

# Envisioning Science and Technology

**Katy Börner**

Cyberinfrastructure for Network Science Center, Director  
Information Visualization Laboratory, Director  
School of Library and Information Science  
Indiana University, Bloomington, IN

[katy@indiana.edu](mailto:katy@indiana.edu)

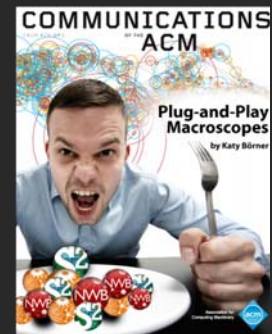
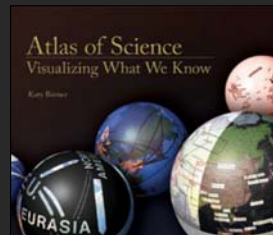
With special thanks to the members at the Cyberinfrastructure for Network Science Center; the Sci2, NWB, and EpiC team; and the VIVO Collaboration



*American Society for Information Science & Technology (ASIS&T) Webinar*

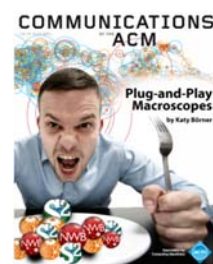
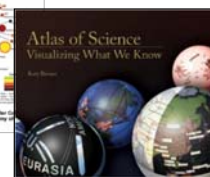
<https://www3.gotomeeting.com/register/756023558>

*November 15, 2011, 11:30a - 12:30p EST*



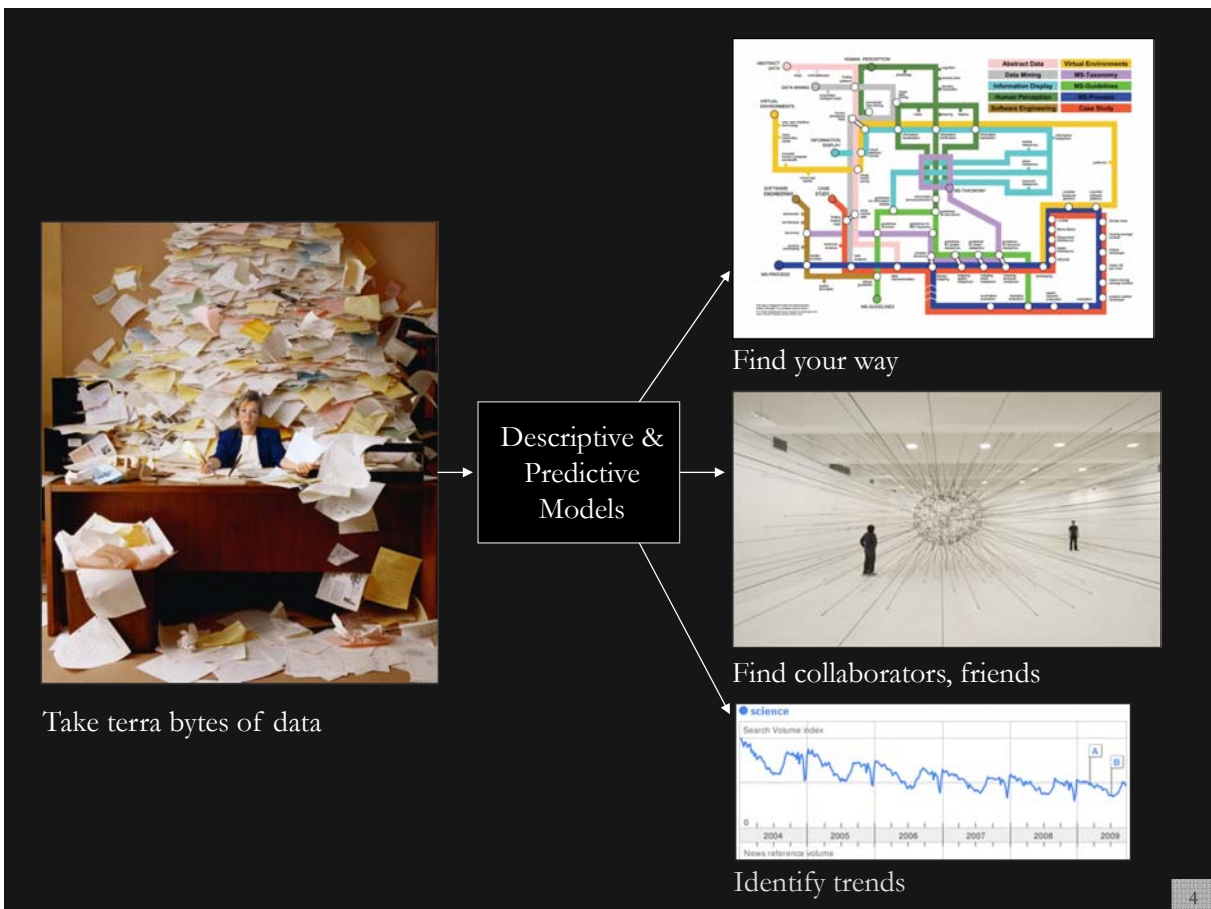
## Overview

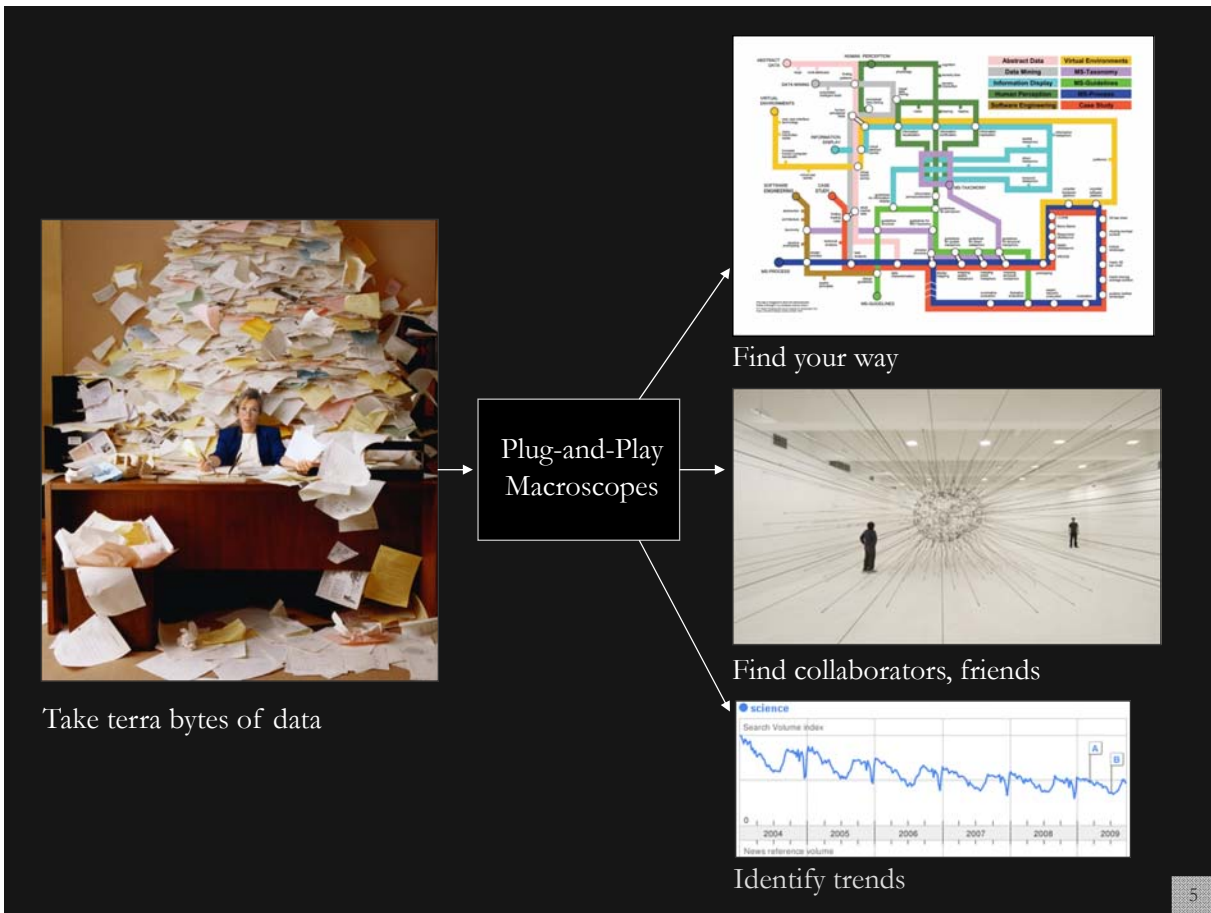
- 1. Data mining and visualization research** that aims to increase our scientific understanding of the structure and dynamics of science and technology.
- 2. Novel approaches and services** that improve information access, researcher networking, and research management.
- 3. Data services and plug-and-play macroscope tools** that commoditize data mining and visualization.



## Overview

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3. **Data services and plug-and-play macroscope tools** that commoditize data mining and visualization.





### Type of Analysis vs. Level of Analysis

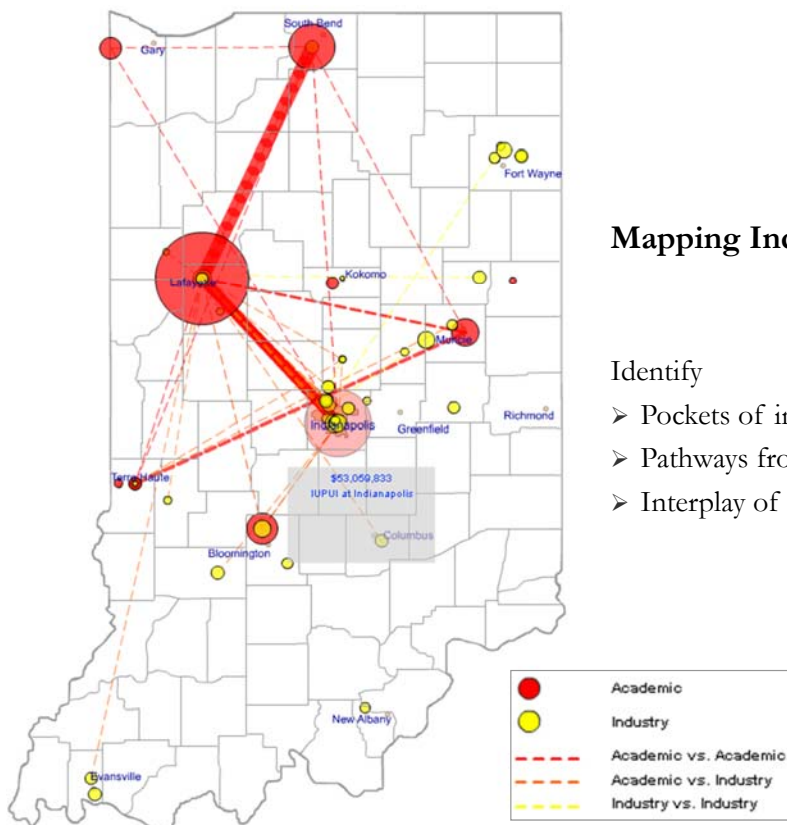
	<i>Micro/Individual (1-100 records)</i>	<i>Meso/Local (101-10,000 records)</i>	<i>Macro/Global (10,000 &lt; records)</i>
<b>Statistical Analysis/Profiling</b>	Individual person and their expertise profiles	Larger labs, centers, universities, research domains, or states	All of NSF, all of USA, all of science.
<b>Temporal Analysis (When)</b>	Funding portfolio of one individual	Mapping topic bursts in 20-years of PNAS	113 Years of Physics Research
<b>Geospatial Analysis (Where)</b>	Career trajectory of one individual	Mapping a states intellectual landscape	PNAS publications
<b>Topical Analysis (What)</b>	Base knowledge from which one grant draws.	Knowledge flows in Chemistry research	VxOrd/Topic maps of NIH funding
<b>Network Analysis (With Whom?)</b>	NSF Co-PI network of one individual	Co-author network	NIH's core competency

## Type of Analysis vs. Level of Analysis

	<i>Micro/Individual</i> (1-100 records)	<i>Meso/Local</i> (101-10,000 records)	<i>Macro/Global</i> (10,000 < records)
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7



## Mapping Indiana's Intellectual Space

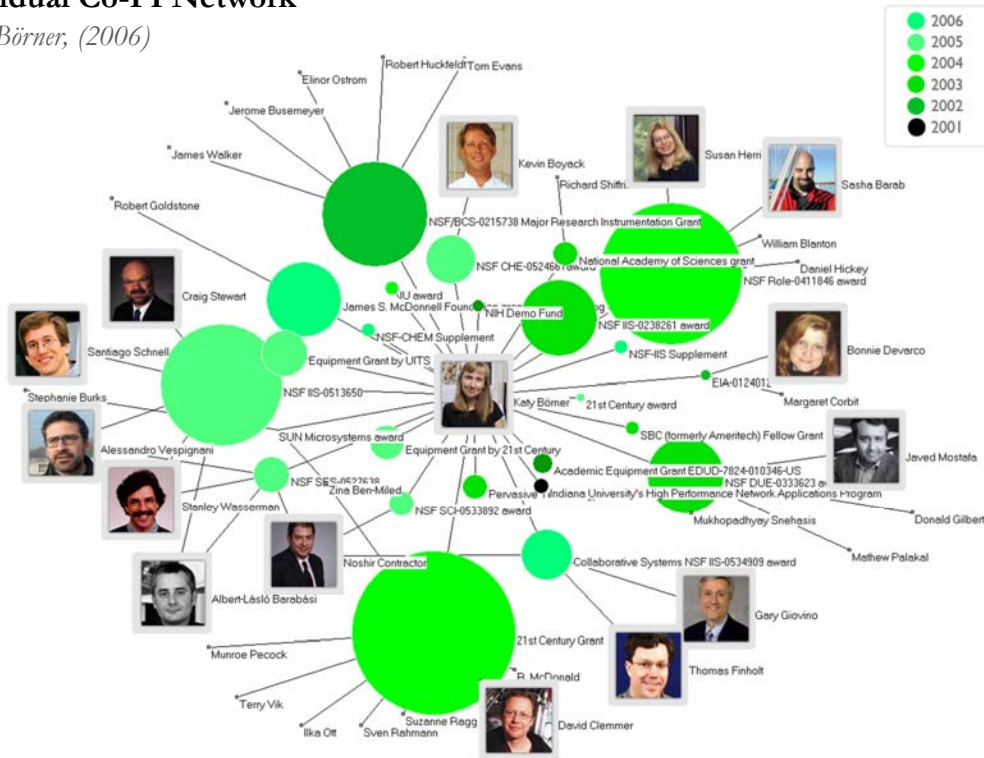
Identify

- Pockets of innovation
- Pathways from ideas to products
- Interplay of industry and academia

8

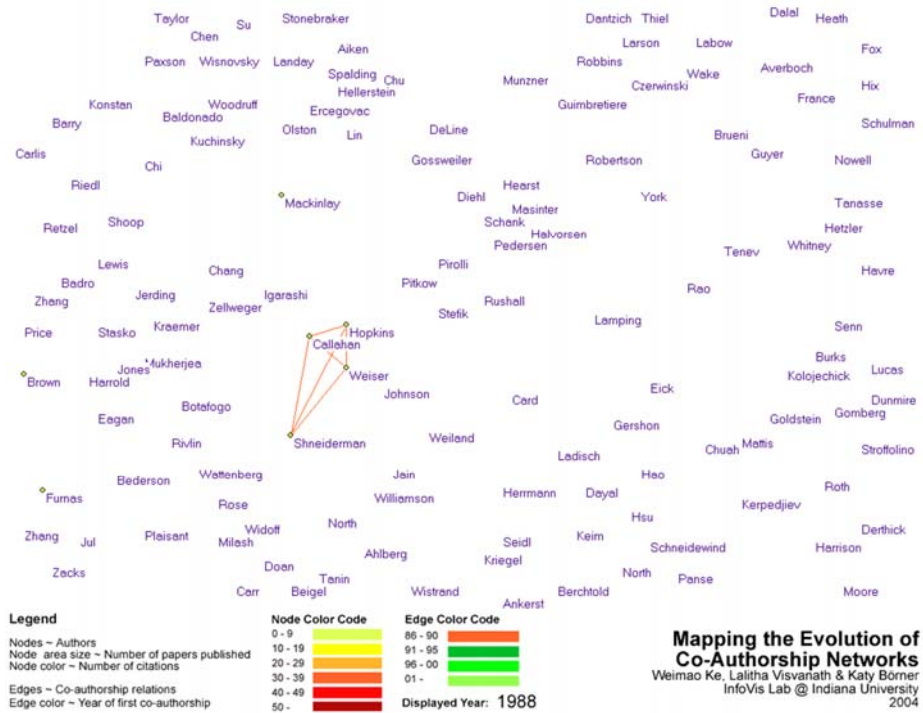
# Individual Co-PI Network

Ke & Börner, (2006)



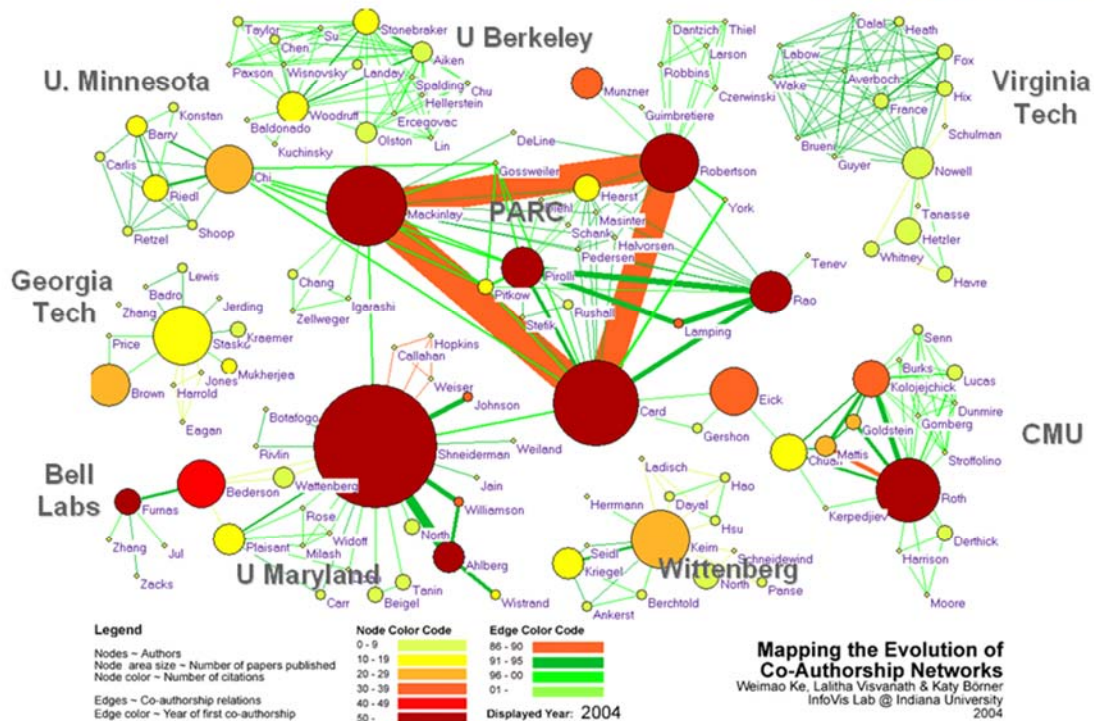
# Mapping the Evolution of Co-Authorship Networks

Ke, Visvanath & Börner, (2004) Won 1st price at the IEEE InfoVis Contest.



## Mapping the Evolution of Co-Authorship Networks

Ke, Viswanath & Börner, (2004) Won 1st price at the IEEE InfoVis Contest



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## Studying the Emerging Global Brain: Analyzing and Visualizing the Impact of Co-Authorship Teams

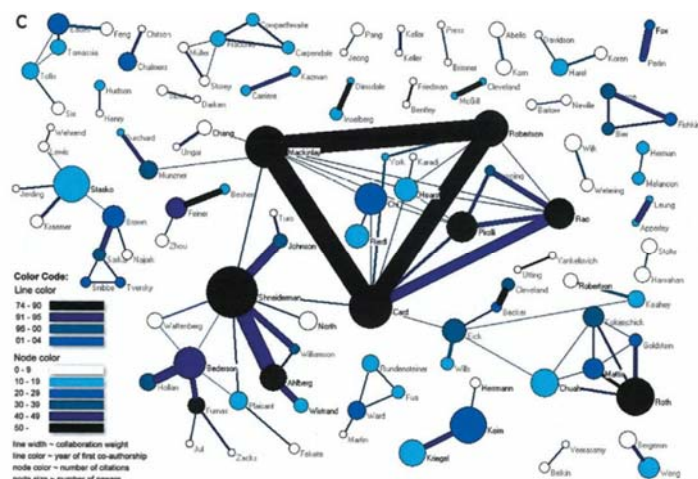
Börner, Dall'Asta, Ke & Vespignani (2005)  
*Complexity*, 10(4):58-67.

### Research question:

- Is science driven by prolific single experts or by high-impact co-authorship teams?

### Contributions:

- New approach to allocate citational credit.
- Novel weighted graph representation.
- Visualization of the growth of weighted co-author network.
- Centrality measures to identify author impact.
- Global statistical analysis of paper production and citations in correlation with co-authorship team size over time.
- Local, author-centered entropy measure.



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## Spatio-Temporal Information Production and Consumption of Major U.S. Research Institutions

Börner, Katy, Penumarty, Shashikant, Meiss, Mark and Ke, Weimao. (2006)  
*Mapping the Diffusion of Scholarly Knowledge Among Major U.S. Research Institutions. Scientometrics. 68(3), pp. 415-426.*



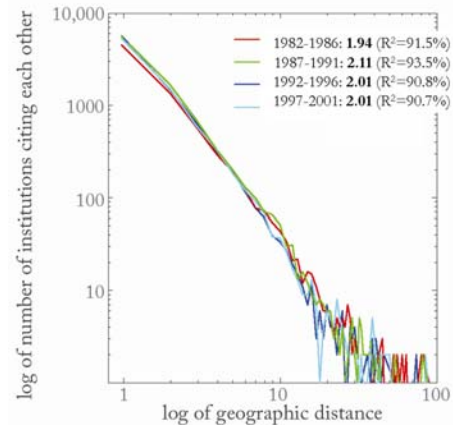
### Research questions:

1. Does space still matter in the Internet age?
2. Does one still have to study and work at major research institutions in order to have access to high quality data and expertise and to produce high quality research?
3. Does the Internet lead to more global citation patterns, i.e., more citation links between papers produced at geographically distant research institutions?



### Contributions:

- Answer to Qs 1 + 2 is YES.
- Answer to Qs 3 is NO.
- Novel approach to analyzing the dual role of institutions as information producers and consumers and to study and visualize the diffusion of information among them.



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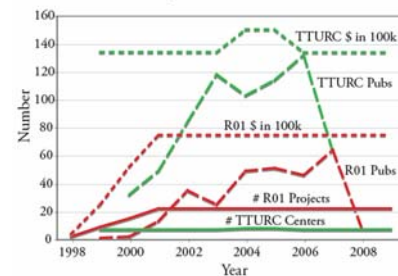
## Mapping Transdisciplinary Tobacco Use Research Centers Publications

Compare R01 investigator based funding with TTURC Center awards in terms of number of publications and evolving co-author networks.

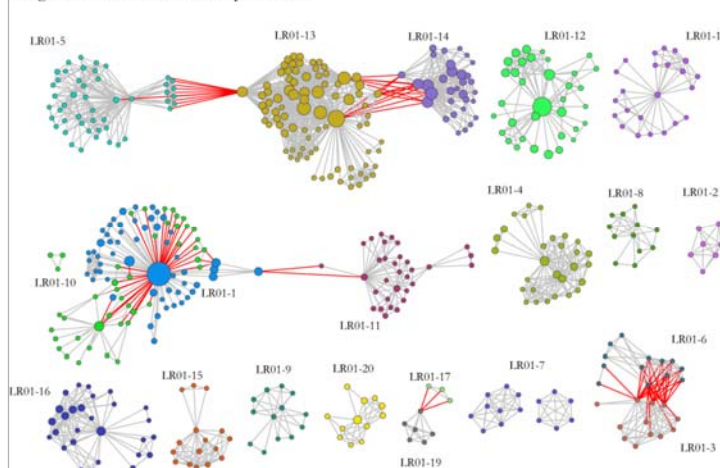
Zoss & Börner, forthcoming.

Supported by NIH/NCI Contract HHSN261200800812

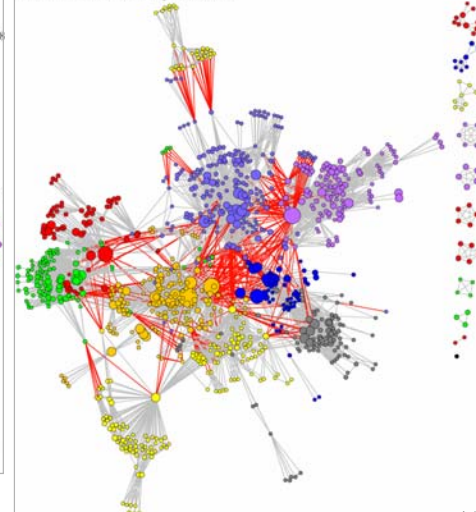
R01 & TTURC Project Information



Longitudinal R01 Co-Authorship Network



TTURC Co-Authorship Network



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Debut of 5<sup>th</sup> Iteration of Mapping Science Exhibit at MEDIA X was on May 18, 2009 at Wallenberg Hall, Stanford University, <http://mediax.stanford.edu>, <http://scaleindependentthought.typepad.com/photos/scimaps>

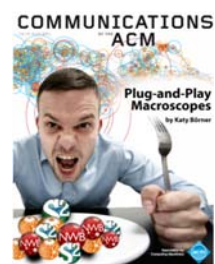


Science Maps in “Expedition Zukunft” science train visiting 62 cities in 7 months 12 coaches, 300 m long Opening was on April 23<sup>rd</sup>, 2009 by German Chancellor Merkel  
<http://www.expedition-zukunft.de>



## Overview

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## Different Stakeholder Groups and Their Needs

### Funding Agencies

- Need to monitor (long-term) money flow and research developments, identify areas for future development, stimulate new research areas, evaluate funding strategies for different programs, decide on project durations, funding patterns.

### Scholars

- Want easy access to research results, relevant funding programs and their success rates, potential collaborators, competitors, related projects/publications (*research push*).

### Industry

- Is interested in fast and easy access to major results, experts, etc. Influences the direction of research by entering information on needed technologies (*industry-pull*).

### Advantages for Publishers

- Need easy to use interfaces to massive amounts of interlinked data. Need to communicate data provenance, quality, and context.

### Society

- Needs easy access to scientific knowledge and expertise.

## Scholars Have Different Roles/Needs

**Researchers and Authors**—need to select promising research topics, students, collaborators, and publication venues to increase their reputation. They benefit from a global view of competencies, reputation and connectivity of scholars; hot and cold research topics and bursts of activity, and funding available per research area.

**Editors**—have to determine editorial board members, assign papers to reviewers, and ultimately accept or reject papers. Editors need to know the position of their journals in the evolving world of science. They need to advertise their journals appropriately and attract high-quality submissions, which will in turn increase the journal's reputation.

**Reviewers**—read, critique, and suggest changes to help improve the quality of papers and funding proposals. They need to identify related works that should be cited or complementary skills that authors might consider when selecting project collaborators.

**Teachers/Mentors**—teach classes, train doctoral students, and supervise postdoctoral researchers. They need to identify key works, experts, and examples relevant to a topic area and teach them in the context of global science.

**Inventors**—create intellectual property and obtain patents, thus needing to navigate and make sense of research spaces as well as intellectual property spaces.

**Investigators**—scholars need funding to support students, hire staff, purchase equipment, or attend conferences. Here, research interests and proposals have to be matched with existing federal and commercial funding opportunities, possible industry collaborators and sponsors.


**Team Leads and Science Administrators**—many scholars direct multiple research projects simultaneously. Some have full-time staff, research scientists, and technicians in their laboratories and centers. Leaders need to evaluate performance and provide references for current or previous members; report the progress of different projects to funding agencies.

# Mapping Sustainability Research

## MAPSustain

Mapping Sustainability Research

**Geographic Map** **Science Map**



Map data ©2010 Europa Technologies, INEGI

Funding  
 NIH  
 NSF  
 USDA

Publications  
 DOE  
 ISI  
 Medline

Patents  
 USPTO

Citations  Count

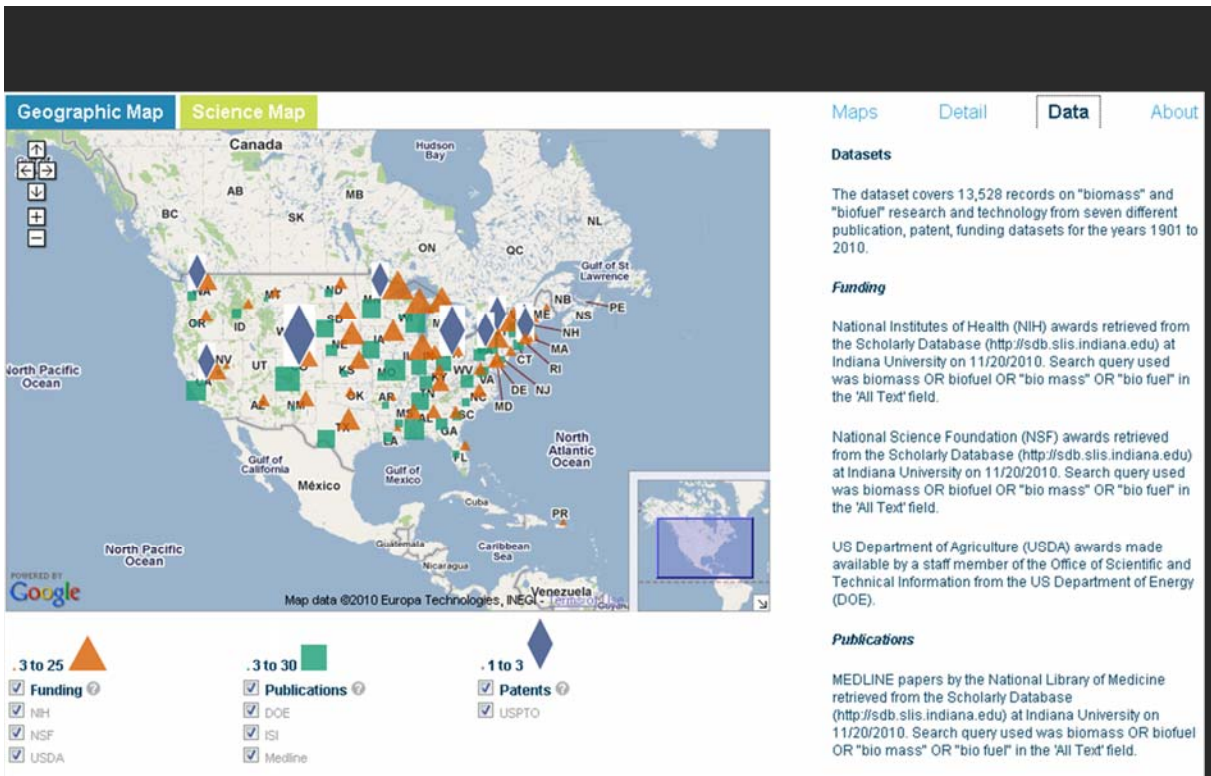
Amount  Count

From year 1901 to year 2009

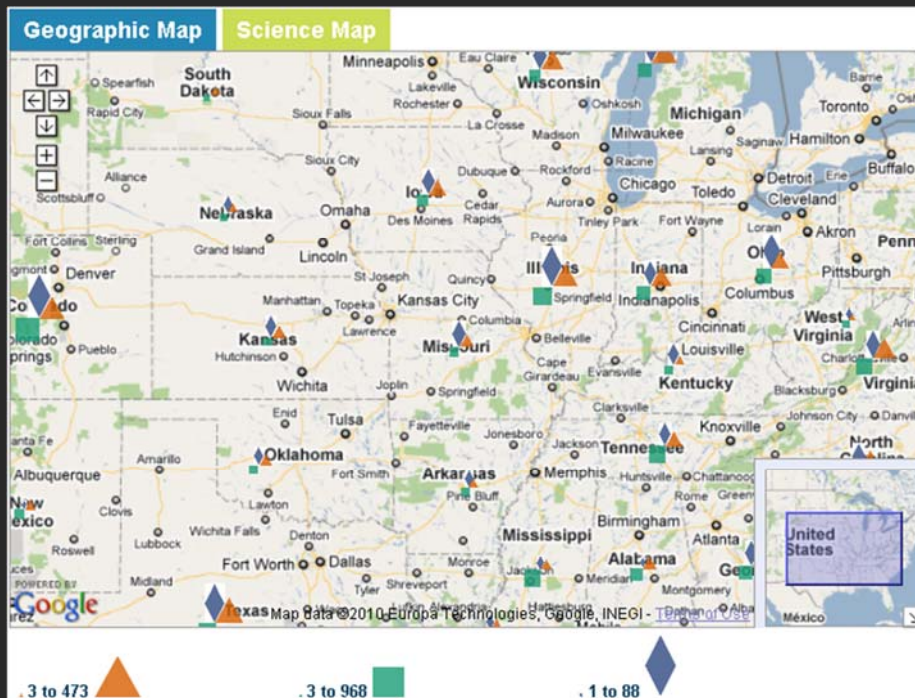
Search by keyword

<http://mapsustain.cns.iu.edu>

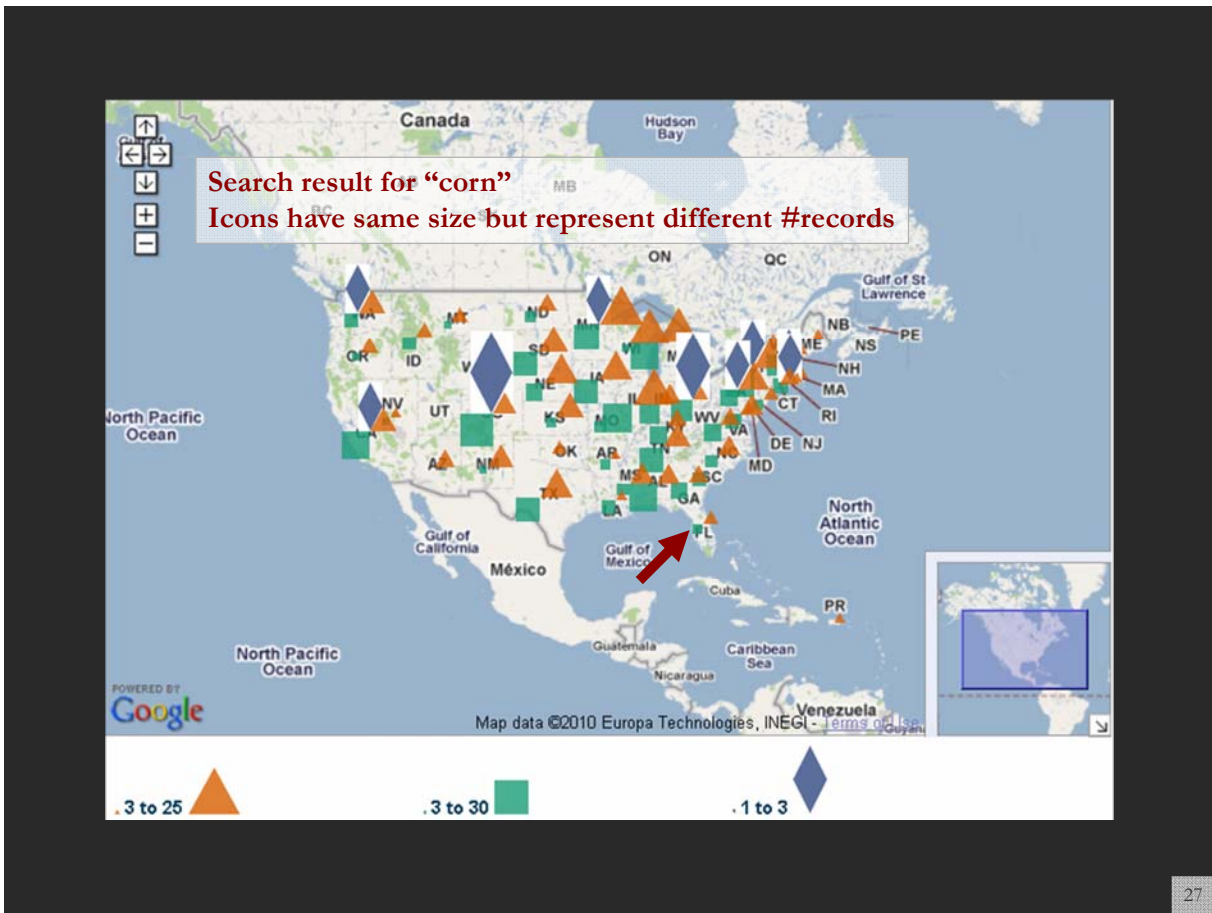
**CYBERINFRASTRUCTURE for NETWORK SCIENCE CENTER**  
School of Library and Information Science, Indiana University



The geographic map at state level.



The geographic map at city level.



Science Map

Click on one icon to display all records of one type.  
Here publications in the state of Florida.

Florida publications: 2 records  
DOE: 1  
MEDLINE: 1

Maps Detail Data About

> Florida

MEDLINE 2002

- Recovery Of Dairy Manure Nutrients By Benthic Freshwater Algae

DOE 1985

- Enzymatic Hydrolysis And Fermentation Of Corn For Fuel Alcohol

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Information Bridge: DOE Scientific and Technical Information - - Document #5789929 - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://www.osti.gov/bridge/product.biblio.jsp?osti\_id=5789929

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MapSustain Information Bridge: DOE Scientifi...

DOE Scientific and Technical Information

DOE • OSTI

INFORMATION BRIDGE

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**Full Text** Availability information may be found in the Availability, Publisher, Research Organization, Resource Relation and/or Author (affiliation information) fields and/or via the "Full-text Availability" link. For a journal article, please see the Resource Relation field.

**Title** Enzymatic hydrolysis and fermentation of corn for fuel alcohol  
[Word Cloud](#) | [More Like This](#)

**Creator/Author** [Mullins, J.T.](#)

**Publication Date** 1985 Jan 01

**OSTI Identifier** OSTI ID: 5789929

**Other Number(s)** Journal ID: CODEN: BIBIA

**Resource Type** Journal Article

**Resource Relation** Journal Name: Biotechnol. Bioeng.; (United States); Journal Volume: 27:3

**Research Org** Univ. of Florida, Gainesville

**Subject** 09 BIOMASS FUELS; 32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION; ETHANOL FUELS; BIOSYNTHESIS; MAIZE; ENZYMATIC HYDROLYSIS; FERMENTATION; PRODUCTIVITY; COST; ENERGY EFFICIENCY; EXPERIMENTAL DATA; WASTE PRODUCT UTILIZATION; ALCOHOL FUELS; BIOCONVERSION; CEREALS; CHEMICAL REACTIONS; DATA DECOMPOSITION; EFFICIENCY; FUEL; GRASS; HYDROLYSIS; INFORMATION; LYSIS; NUMERICAL DATA; PLANTS;

Done

Detailed information on demand via original source site for exploration and study.

Geographic Map Science Map

Color B & W

Math and Physics Chemistry Health Professionals

Engineering and Computer Science Medical Societies

Biotechnology Brain Research

Chemical, Materials and Earth Sciences Biology Social Sciences

Humanities

Biology funding: 2112 records  
 NSF: 1617  
 NIH: 114  
 USDA: 391

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Maps Detail Data Ab

> Biology

NIH  
 2009

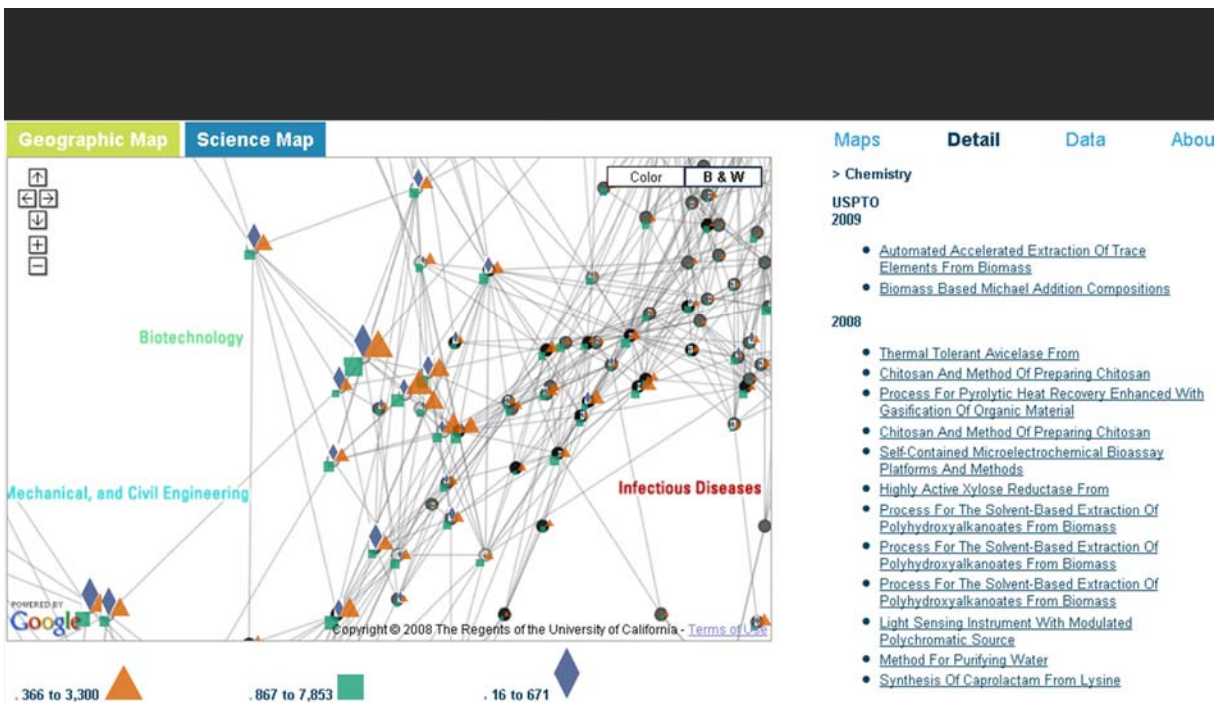
- Label-Free And Simultaneous Detection Of Multiple Bacterial Pathogens And Virulen
- Mechanism Of Psp Mediated Adhesion
- Label-Free And Simultaneous Detection Of Multiple Bacterial Pathogens And Virulen
- Novel Mechanism Of Uranium Reduction Via Microbial Nanowires
- Nano-Scale Mechanisms Of Metal(Loid) Rhizostabilization In Desert Mine Tailings
- Label-Free And Simultaneous Detection Of Multiple Bacterial Pathogens And Virulen
- Mechanism Of Psp Mediated Adhesion

2008

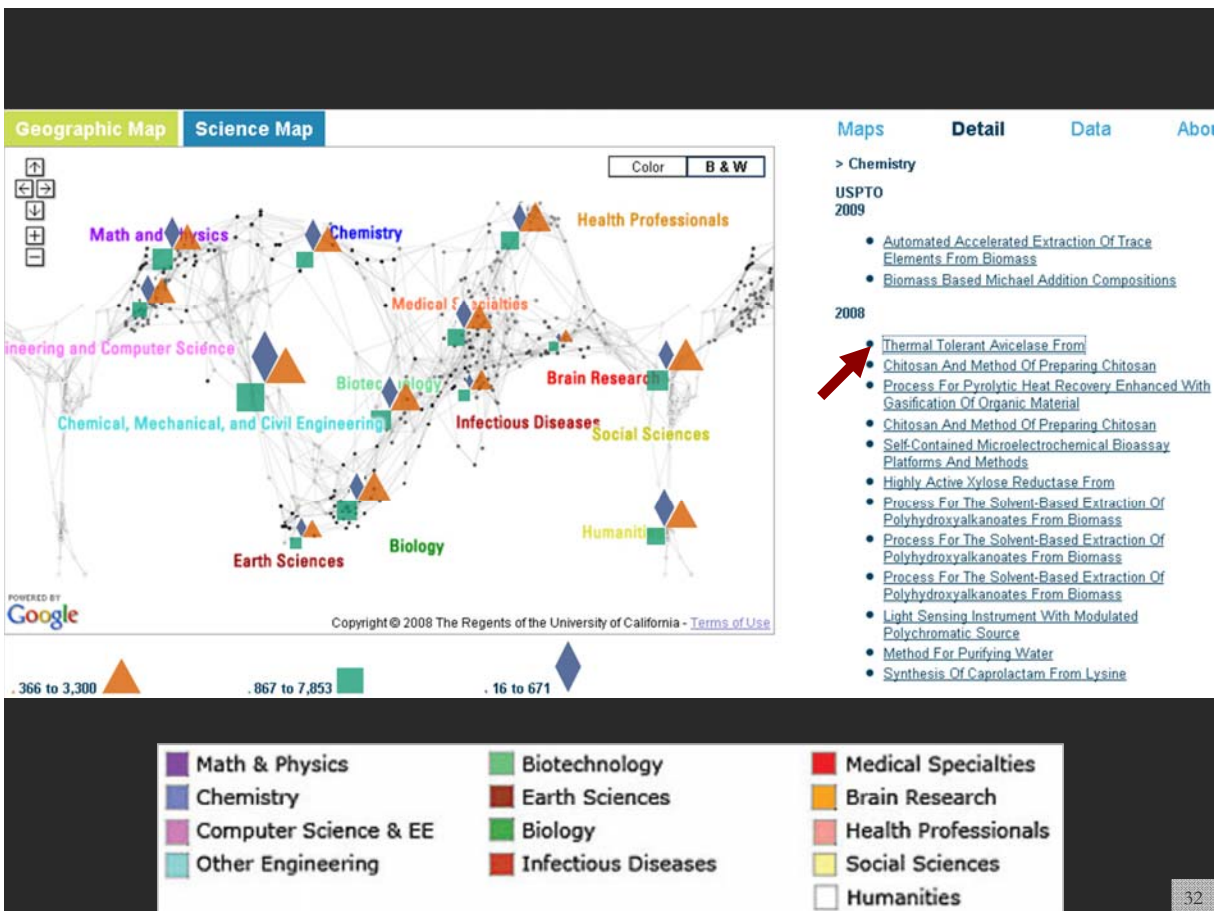
- The Effect Of Inter-Species Interactions On The Virulence Of Streptococcus Mutans
- Cook-stove Replacement For Prevention Of Ari And Low Birthweight In Nepal
- Diverse Drug Lead Compounds From Bacterial Symbionts In Tropical Marine Mollusks
- Remote Sensing Of Wildfire Smoke Exposures To Assess Health Effects
- Cook-stove Replacement For Prevention Of Ari And Low Birthweight In Nepal

.366 to 3,300 .867 to 7,853 .16 to 671

The science map at 13 top-level scientific disciplines level.



The science map at 554 sub-disciplines level.







# NIH TOPIC MAPS

NIH Map Viewer

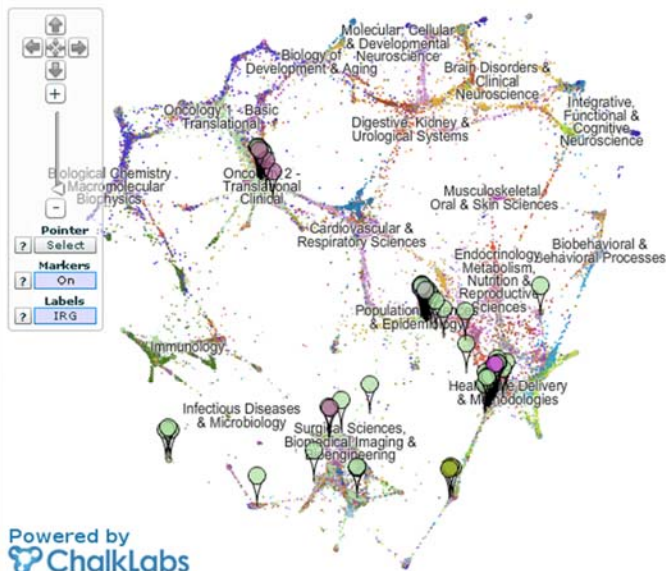
Show Topic Browser ?

Export Data

Methods

Feedback

2009 ? add delete AND Topic Words cancer breast cancers cancer\_risk cancer\_p 20 0/0 ? Search Clear Search



- FIC
- NCCAM
- NCI
- NCMHD
- NCRR
- NEI
- NHGRI
- NHLBI
- NIA
- NIAAA
- NIAID
- NIAMS
- NIBIB
- NICHD
- NIDA
- NIDCD
- NIDCR
- NIDDK
- NIEHS
- NIGMS
- NIMH
- NINDS
- NINR
- NLM
- OD

**Institutes (9)**

NIH Inst	# Grants	Count	+
NCI	116		
NCRR	10		
NIEHS	5		
NCMHD	1		
NIA	-		

**Topics**

%	Title Words	+
25.9	breast, cancer, cancer_risk, women, cancer_sui	
3.86	risk, risk_factors, cancer, prospective, women,	
3.76	genome_wide_association, loci, genome_wide,	
3.70	genetic, genetics, genes, gene_environment, i	

**Grants (137)**

NIH Inst	Grant	+
NCRR	3P20RR011792-10S2 6914 OBESITY, INSULIN RESISTANCE, IGF'S, AND BREAST CANCER RISK IN AFRICAN AMERICANS PI: CUI, YONG	
NCI	3R01CA120562-03S1 Commonly Used Medications and Breast Cancer Recurrence PI: BOUDREAU, DENISE M	
NCI	5R01CA120562-03 Commonly Used Medications and Breast Cancer Recurrence PI: BOUDREAU, DENISE M	
NCI	5R01CA093772-06 Long-term Survivorship in Older Women with Early Stage Breast	

Powered by ChalkLabs

<https://app.nihmaps.org>

# NIH TOPIC MAPS

NIH Topic Browser

Show Map Viewer ?

Export Data

Methods

Feedback

2009 ? add delete AND Exact Text cancer Search Clear Search

2009 Grants (137)

Institutes (9)

Col	NIH Inst	Project/Subproj	Title	Investigator(s)	# 1 Topi	# 1 Topic Work
	NCRR	3P20RR011792-10S2 6914	OBESITY, INSULIN RESISTANCE, IGF'S, AND BREAST CANCER RISK IN AFRICAN AMERICANS	CUI, YONG	686 (50%)	cancer brea...
	NCI	3R01CA120562-03S1	Commonly Used Medications and Breast Cancer Recurrence	BOUDREAU, DENISE M	686 (42%)	cancer brea...
	NCI	5R01CA120562-03	Commonly Used Medications and Breast Cancer Recurrence	BOUDREAU, DENISE M	686 (42%)	cancer brea...
	NCI	5R01CA093772-06	Long-term Survivorship in Older Women with Early Stage Breast Cancer	SILLIMAN, REBECCA A	686 (42%)	cancer brea...
	NCI	5R01CA064277-11	Shanghai Breast Cancer Study	ZHENG, WEI	686 (41%)	cancer brea...

NIH Inst	# Grants	Count	+
NCI	116		
NCRR	10		
NIEHS	5		
NCMHD	1		
NIA	1		
NCCAM	1		
NICHD	1		
NINR	1		
NHGRI	1		

Topics

Similar Grants

Show Top 100 on Map

%	Topic	Topic Words	Title Words	+
25.91	686	cancer breast cancers cancer_risk cancer_patients	breast, cancer, car	
3.86	437	risk risk_factors cases cohort prospective high_nis	risk, risk_factors, v	
3.76	544	snps snp genome_wide_association cases genes	genome_wide_ass	
3.70	173	genetic genes risk susceptibility polymorphisms g	genetic, genetics,	
2.62	252	treatment patients management patient outcom	management, tre	
1.64	235	conference meeting workshop symposium scienti	th, conference, sy	
1.63	351	community implementation community_based he	community, preve	
1.54	325	million disease treatment united_states public_h	disease, treatmen	
1.51	580	training candidate career skills applicant program	treatment, depres	

Similar	NIH Inst	Grant	+
6.51	NCI	1R01CA129639-01A2 Genome-Wide Association Study of Radiation Exposure and Bilateral Breast Cancer PI: BERNSTEIN, JONINE LISA	
6.46	NCI	1K07CA136758-01A1 Genetic variants in the PI3K pathway in mammographic density and breast cancer PI: THOMPSON, CHERYL L.	
6.31	NCI	5P50CA116199-05 UTMADACC SPORE in Breast Cancer PI: HORTOBAGYI, GABRIEL N	
6.02	NCI	2R01CA050385-21A1 Risk Factors for Breast Cancer in Younger Nurses PI: WILLETT, WALTER C.	
4.6	NCI	5R01CA127617-02 Who Cares For Older Breast Cancer Survivors And How Does It Affect Quality? PI: MANDELBLATT, JEANNE	

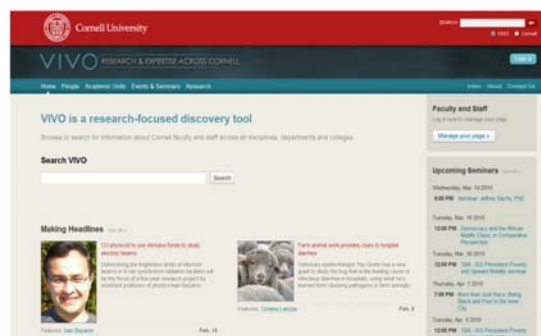
<https://app.nihmaps.org>

# VIVO International Researcher Network

## VIVO: A Semantic Approach to Creating a National Network of Researchers (<http://vivoweb.org>)



- Semantic web application and ontology editor originally developed at Cornell U.
- Integrates research and scholarship info from systems of record across institution(s).
- Facilitates research discovery and cross-disciplinary collaboration.
- Simplify reporting tasks, e.g., generate biosketch, department report.



Funded by \$12 million NIH award.

**Cornell University:** Dean Krafft (Cornell PI), Manolo Bevia, Jim Blake, Nick Cappadona, Brian Caruso, Jon Corson-Rikert, Elly Cramer, Medha Devare, John Ferreira, Brian Lowe, Stella Mitchell, Holly Mistlebauer, Anup Sawant, Christopher Westling, Rebecca Younes. **University of Florida:** Mike Conlon (VIVO and UF PI), Cecilia Botero, Kerry Britt, Erin Brooks, Amy Buhler, Ellie Bushhousen, Chris Case, Valrie Davis, Nita Ferree, Chris Haines, Rae Jesano, Margeaux Johnson, Sara Kreinest, Yang Li, Paula Markes, Sara Russell Gonzalez, Alexander Rockwell, Nancy Schaefer, Michele R. Tennant, George Hack, Chris Barnes, Narayan Raum, Brenda Stevens, Alicia Turner, Stephen Williams. **Indiana University:** Katy Borner (IU PI), William Barnett, Shanshan Chen, Ying Ding, Russell Duhon, Jon Dunn, Micah Linnemeier, Nianli Ma, Robert McDonald, Barbara Ann O'Leary, Mark Price, Yuyin Sun, Alan Walsh, Brian Wheeler, Angela Zoss. **Ponce School of Medicine:** Richard Noel (Ponce PI), Ricardo Espada, Damaris Torres. **The Scripps Research Institute:** Gerald Joyce (Scripps PI), Greg Dunlap, Catherine Dunn, Brant Kelley, Paula King, Angela Murrell, Barbara Noble, Cary Thomas, Michaelen Trimarchi. **Washington University, St. Louis:** Rakesh Nagarajan (WUSTL PI), Kristi L. Holmes, Sunita B. Koul, Leslie D. McIntosh. **Weill Cornell Medical College:** Curtis Cole (Weill PI), Paul Albert, Victor Brodsky, Adam Cheriff, Oscar Cruz, Dan Dickinson, Chris Huang, Itay Klaz, Peter Michelini, Grace Migliorisi, John Ruffing, Jason Specland, Tru Tran, Jesse Turner, Vinay Varughese.

**VIVO** Enabling a National Network of Scientists

Home People Organizations Research Events

**Davis, Vairie I** | AST UNV LIBRA

**Positions**

- Medical Science Librarian, Outreach Librarian for Agricultural Sciences (2002 - 2003)
- Medical Science Librarian, Staff Maintenance Supervisor (2001 - 2002)
- AST UNV LIBRARIAN

**13 publications within the last 10 years (11 leads)**

**17 identifiers**

**History Web Page**

**Affiliations**

Outreach Librarian for Agricultural Sciences

**VIVO** Enabling a National Network of Scientists

Home People Organizations Research Events

**University of Florida**

How do you want to compare?  
by Publications

Who do you want to compare?  
Search: [ ] X

Records 1 - 10 of 13

Entity Name	Publication Count	Entity Type
<input checked="" type="checkbox"/> Interdisciplinary Center for Bioremediation	10	UF Center, Agent, Center
<input checked="" type="checkbox"/> Continuing Education	24	UF Department, Agent, Non-Academic Department, Department
<input checked="" type="checkbox"/> Levin College of Law	17	Agent, UF College, College
<input checked="" type="checkbox"/> College of Agricultural and Life Sciences	14	Agent, UF College, College
<input type="checkbox"/> Whittier College of Journalism and Communication	14	Agent, UF College, College
<input type="checkbox"/> Evelyn F. and William L. McKnight Brain Institute of the University of Florida	8	UF Center, Agent, Center

**Comparing Publications of Organizations in University of Florida**

**Total Number of Publications**

You have selected 4 of a maximum 10 organizations to compare. **Clear**

- College of Agricultural and Life Sciences: 14
- Levin College of Law: 17
- Continuing Education: 24
- Interdisciplinary Center for Bioremediation: 10

**VIVO** Enabling a National Network of Scientists

Home People Organizations Research Events

**Search results for 'geriatrics'**

Show only results of this type: **people activities organizations research**

**AMERICAN GERIATRICS SOCIETY**

- Geriatrics Education Curriculum, Residents (GEC) Program
- Evidence Based Decision Making in Geriatrics, Geriatrics Outreach

**AMERICAN GERIATRICS SOCIETY**

- Harford Geriatrics Leadership Scholar
- Geriatrics and Aging Research Institute on Aging (GARI)
- AGS ON GERIATRICS ACADEMIC PROGRAMS
- US OLTH RESOURCES AND SERVICES ADMIN
- Supporter Study
- 2003 Scholar, Harford Institute of Geriatrics, Nursing Research, John A. Harford Institute for Geriatrics, Nursing, New York University
- Gene, Polysomnography and Prevention of Obstructive
- Supporter in the Sea, Sea Grant, Other
- Cardiac Mitral Regurgitation, Regurgitation and Mitral Regurgitation
- AMES ACAD OF NURSING
- The Epidemiology of Stress and the Menopausal Syndrome
- Supporter in a Sea Grant, Other

**VIVO** Enabling a National Network of Scientists

Home People Organizations Research Events

Welcome to VIVO

VIVO is a research-focused discovery tool that enables collaboration among scientists across all disciplines.

Browse or search information on people, departments, courses, grants, and publications.

Search VIVO

Log in

Search

Log in

Browse by

- Grants (11,814)
- People (48,721)
- Activities (11,819)
- Courses (1116)
- Events (379)
- Organizations (20,328)
- Research (11,283)
- Locations (376)

- Faculty Member (8882)
- Graduate Student (1)
- Librarian (67)
- Non-Academic (7536)
- Non-Faculty Academic (2)
- Alumn (8972)
- Professor Emeritus (802)

**University of Florida**

How do you want to compare?  
by Grants

Who do you want to compare?  
Search: [ ] X

Records 1 - 10 of 30

Entity Label	Grant Count	Entity Type
<input checked="" type="checkbox"/> Continuing Education	562	UF Department, Agent, Non-Academic Department, Department
<input checked="" type="checkbox"/> Florida Museum of Natural History	203	Museum, Agent
<input checked="" type="checkbox"/> College of Agricultural and Life Sciences	166	Agent, UF College, College
<input checked="" type="checkbox"/> College of Engineering	103	Agent, UF College, College
<input checked="" type="checkbox"/> Evelyn F. and William L. McKnight Brain Institute of the University of Florida	64	UF Center, Agent, Center
<input checked="" type="checkbox"/> International Center	54	UF Department, Agent, Non-Academic Department, Department
<input checked="" type="checkbox"/> Florida Sea Grant	44	UF Center, Agent, Center
<input type="checkbox"/> Whitney Laboratory for Marine Bioscience	42	UF Research Laboratory, Agent, Laboratory, Research Laboratory
<input type="checkbox"/> Water Institute	38	UF Center, Agent, Center
<input type="checkbox"/> College of Dentistry	35	Agent, UF College, College

**Comparing Grants of Organizations in University of Florida**

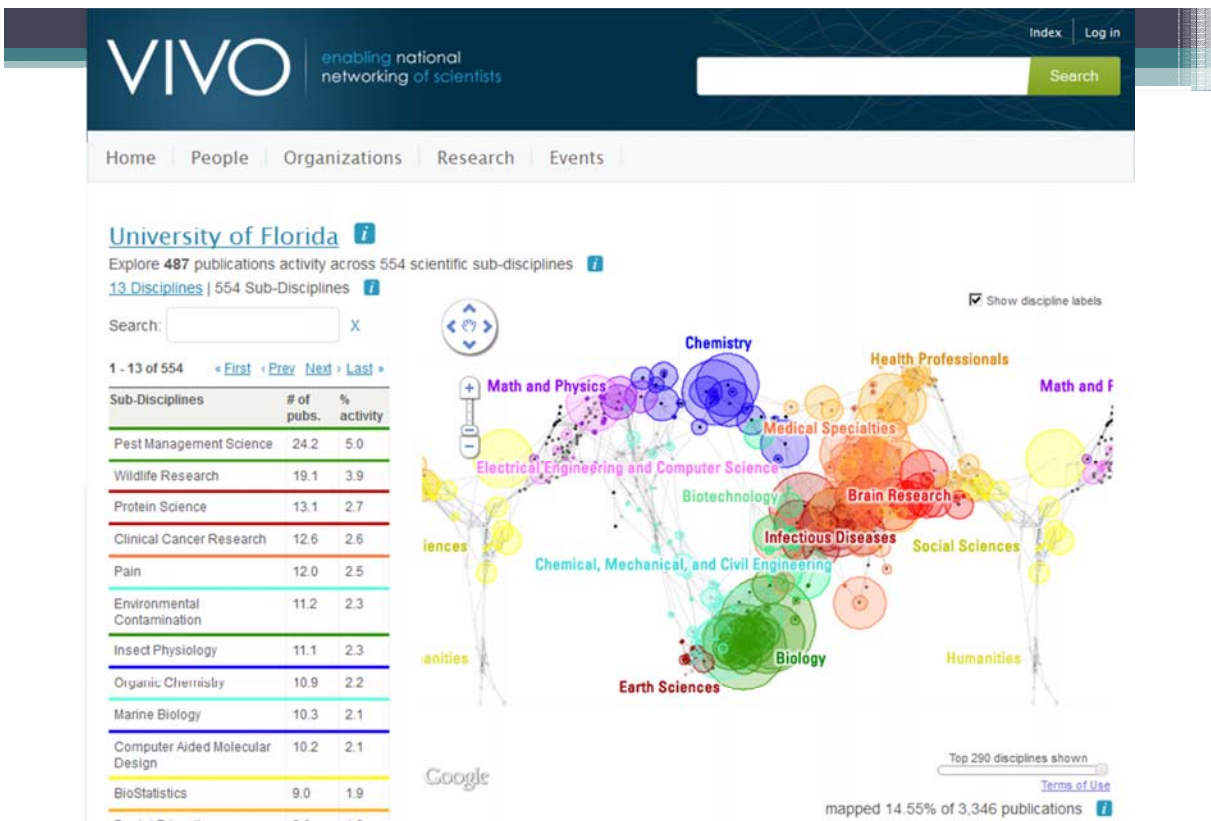
**Total Number of Grants**

You have selected 7 of a maximum 10 organizations to compare. **Clear**

- Florida Sea Grant: 44
- International Center: 54
- Evelyn F. and William L. McKnight Brain Institute of the University of Florida: 64
- College of Engineering: 103
- College of Agricultural and Life Sciences: 166
- Florida Museum of Natural History: 203
- Continuing Education: 562

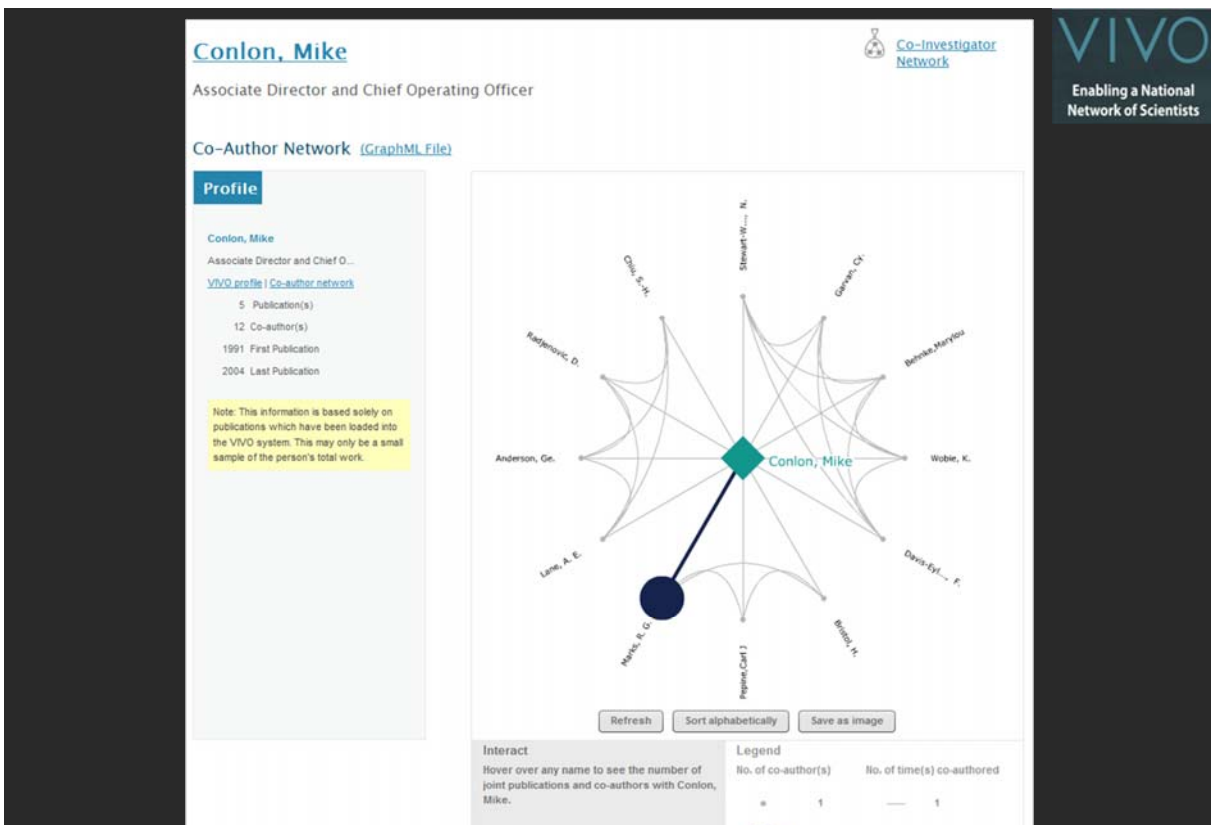
**Save as CSV** **Clear**

**Temporal Analysis (When)** Temporal visualizations of the number of papers/funding award at the institution, school, department, and people level



**Topical Analysis (What)** Science map overlays will show where a person, department, or university publishes most in the world of science. (in work)

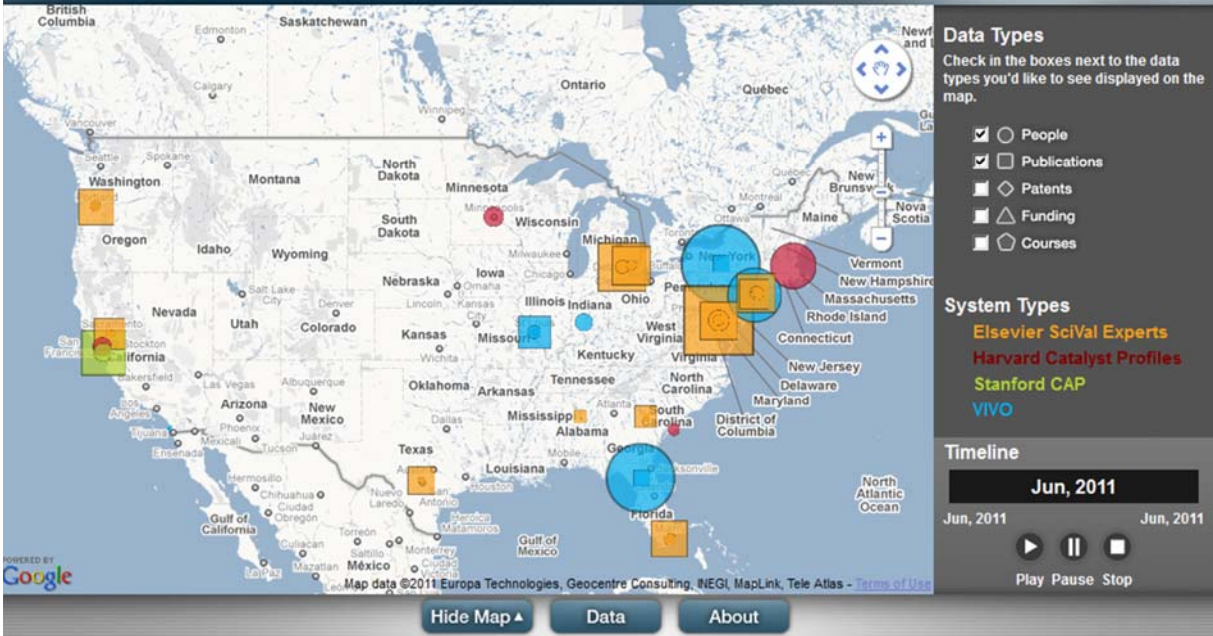
41



**Network Analysis (With Whom?)** Who is co-authoring, co-investigating, co-inventing with whom? What teams are most productive in what projects?

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# National Researcher Networking Visualization 1.0



<http://nrn.cns.iu.edu>

**Geospatial Analysis (Where)** Where is what science performed by whom? Science is global and needs to be studied globally.



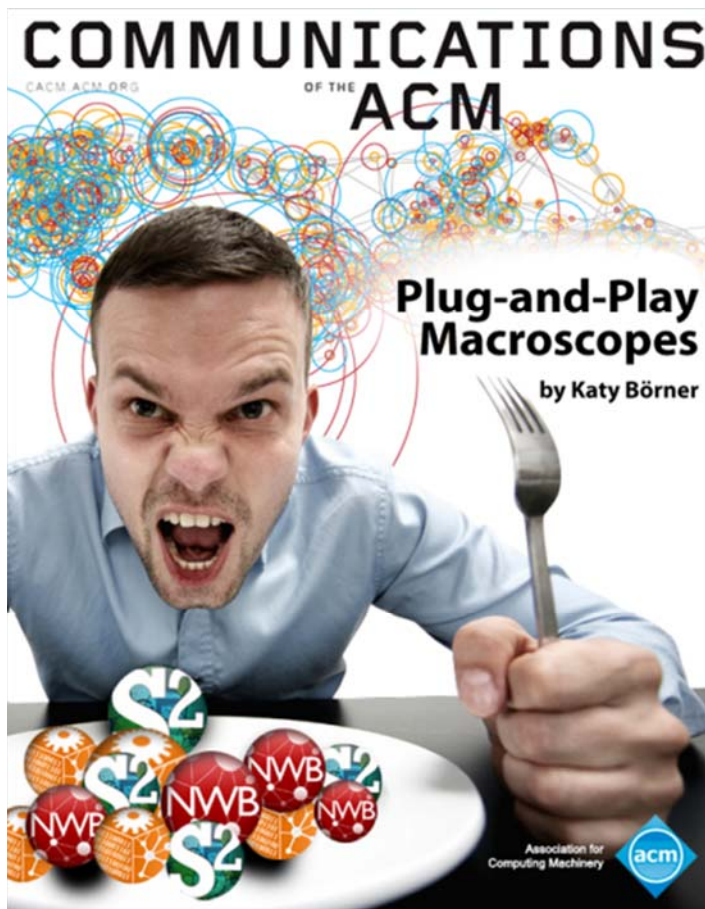
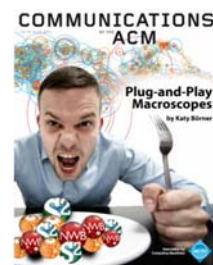
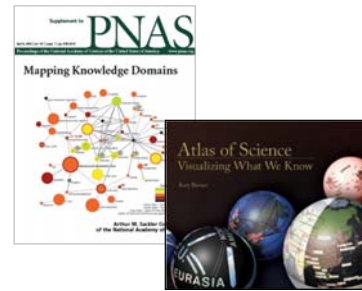
## VIVO On-The-Go

Overview, Interactivity,  
Details on Demand  
come to  
commonly  
used devices  
and environments



## Overview

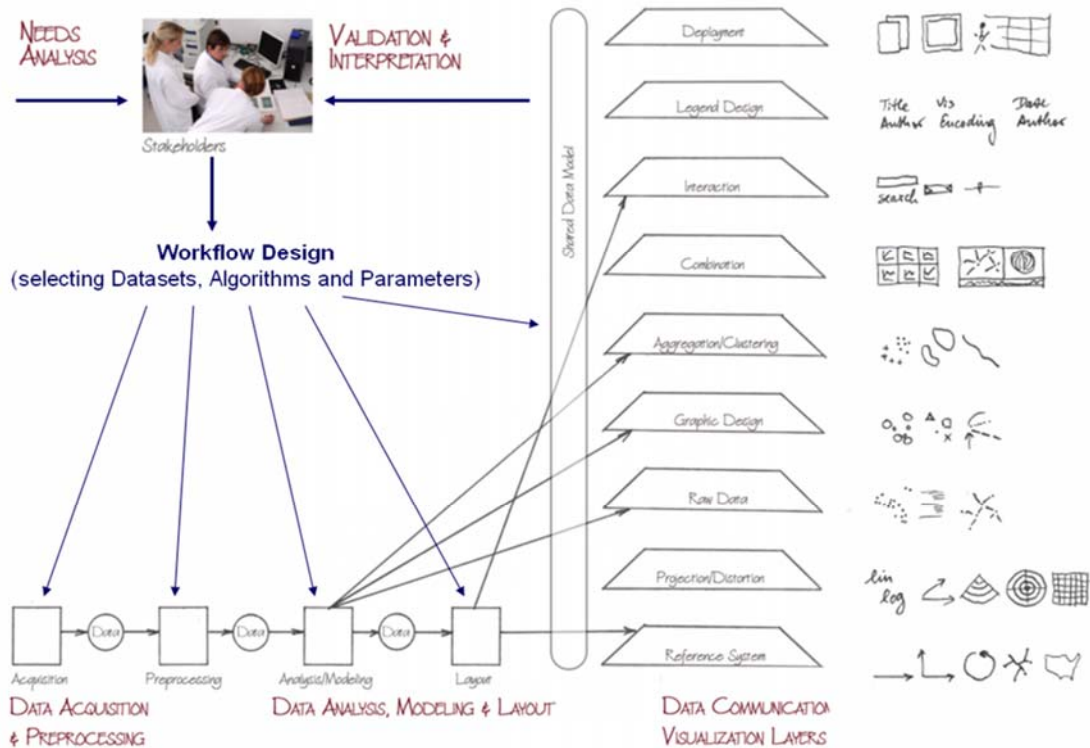
1. **Data mining and visualization research** that aims to increase our scientific understanding of the structure and dynamics of science and technology.
2. **Novel approaches and services** that improve information access, researcher networking, and research management.
3. **Data services and plug-and-play macroscope tools** that commoditize data mining and visualization.



Börner, Katy. (March 2011). Plug-and-Play Macroscopes. *Communications of the ACM*, 54(3), 60-69.

Video and paper are at <http://www.scivee.tv/node/27704>

**Needs-Driven Workflow Design** using a modular data acquisition/analysis/ modeling/ visualization pipeline as well as modular visualization layers.

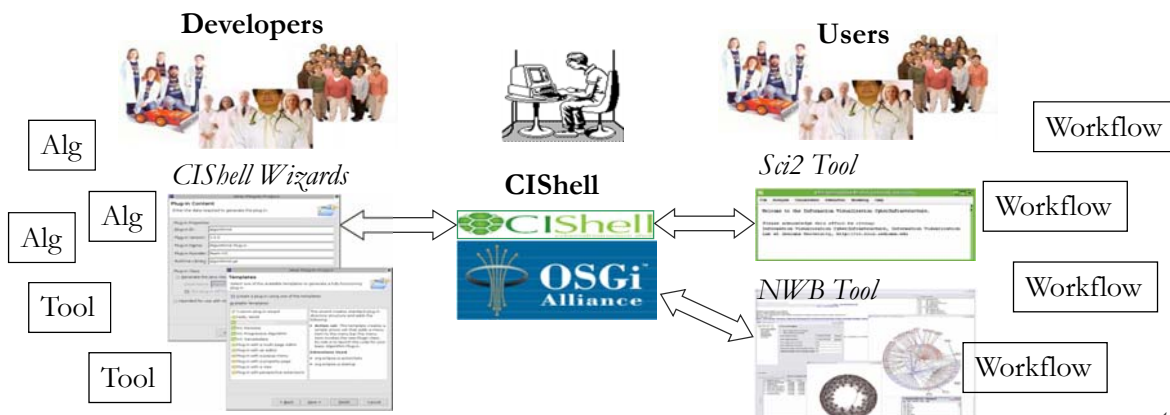


Börner, Katy (2010) *Atlas of Science*. MIT Press. 47



OSGi & CIShell

- CIShell (<http://cishell.org>) is an open source software specification for the integration and utilization of datasets, algorithms, and tools.
- It extends the Open Services Gateway Initiative (OSGi) (<http://osgi.org>), a standardized, component oriented, computing environment for networked services widely used in industry since more than 10 years.
- Specifically, CIShell provides “sockets” into which existing and new datasets, algorithms, and tools can be plugged using a wizard-driven process.







## CIShell Developer Guide

(<http://cishell.wiki.cns.iu.edu>)



Edit Add ▾

1 Added by [Micah Linnemeier](#), last edited by [Micah Linnemeier](#) on Mar 16, 2011 ([view change](#))

### About the Cyberinfrastructure Shell

The Cyberinfrastructure Shell (CIShell) is an open source, community-driven platform for the integration and utilization of datasets, algorithms, tools, and computing resources. Algorithm integration support is built in for Java and most other programming languages. Being Java based, it will run on almost all platforms. The software and specification is released under an Apache 2.0 License.

CIShell is the basis of [Network Workbench](#), [TexTrend](#), [Sci<sup>2</sup>](#) and the upcoming [EpiC](#) tool.

CIShell supports remote execution of algorithms. A standard web service definition is in development that will allow pools of algorithms to transparently be used in a peer-to-peer, client-server, or web front-end fashion.

### CIShell Features

**A framework for easy integration of new and existing algorithms written in any programming language**

Using CIShell, an algorithm writer can fully concentrate on creating their own algorithm in whatever language they are comfortable with. Simple tools are provided to then take their algorithm and

### Learn More...

- [CIShell Papers](#)
- [CIShell Powered Tools](#)
- [Algorithms](#)
- [Plugins \(coming soon\)](#)
- [Misc. Tool Documentation](#)
- CIShell Web Services (coming soon)
- [Screenshots](#)

### Getting Started...

- [Documentation & Developer Resources](#)
- [Download](#)

### Getting Involved...

- [Contact Us](#)

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## CIShell Portal (<http://cishell.org>)

**Cyberinfrastructure Shell (CIShell)**  
CIShell supports the plug-and-play of datasets and algorithms and their bundling into custom tools that serve the specific needs of a user group or research community. It has been applied to develop diverse custom tools, see below. Feel free to take plugins from any of these tools to design your personal dream tool.

Provided by the [Cyberinfrastructure for Network Science Center](#) at Indiana University.

**Visit the CIShell wiki**  
to learn more about using CIShell as a platform for your tool!

**Learn more about existing CIShell-powered tools below.**

**Network Workbench Tool (NWB)**  
The NWB Tool supports researchers, educators, and practitioners interested in the study of biomedical, social and behavioral science, physics, and other networks. It comes with a 77-page [user manual](#).

Gallery

**Science of Science Tool (Sci<sup>2</sup>)**  
The Sci<sup>2</sup> Tool was specifically developed for science policy makers and researchers that study science by scientific means. It supports the temporal, geospatial, topical, and network analysis and visualization of scholarly datasets at the micro (individual), meso (local), and macro (global) levels. There exists a [112-page user manual](#) and 24 hours of [NIM tutorials](#) in this tool.

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The Network Workbench (NWB) tool supports researchers, educators, and practitioners interested in the study of biomedical, social and behavioral science, physics, and other networks.

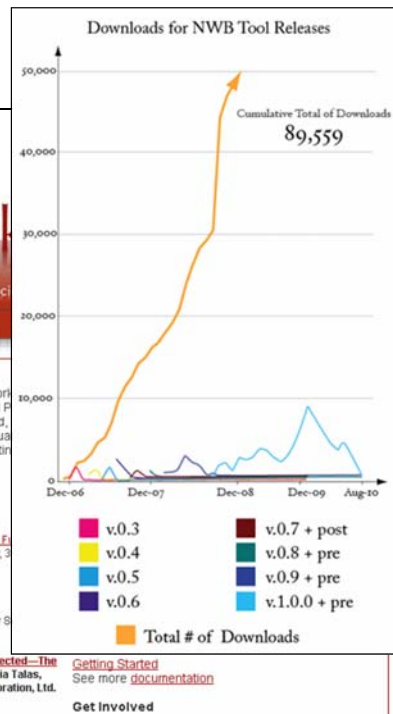
In February 2009, the tool provides more than 169 plugins that support the preprocessing, analysis, modeling, and visualization of networks.

**More than 50 of these plugins can be applied or were specifically designed for S&T studies.**

It has been downloaded more than 65,000 times since December 2006.



The screenshot shows the Network Workbench website with a navigation menu (Home, People, Research, Publications) and a 'Summary' section. The summary describes it as a 'Large-Scale Network Toolkit for Biomedical, Social Science and P...' and lists 'News & Updates' with dates and titles.



Herr II, Bruce W., Huang, Weixia (Bonnie), Penumarthy, Shashikant & Börner, Katy. (2007). Designing Highly Flexible and Usable Cyberinfrastructures for Convergence. In Bainbridge, William S. & Roco, Mihail C. (Eds.), *Progress in Convergence - Technologies for Human Wellbeing* (Vol. 1093, pp. 161-179), *Annals of the New York Academy of Sciences*, Boston, MA.

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## Computational Proteomics

What relationships exist between protein targets of all drugs and all disease-gene products in the human protein-protein interaction network?

Yildirim, Muhammed A., Kwan-II Goh, Michael E. Cusick, Albert-László Barabási, and Marc Vidal. (2007). *Drug-target Network*. *Nature Biotechnology* 25 no. 10: 1119-1126.



**Figure 2** Drug-target network (DT network). The DT network is generated by using the known associations between FDA-approved drugs and their target proteins. Circles and rectangles correspond to drugs and target proteins, respectively. A link is placed between a drug node and a target node if the protein is a known target of that drug. The area of the drug (protein) node is proportional to the number of targets that the drug has (the number of drugs targeting the protein). Color codes are given in the legend. Drug nodes (circles) are colored according to their Anatomical Therapeutic Chemical Classification, and the target proteins (rectangular boxes) are colored according to their cellular component obtained from the Gene Ontology database.

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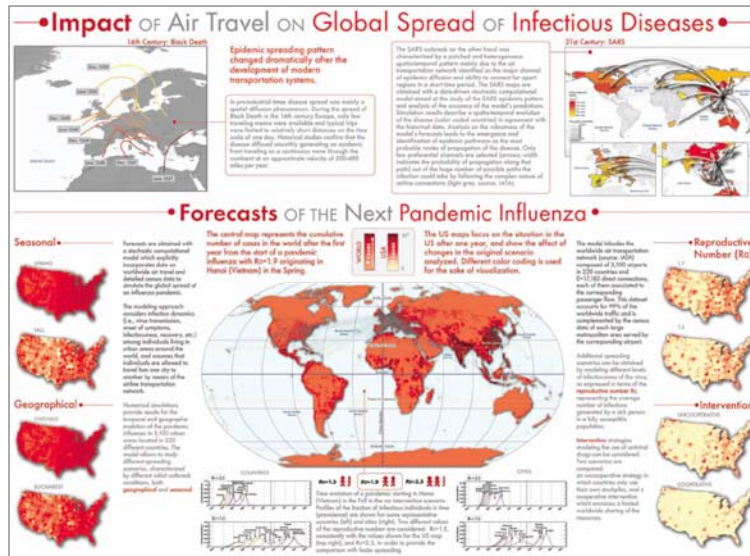
## Computational Epidemics

Forecasting (and preventing the effects of) the next pandemic.

*Epidemic Modeling in Complex realities*, V. Colizza, A. Barrat, M. Barthelemy, A. Vespignani, *Comptes Rendus Biologie*, 330, 364-374 (2007).

*Reaction-diffusion processes and metapopulation models in heterogeneous networks*, V. Colizza, R. Pastor-Satorras, A. Vespignani, *Nature Physics* 3, 276-282 (2007).

*Modeling the Worldwide Spread of Pandemic Influenza: Baseline Case and Containment Interventions*, V. Colizza, A. Barrat, M. Barthelemy, A.-J. Valleron, A. Vespignani, *PLoS-Medicine* 4, e13, 95-110 (2007).



## Science of Science Tool

<http://sci2.cns.iu.edu>

### Sci2 Tool v0.5.1 Alpha (May 4th, 2011)

Can be freely downloaded for all major operating systems from

<http://sci2.cns.iu.edu>

Select your operating system from the pull down menu and download.

Unpack into a /sci2 directory.

Run /sci2/sci2.exe

Sci2 Manual is at

<http://sci2.wiki.cns.iu.edu>

### Cite as

Sci<sup>2</sup> Team. (2009). *Science of Science (Sci<sup>2</sup>) Tool*. Indiana University and SciTech Strategies, <http://sci2.cns.iu.edu>

**Sci<sup>2</sup> Tool**  
A Tool for Science of Science Research & Practice

Home Download Documentation Ask An Expert Testimonials Developers

The Science of Science (Sci<sup>2</sup>) Tool is a modular toolset specifically designed for the study of science. It supports the temporal, geospatial, topical, and network analysis and visualization of scholarly datasets at the micro (individual), meso (local), and macro (global) levels.

Registration required.

Download Sci<sup>2</sup> Tool

Mapping Topics and Topic Bursts in PHAS

News

Sci<sup>2</sup> Tool v0.5.1 alpha is now available, featuring enhancements to the Burst Detection algorithm and several bug fixes. [Release Notes](#)



**Sci<sup>2</sup> Tool**  
A tool for science of science research & practice

Email Address

Password

Login

Forgot your password?  
To recover your account password, please visit our [password recovery page](#).

Not registered yet?  
[Register now](#)

**Tutorials**  
Katy Börner (2010) Science of Science Research and Tools (12 Tutorials). Reporting Branch, Office of Extramural Research/Office of the Director, National Institutes of Health, Bethesda, MD.

- Tutorial #01: [Science of Science Research](#)
- Tutorial #02: [Network Science / Information Visualization](#)
- Tutorial #03: [CIShell Powered Tools: Network Workbench and Science of Science Tool](#)
- Tutorial #04: [Temporal Analysis—Burst Detection](#)
- Tutorial #05: [Geospatial Analysis and Mapping](#)
- Tutorial #06: [Topical Analysis & Mapping](#)
- Tutorial #07: [Tree Analysis and Visualization](#)
- Tutorial #08: [Network Analysis and Visualization](#)
- Tutorial #09: [Large Network Analysis and Visualization](#)
- Tutorial #10: [Using the Scholarly Database at IU](#)
- Tutorial #11: [VIVO National Researcher Networking](#)
- Tutorial #12: [Future Developments](#)

<http://sci2.cns.indiana.edu>  
<http://sci2.wiki.cns.indiana.edu>

Geetha Senthil (2010) [Multidisciplinary Nature of Work With Reference to PIs and ICs Within a Portfolio](#). PA Group at NIH.

NIH Office of Extramural Research and Katy Börner (2010) [Network Visualizations Using SPIRES Data and the Sci2 Tool](#). Office of Extramural Research at NIH.

**EpiC Tool**  
File | Compartmental Modeling | Networks | Simulation | Visualization | R | Help

Welcome to the EpiC tool, which supports the modeling, analysis, and visualization of epidemic processes.

The EpiC project (<http://epic.sls.indiana.edu>) is supported in part by the NIH RM-07-004 award. The primary investigators are Dr. Katy Börner, Dr. Alessandro Vespignani, and Dr. Jim Sherman.

Please cite as follows:  
EpiC Team. (2009). EpiC Tool. Indiana University.

**File**  
Create a compartmental model  
Edit compartmental model

**Simulation**  
Single-Population  
Exact  
Network

**Visualization**  
Line Graph

**R** | Help  
Create an R Instance  
Run Rgui  
Import Table Into R  
Export Table From R

**EpiC**  
cyberinfrastructure for NETWORK SCIENCE CENTER  
CIShell Powered

TEXTrend adds WEKA, UIMA, Wordij, CFinder, and more.

See the latest versions of TEXTrend Toolkit modules at <http://texttrend.org>

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## OSGi/CIShell Adoption

A number of other projects recently adopted OSGi and/or CIShell:

- USA**
- *Cytoscape* (<http://cytoscape.org>) Led by Trey Ideker at the University of California, San Diego is an open source bioinformatics software platform for visualizing molecular interaction networks and integrating these interactions with gene expression profiles and other state data (Shannon et al., 2002).
  - *MAEviz* (<https://wiki.ncsa.uiuc.edu/display/MAE/Home>) Managed by Jong Lee at NCSA is an open-source, extensible software platform which supports seismic risk assessment based on the Mid-America Earthquake (MAE) Center research.
- Europe**
- *Taverna Workbench* (<http://taverna.org.uk>) Developed by the myGrid team (<http://mygrid.org.uk>) led by Carol Goble at the University of Manchester, U.K. is a free software tool for designing and executing workflows (Hull et al., 2006). Taverna allows users to integrate many different software tools, including over 30,000 web services.
  - *TEXTrend* (<http://texttrend.org>) Led by George Kampis at Eötvös Loránd University, Budapest, Hungary supports natural language processing (NLP), classification/mining, and graph algorithms for the analysis of business and governmental text corpuses with an inherently temporal component.
  - *DynaNets* (<http://www.dynanets.org>) Coordinated by Peter M.A. Sloot at the University of Amsterdam, The Netherlands develops algorithms to study evolving networks.
  - *SISOB* (<http://sisob.lcc.uma.es>) An Observatory for Science in Society Based in Social Models.
- As the functionality of OSGi-based software frameworks improves and the number and diversity of dataset and algorithm plugins increases, the capabilities of custom tools will expand.

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## CTSI Accelerating Science Core

The core provides consulting, data mining, and visualization of information on the current practice of science to accelerate science and competitive research using a network science and science mapping approach.

Findings from theory-based research on the formation of productive teams, the identification of trends and emerging ideas, and the effective communication of complex results to diverse stakeholders are used to optimize science itself.

The Accelerating Science Core provides integrative analyses of relationships in support of institutes, programs, and projects, interested to accelerate the translation of scientific results to the improvement of human health.

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## CTSI Accelerating Science Core—Services Offered

**Evaluation & Monitoring:** Impact and/or strength analysis for a lab, center (e.g., NSF STCs or NIH CTSA), institution, or region in order to evaluate, plan, or implement research efforts. Relevant data must be provided.

**\$2000–\$6000\***

**Data Compilation:** The construction of a custom data set (e.g., all papers, patents, grants for a certain institution or area of research) using the Scholarly Database (<http://sdb.cns.iu.edu>).

**\$3000\***

**Visual Interface to Community Data:** Setting up an online interactive interface similar to <http://mapsustain.cns.iu.edu> (relevant data must be provided to the Core).

**\$6000\***

64



