

UNITED STATES
ENVIRONMENTAL
PROTECTION AGENCY



Phytotechnologies

6th International Conference

December 2-4, 2009
Hyatt Regency
St. Louis Riverfront



By the International Phytotechnology Society

MISSOURI
S&T

2009 Conference Supporters and Exhibitors

Special Acknowledgements

The International Phytotechnologies Society would like to express a deep appreciation to NSF and NIEHS/NIH for their financial contributions supporting activities occurring at the **6th International Phytotechnologies Conference**. The NSF support made the Phyto Scholars program possible, enabling over 100 students to attend; NIEHS provided support for conference materials. Their combined support made many things possible that would not have been otherwise.

Thank you to the following supporters:



ROUX ASSOCIATES, INC.
*Environmental Consulting
& Management*

Exhibitors



Taylor & Francis
Taylor & Francis Group



SIMPLY. SMARTER. GREEN ROOFS.



*Creative Technologies
Worldwide*



ROUX ASSOCIATES, INC.
*Environmental Consulting
& Management*



Table of Contents

Conference Supporters and Exhibitors.....	Inside Front Cover
Table of Contents.....	3-4
Conference Organizing Committee	4
Forward	5
Phytotechnology Society Overview	5
2009 Conference Schedule	6-7
Plenary Speakers:.....	8-11
Keynote Speaker: Dr. Peter Raven	8-9
Dr. Alan Baker.....	9
Dr. Dennis Hazel.....	10
Dr. Richard Sayre.....	10
Dr. William Suk.....	11
Plenary Abstracts	12-15
Platform Abstracts:.....	16-111
Phytomonitoring.....	16-19
Genetic Engineering and Systems Biology (I)	20-23
Restoration.....	24-27
Persistent Organic Pollutants	28-32
Genetic Engineering and Systems Biology (II).....	33-37
Metals in Terrestrial Systems	38-42
Nano	43-47
Green Infrastructure/Storm Water	48-51
Green Roof.....	52-56
Plant Interactions with Novel Contaminants.....	57-60
Groundwater.....	61-64
Covers	65-68
Biofuels	69-72

Table of Contents, *continued*

Platform Abstracts, *continued*

Explosives and Munitions.....	73-76
Sustainability	77-80
Long-term Trials	81-85
Metalloids in Terrestrial Systems	86-91
TPH-PAH.....	92-96
Wetlands	97-101
Salt/Selenium.....	102-106
Endophytes.....	107-111

Poster Abstracts.....	112-206
Poster Session #1 (Abstracts 1-54).....	112-165
Poster Session #2 (Abstracts 55-95).....	166-206

Author Biographies	207-247
--------------------------	---------

Conference Organizing Committee

Dr. Joel G. Burken

Missouri University
of Science and Technology
224 Butler-Carlton Hall
401 N. Pine Street
Rolla, MO 65409 USA
573-341-6547
burken@mst.edu

Dr. Barbara A. Zeeb

Royal Military College of Canada
Canada Research Chair
Biotechnologies & Environment
Professor of Chemistry &
Chemical Engineering
P.O. Box 1700 Station Forces
Kingston, Ontario K7K7B4 Canada
613-541-6000 x6713
zeeb-b@rmc.ca

Dr. Lee A. Newman

Brookhaven National Laboratory
Associate Biochemist
Biology Dept., Bldg. 463
Upton, NY 11973 USA
631-344-5702
newman@bnl.gov

Dr. Elizabeth Guthrie Nichols

North Carolina State University
Department of Forest and
Environmental Resources
2800 Faucette Drive, Box 8006
Raleigh, NC USA
919-513-4832
egnichol@ncsu.edu

Dr. Jason C. White

Agricultural Scientist
Dept. of Soil and Water
Connecticut Agricultural
Experiment Station
123 Huntington Street
New Haven, CT 06504 USA
203-974-8523
Jason.White@ct.gov

David Tsao

BP Corporation North America
tsaodt@bp.com

Steve Rock

Environmental Engineer
U.S. Environmental Protection Agency
3995 Center Hill Avenue
Cincinnati, OH 45224
513-569-7149
Rock.steven@epa.gov



In the planning and organizing how to best present the great research that is represented in this document, we clearly see that the **6th International Phytotechnologies Conference** is more international and more technologically broad than ever before. Without question, our field is still growing and expanding. When the Phytoremediation: State of the Science Conference was first held in Boston in May 2000, the focus was primarily looking at individual plant-contaminant interactions and identifying potential degradation mechanisms and contaminant fate. We stand at this conference discussing genetic engineering, biofuels production, and long term success, and we are investigating novel compounds and engineered nanoparticles in plant systems, before they are even classified as environmental contaminants. We also look at representative from around the globe, with abstract submissions from 26 countries to represent a truly international field. Not only is there active research globally, full scale applications are impacting our world.

The seeds planted in Boston and by the small group gathered in the one room have also grown into a flourishing young journal and an international organization that works to nurture this conference and disseminate much of the great work represented here through the *International Journal of Phytoremediation*. The International Phytotechnology Society is thriving and this conference has expanded to 21 sessions held in three concurrent tracks. While it is unfortunate we can't see all of our colleague's work, the expansion of great research is a great problem to have.

We also welcome you to St. Louis, the Gateway City. We hope that this conference offers a fantastic opportunity to interact with colleagues from around the globe. We see this as a Gateway to a continued advancement of green remediation and technologies that will have a sustained position in the betterment of our environment.

Phytotechnology Society Overview

The International Phytotechnology Society (IPS) is a nonprofit, worldwide professional society comprised of individuals and institutions engaged in the science and application of using plants to deal with environmental problems.

IPS's mission is to promote research, education, training, and application of those technologies that use plants to deal with problems of environmental contamination, carbon sequestration, alternative fuels, and ecological restoration.

IPS is open to all researchers, practitioners, regulators, site owners and interested and concerned individuals who want to promote a natural way to deal with environmental problems.

2009 Conference Schedule

Tuesday, December 1, 2009

8:30 a.m.- 5:30 p.m.

Pre-Conference Workshops:

Phytotechnology (Phyto-3, 2009)

Greenroof Technologies & Related Practices in Buildings

Wednesday, December 2, 2009

7:30 a.m. - 6:00 p.m.
Registration Desk Open

7:30 a.m. - 8:30 a.m.
Continental Breakfast

8:30 a.m. - 9:00 a.m.
Opening Session – Welcome

9:00 a.m. - 10:00 a.m.
Keynote Speaker – Dr. Peter Raven

10:00 a.m. - 10:30 a.m.
Plenary Speaker – Dr. Bill Suk

10:30 a.m. - 11:00 a.m.
Break

11:00 a.m. - 11:30 a.m.
Plenary Speaker – Dr. Alan Baker

11:30 a.m. - 12:00 p.m.
Plenary Speaker – Dr. Dennis Hazel

12:00 p.m. - 1:30 p.m.
Lunch (on your own)

1:30 p.m. - 3:00 p.m.
Concurrent Sessions:
Session A-1: Phytomonitoring
Session B-1: Genetic Engineering
and Systems Biology (I)
Session C-1: Restoration

3:00 p.m. - 3:30 p.m.
Break

3:30 p.m. - 5:20 p.m.
Concurrent Sessions:
Session A-2: Persistent Organic Pollutants
Session B-2: Genetic Engineering and
Systems Biology (II)
Session C-2: Metals in Terrestrial Systems

5:20 p.m. - 7:00 p.m.
Poster Session I
Reception & Cash Bar
Visit Exhibits

7:30 p.m.
Phytotechnology Society Business Meeting



2009 Conference Schedule

Thursday, December 3, 2009

7:00 a.m. - 8:00 a.m.
Continental Breakfast

7:30 a.m. - 6:00 p.m.
Registration Desk Open

8:10 a.m. - 10:00 a.m.
Concurrent Sessions:
Session A-3: Nano
Session B-3: Green Infrastructure/
Storm Water
Session C-3: Green Roof

10:00 a.m. - 10:30 a.m.
Break

10:30 a.m. - 12:00 p.m.
Concurrent Sessions:
Session A-4: Plant Interactions
with Novel Contaminants
Session B-4: Groundwater
Session C-4: Covers

1:30 p.m. - 3:00 p.m.
Concurrent Sessions:
Session A-5: Biofuels
Session B-5: Explosives and Munitions
Session C-5: Sustainability

3:00 p.m. - 3:30 p.m.
Break

3:30 p.m. - 5:20 p.m.
Concurrent Sessions:
Session A-6: Long-term Trials
Session B-6: Metalloids in Terrestrial Systems
Session C-6: TPH-PAH

5:20 p.m. - 7:00 p.m.
Poster Session II
Reception & Cash Bar
Visit Exhibits

7:30 p.m.
Intn'l Journal of Phytoremediation
Editor's Meeting

Friday, December 4, 2009

7:30 a.m. - 12:00 p.m.
Registration Desk Open

7:30 a.m. - 8:30 a.m.
Continental Breakfast

8:30 a.m. - 10:20 a.m.
Concurrent Sessions:
Session A-7: Wetlands
Session B-7: Salt/Selenium
Session C-7: Endophytes

10:20 a.m. - 10:40 a.m.
Break

10:40 a.m. - 12:00 p.m.
Plenary Session

12:00 p.m.
Conference Adjourns

1:00 p.m. - 5:00 p.m.
Post Conference Tour



Participation of annexin 1 in the response of *Arabidopsis thaliana* seedlings to lead exposure: potential for phytoremediation

Ing Chia Phang^{1*}; David W.M. Leung¹; Gregory B. Clark²; Harry H. Taylor¹; Ashley Garrill¹; Jason Song¹; Stanley J. Roux².

¹ School of Biological Sciences, University of Canterbury, Private Bag 4800, Christchurch 8140, New Zealand.

² School of Biological Sciences, Section of Molecular Cell and Developmental Biology, University of Texas, Austin, TX 78712, USA.

Heavy metal pollution has become a serious public health and environmental concern. Lead (Pb) is one of the heavy metals known to bioaccumulate in plants. Phytoremediation is an emerging technology based on the ability of green plants to remove Pb from the environment in a cost-efficient and ecologically sound manner. Currently, an important research focus is to seek a better understanding of the mechanisms of Pb tolerance by plant cells, with the aim of genetically engineering plants with improved tolerance to Pb, and hence better phytoremediation capabilities in the near future.

Annexin, a calcium-dependent membrane-binding protein is believed to play a role in many essential cellular processes. It has been shown that expression of annexin genes from *Arabidopsis thaliana* are differentially regulated in response to a variety of abiotic stresses. Thus annexins are likely be involved in the response of plants to heavy metal stress. This study aimed to obtain new insights into whether annexin 1 (*AnnAt1*), is involved in Pb tolerance in plant cells. Message levels of *AnnAt1* were assessed in response to Pb treatments using quantitative realtime PCR. Expression results were analysed using REST 2008 and normalized against the mitosis protein YLS8. We found that Pb effect on *AnnAt1* expression in plants exposed to lower Pb concentrations (25 M, 50 M, and 75 M) was not significantly different from the controls. However, *AnnAt1* message levels doubled (2.12fold, S.E. range is 1.77–2.61, $p < 0.001$) in seedlings treated with 100 M Pb, in comparison to the control plants. The relative contribution of *AnnAt1* in defence against Pb stress will be discussed.

Keywords: lead (Pb), annexin, *AnnAt1*, *Arabidopsis thaliana*, stress, realtime PCR

*Presenting author: ingchia.phang@pg.canterbury.ac.nz, +642102753793.