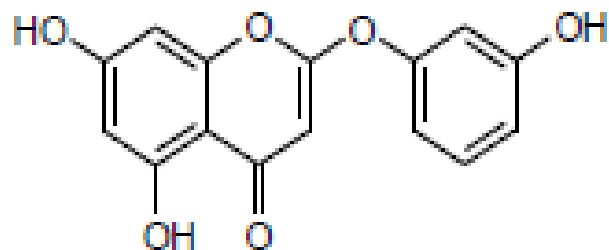


Bioactive Compounds Identified from Russian Tarragon Extract

Davidigenin

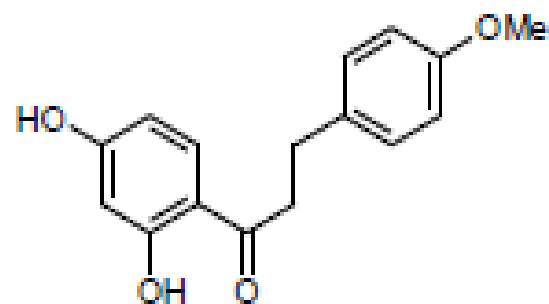


Sakuranetin



DMC-1


2',4'-dihydroxy-4'-methoxydihydrochalcone



DMC-2

2',4'-dihydroxy-4-methoxydihydrochalcone
4'-O-Methyldividigenin

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Center for Natural Product Technologies at UIC

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Archive of CENAPT project U41AT008706 (content until 06/2020)

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 <p>Connecting scientists and technologies</p>	 <p>Offering resources for the natural product community</p>	 <p>Addressing challenges in natural product research</p>
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Our Partners at CENAPT: Guido Pauli, Distinguished Professor Pharmacognosy



What happens when we delete a single compound in the mixture? Using “DESIGNER” Chemistry

JOURNAL OF
**NATURAL
PRODUCTS**

Cite This: *J. Nat. Prod.* XXXX, XXX, XXX–XXX

Article

pubs.acs.org/jnp

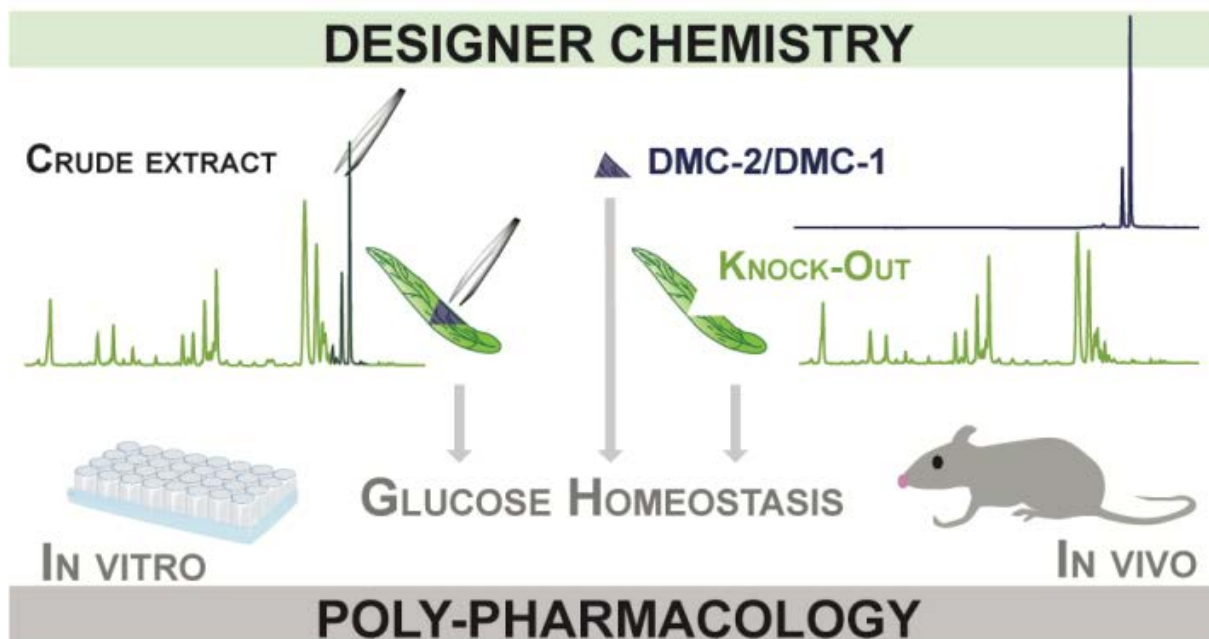
The DESIGNER Approach Helps Decipher the Hypoglycemic Bioactive Principles of *Artemisia dracunculus* (Russian Tarragon)

Yongmei Yu,^{†,‡} Charlotte Simmler,^{‡,§} Peter Kuhn,[§] Alexander Poulev,[§] Ilya Raskin,[§] David Ribnicky,[§] Z. Elizabeth Floyd,^{‡,†} and Guido F. Pauli^{‡,†}

[†]Pennington Biomedical Research Center, Louisiana State University System, Baton Rouge, Louisiana 70808, United States

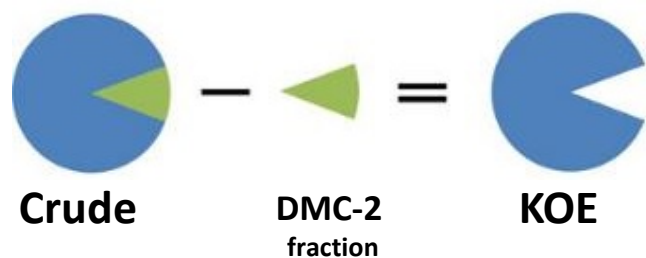
[‡]Center for Natural Product Technologies, Program for Collaborative Research in the Pharmaceutical Sciences and Department of Pharmaceutical Sciences, University of Illinois at Chicago, 833 South Wood Street, Chicago, Illinois 60612, United States

[§]Department of Plant Biology, Rutgers University, New Brunswick, New Jersey 08901, United States

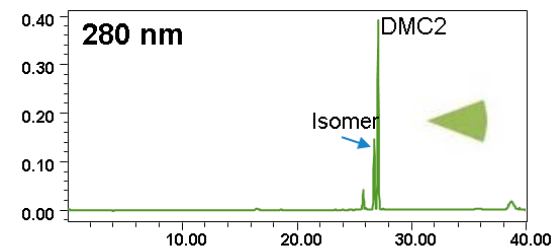
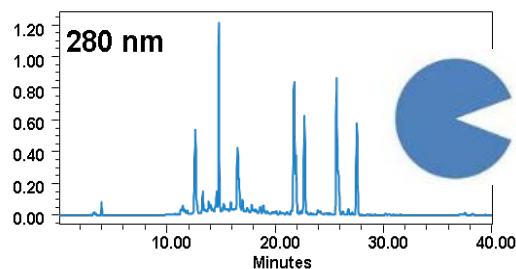
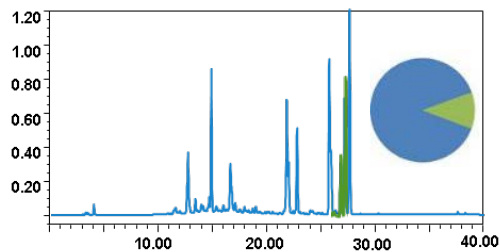
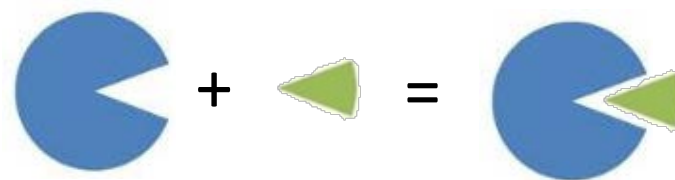


Removing a Single Compound from PMI5011

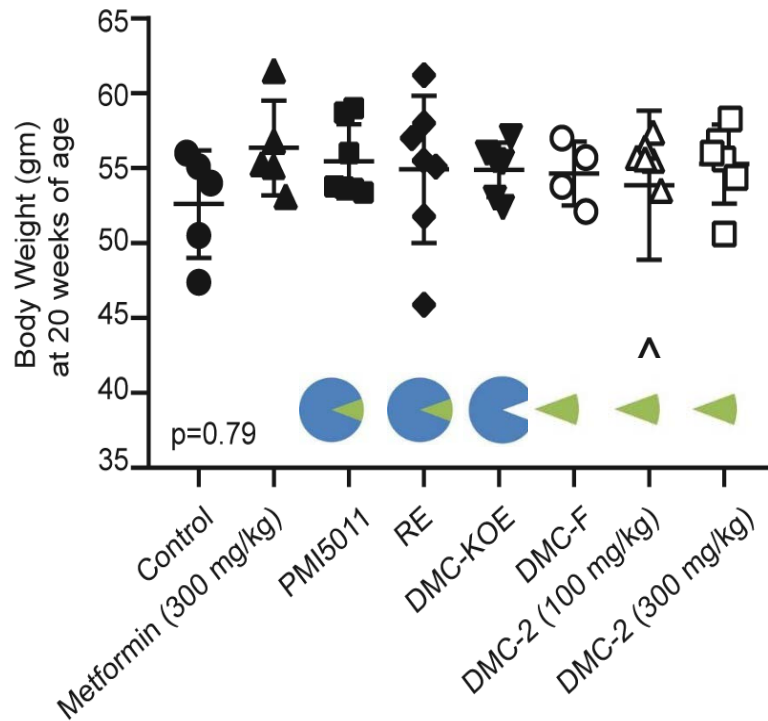
DMC-2, a chalcone



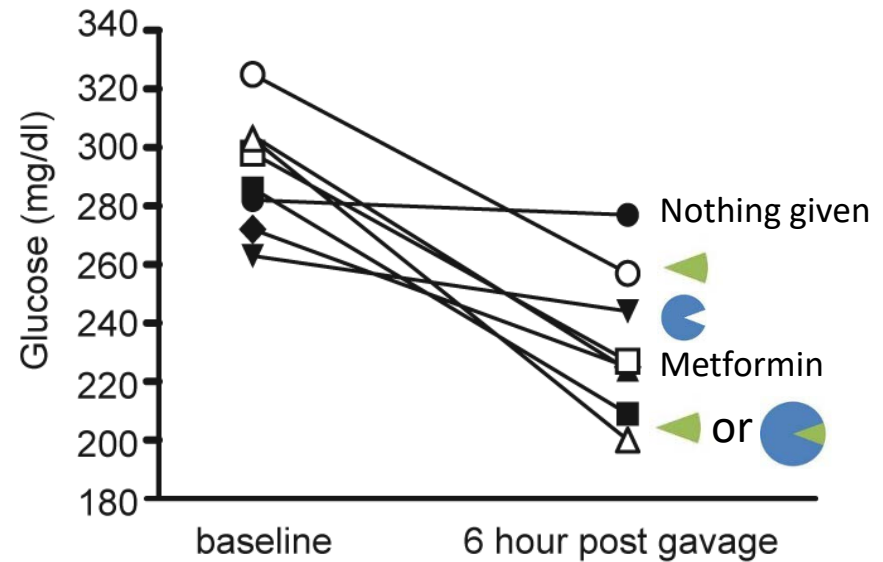
CONTROL = reconstituted extract



The Effect of the Single Compound DMC-2 on Blood Glucose

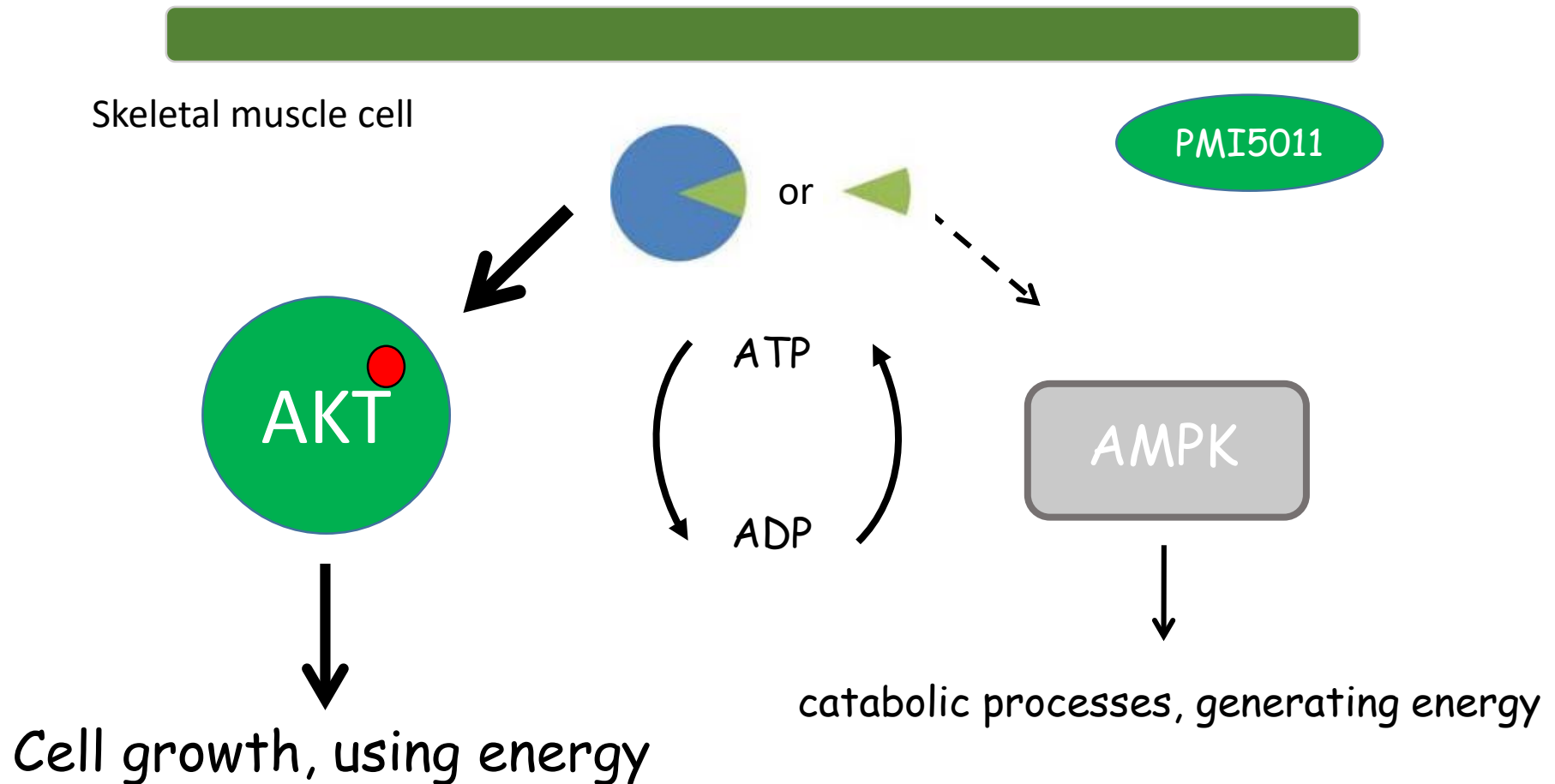


No change in body weight

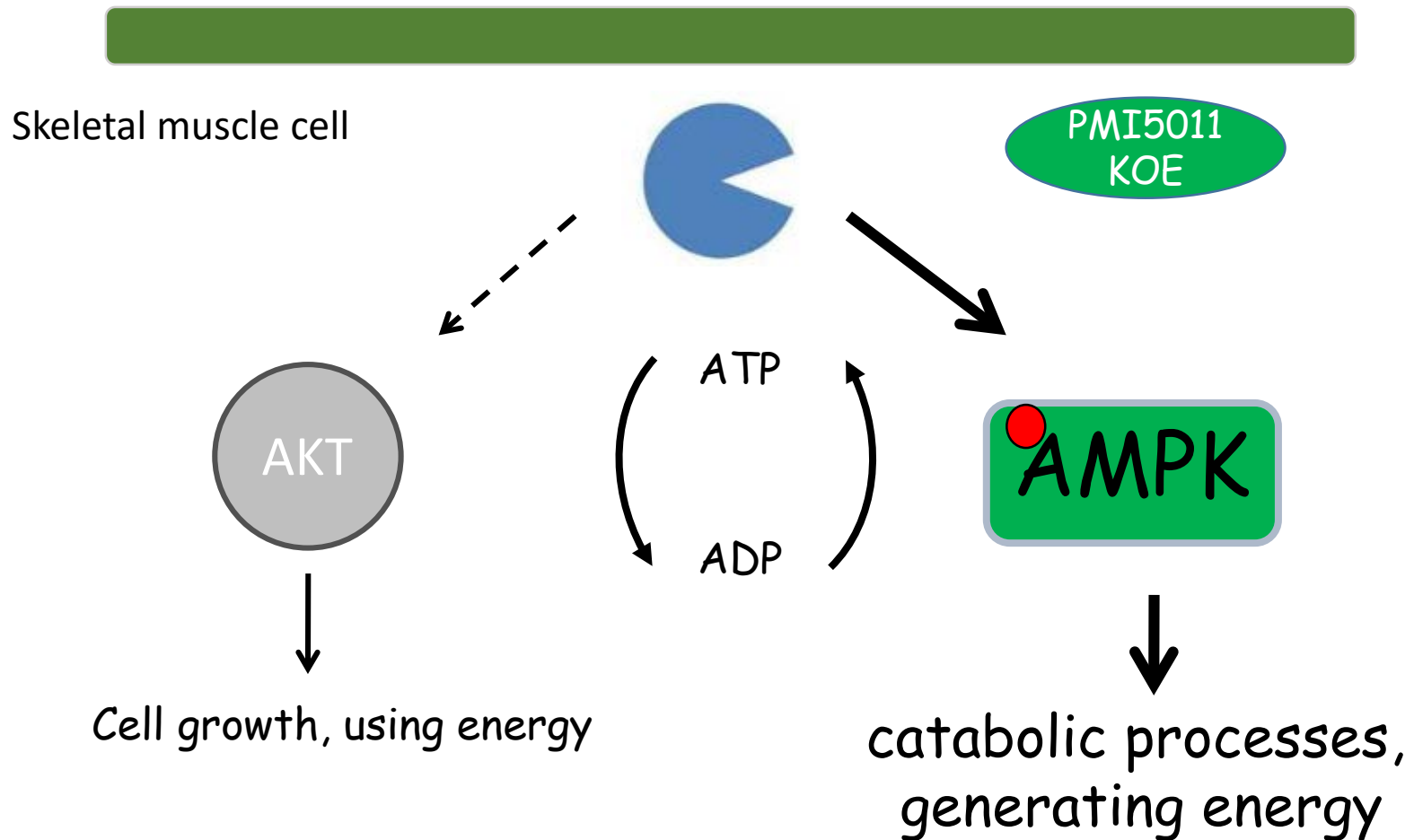


...big change in blood glucose

The Effect of a Single Compound in PMI5011: DMC-2

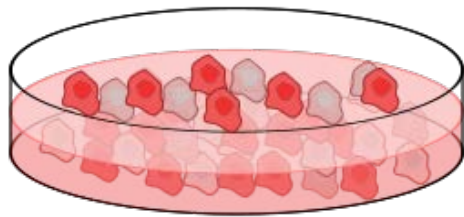


The Effect of a Single Compound in PMI5011



Screening Botanical Extracts

Cell Culture



Animal Model of Disease

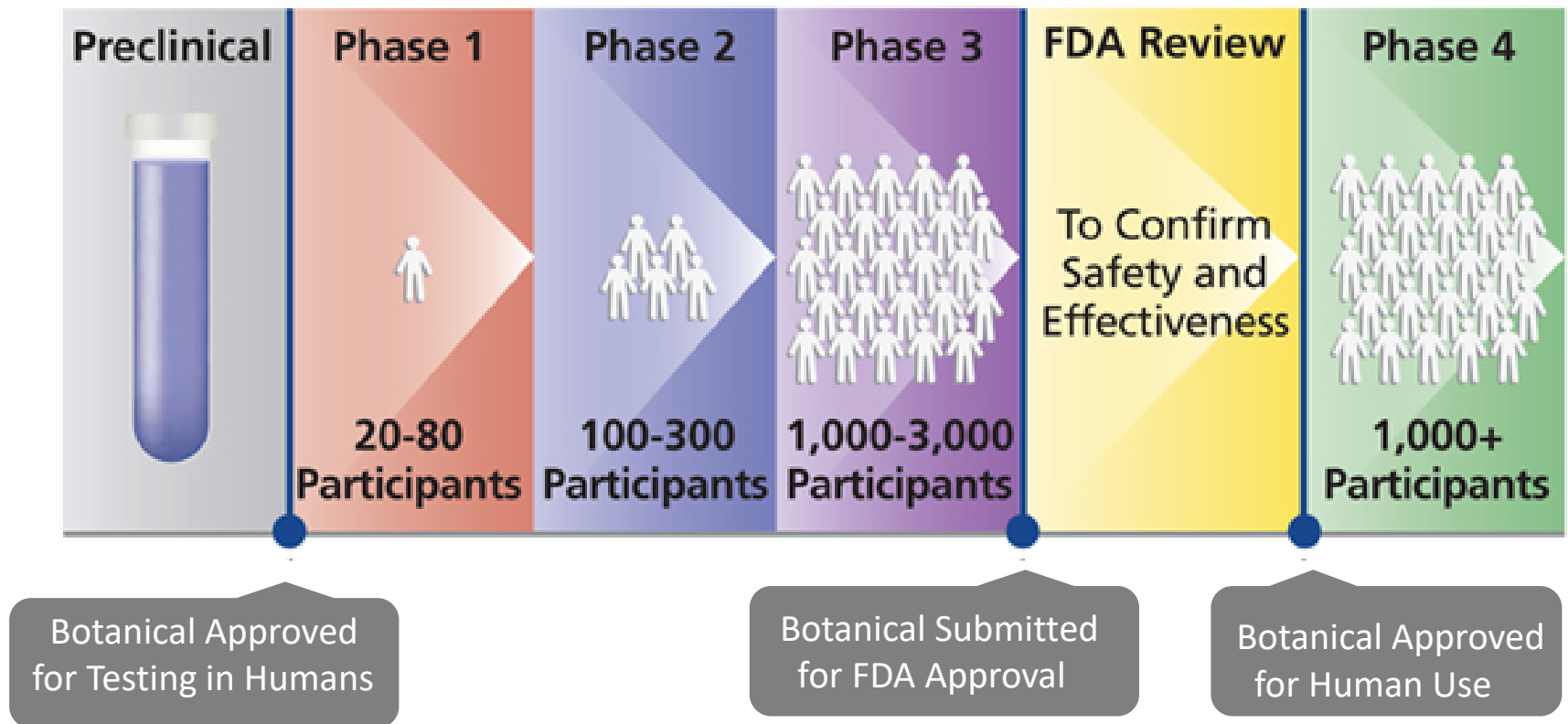


Clinical Trials



Testing Botanical Extracts: Steps Along the Way

How Clinical Trials Work



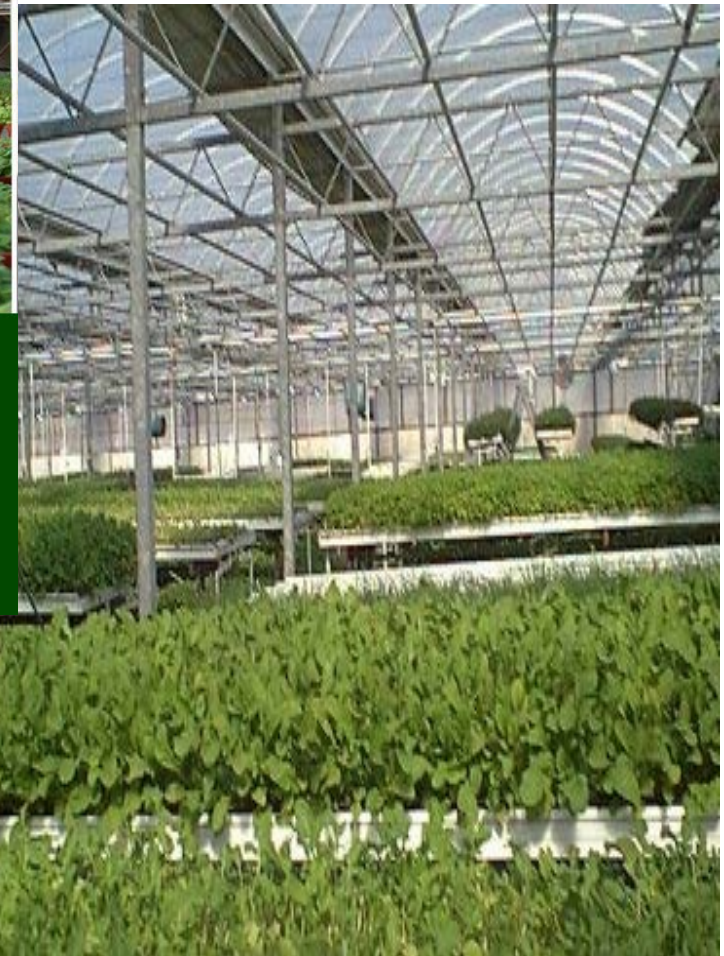
PMI5011: From Isolating the Extract to Clinical Trial: McGregor's Greens, Mt. Doro, Florida




Mr. McGregor's

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New Jersey (856) 451-8800 | orders@mcgregorsgreens.com | Florida (352) 729-5867



From McGregor's Greens, Mt. Doro, Florida To the LSU Food Incubator

176 pounds of Russian tarragon

Shipped and stored frozen



Early Example of Isolating the Medicinal Compounds



Decoction method

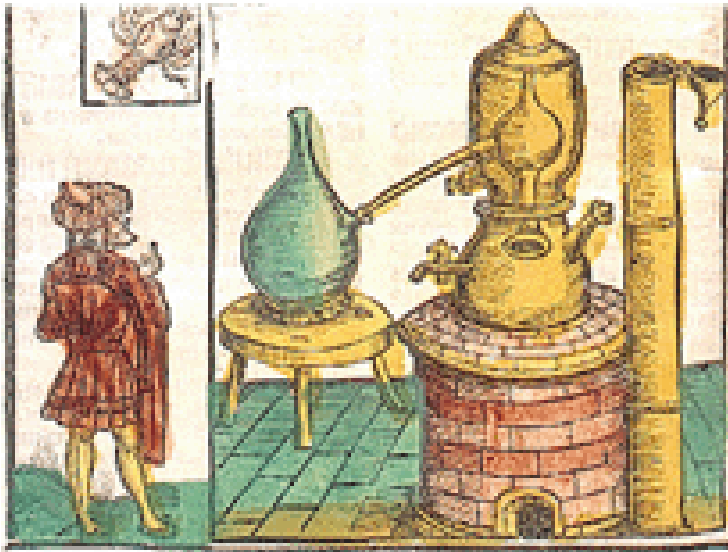
Isolating the Medicinal Compounds for a Clinical Study



- 176 lb Russian tarragon plant material
- 400 liters of water (~106 gallons)
- 12 kg soy protein isolate/flour (26.4 lbs)

1. Make the Russian tarragon tea/the decoction
2. Bind the plant compounds to a soy protein isolate/flour
3. Pour off the tea and unbound plant compounds
4. Freeze dry the bound compounds/soy flour mixture

A Decoction of Russian Tarragon: LSU AgCenter Food Incubator



Early kettles



LSU Food Incubator kettle

A Decoction of Russian Tarragon: LSU AgCenter Food Incubator

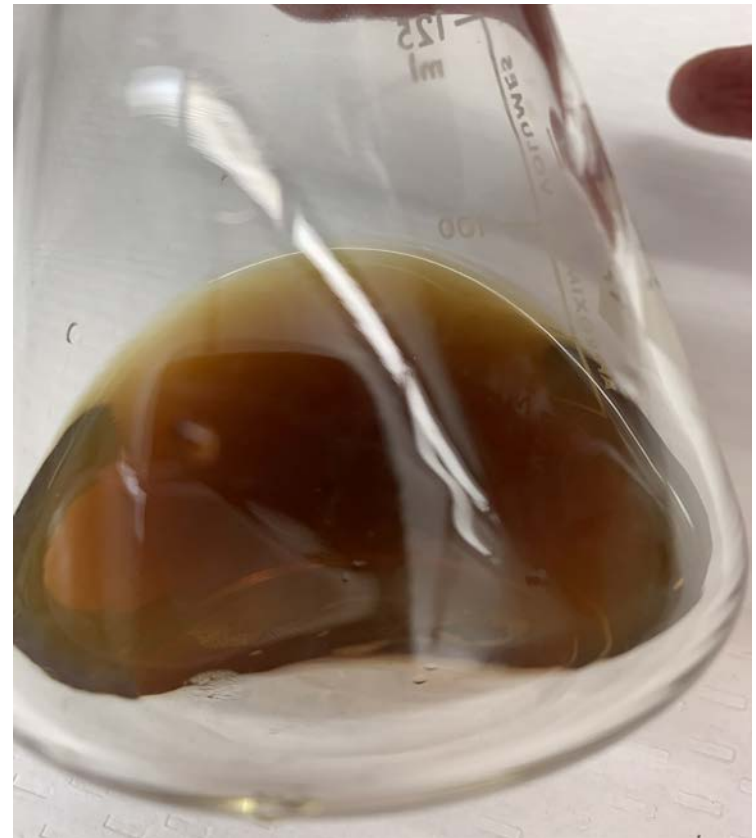


Early Scientists processing
herbal medicines

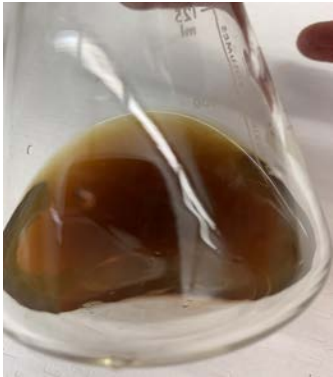


...and PBRC scientists at the Food Incubator

Tea from Russian Tarragon



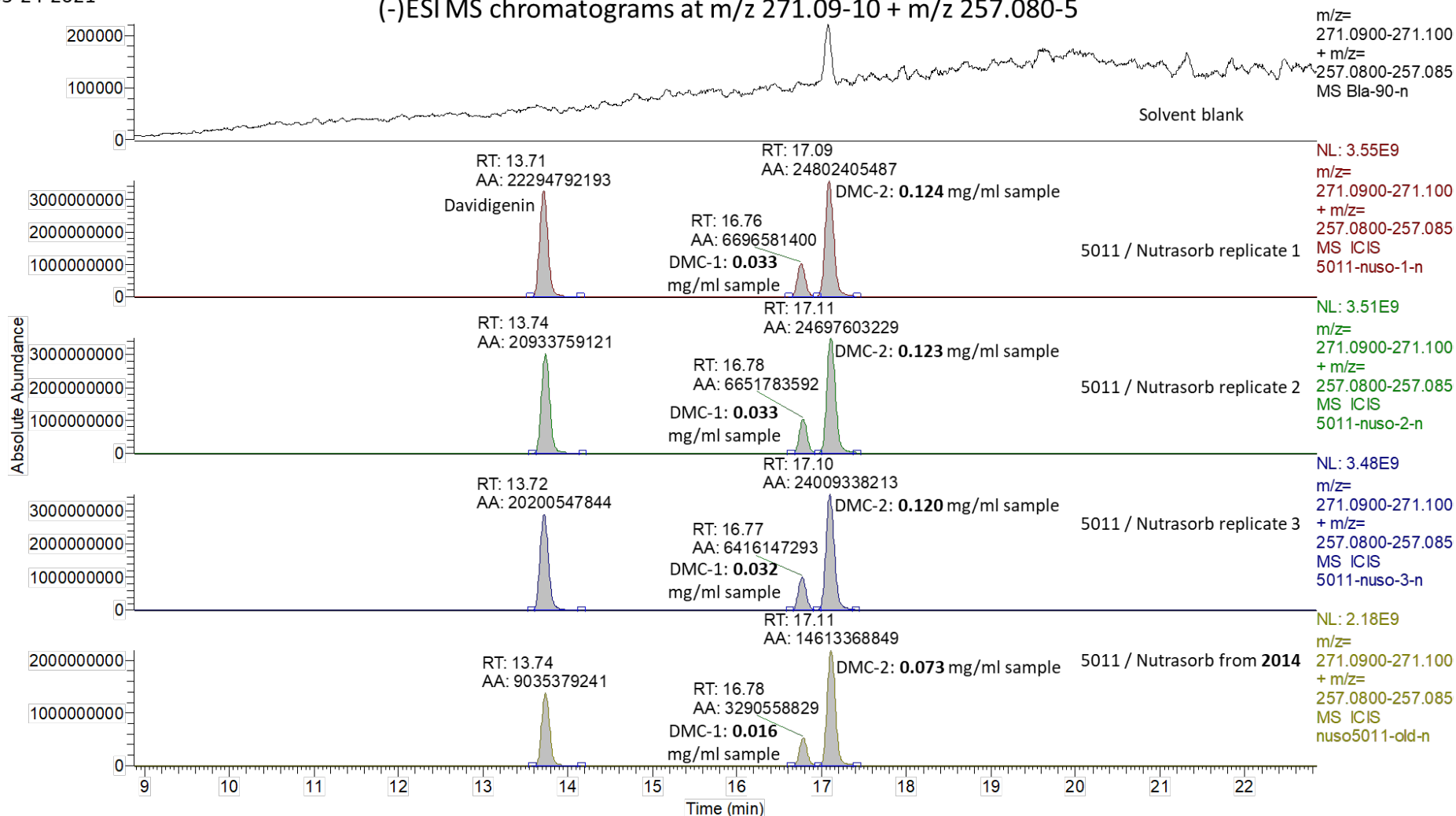
Final Product: Compounds from Russian Tarragon Bound to Soy Protein Isolate (from ADM)



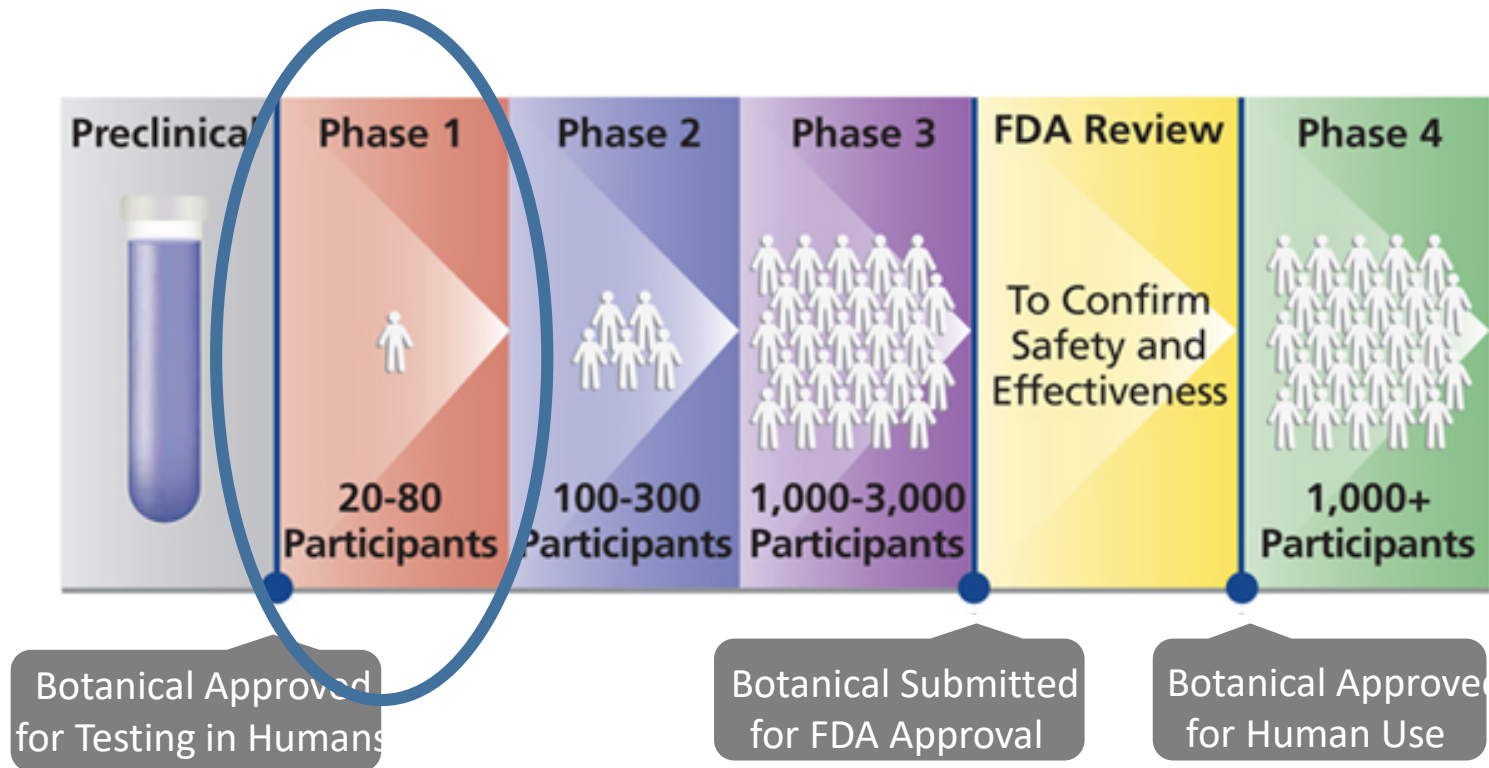
DMC-2 in the Nutrasorb/5011

03-24-2021

(-)ESI MS chromatograms at m/z 271.09-10 + m/z 257.080-5



Testing Nutrasorb/5011 in Clinical Studies: Tolerability/Palatibility Study



- ✓ IRB approval, FDA review
- ✓ Data Safety and Monitoring Plan
- ✓ Study Accrual and Retention Plan
- ✓ Will begin recruiting in the fall

Acknowledgements...and Thank You

Botanical and Dietary Supplements Research Center

Jacqueline Stephens and Elizabeth Floyd

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LSU Food Incubator

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Gaye Sandoz

Jason Gilfour

University of Illinois, Chicago

CENAPT

Guido Pauli

Charlotte Simmler



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**Pennington Biomedical
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Coypu Foundation Trust

John S. McIlhenny Laboratory for Botanical Research