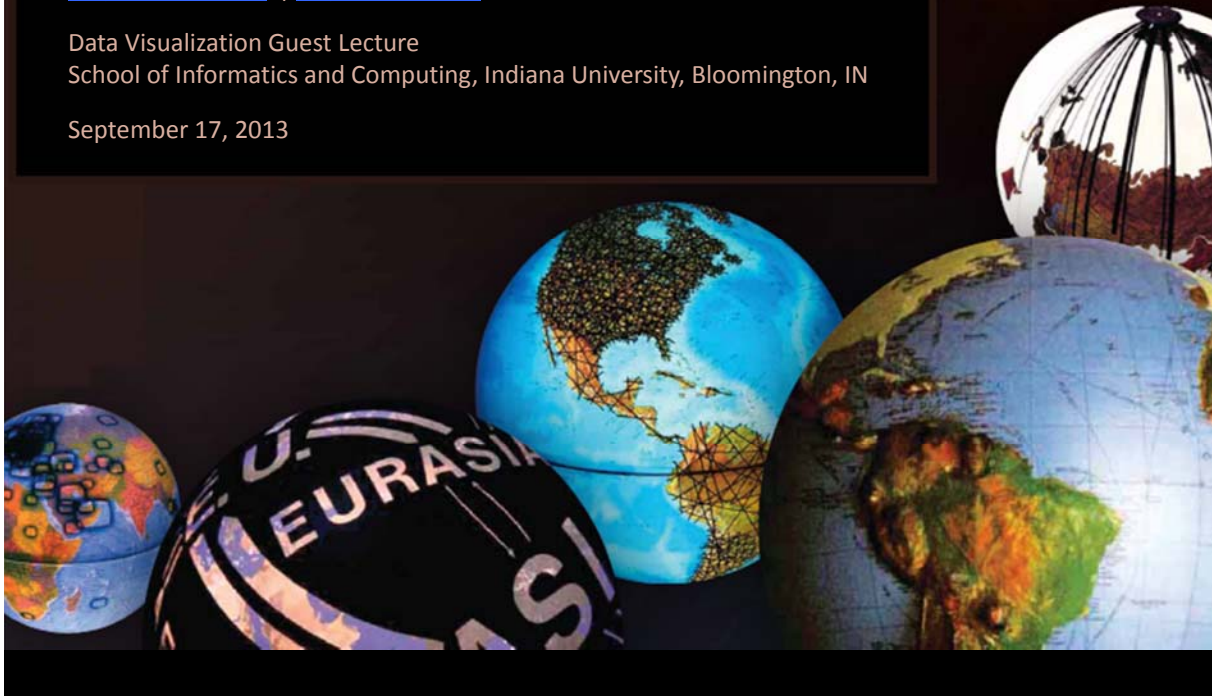


Insightful Data Visualizations

Katy Börner, CNS, LIS, SoIC, Indiana University, Bloomington, Indiana
katy@indiana.edu | <http://cns.iu.edu>

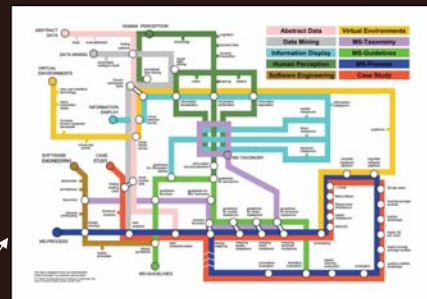
Data Visualization Guest Lecture
School of Informatics and Computing, Indiana University, Bloomington, IN

September 17, 2013



Terra bytes of data

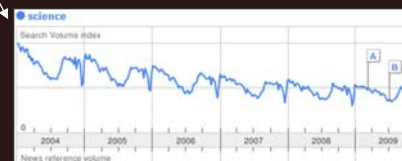
Descriptive &
Predictive
Models



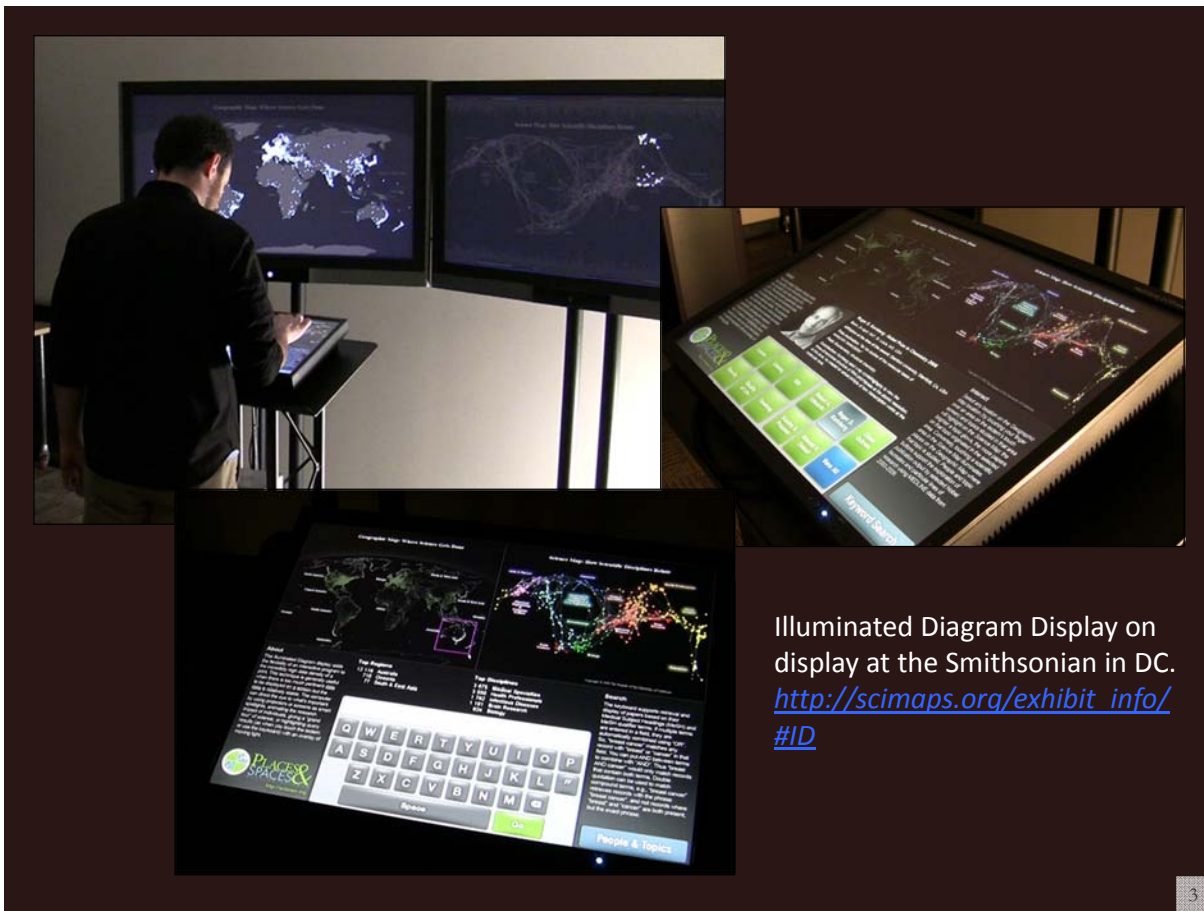
Find your way



Find collaborators, friends



Identify trends



Illuminated Diagram Display on display at the Smithsonian in DC.
http://scimaps.org/exhibit_info/#ID

Geographic Map: Where Science Gets Done

Science Map: How Scientific Disciplines Relate

About

This Illuminated Diagram display adds the flexibility of an interactive program to the incredibly high data density of a print. This technique is generally useful when there is too much pertinent data to be displayed on a screen but the data is relatively stable. The computer can direct the eye to what's important by using projectors or screens as smart spotlights, animating the research impact of individuals, giving a "grand tour" of science, or highlighting query results (as when you touch the ledgem or use the keyboard) with an overlay of moving light.

Top Five Continents

- North America - 4,000 records
- South & East Asia - 3,589
- Australia - 2,431
- Africa - 2,208
- South America - 1,562

Top Five Scientific Disciplines

- Math & Physics - 4,000 records
- Health Professions - 3,589
- Social Sciences - 2,431
- Aeronautical, Chemical, Mechanical & Civil Engineering - 2,208
- Humanities - 1,562

Search

The keyboard supports retrieval and display of papers based on their Medical Subject Headings (MeSH) and MeSH qualifier terms. If multiple terms are entered in a field, they are automatically combined using "OR". So, "breast cancer" matches any record with "breast" or "cancer" in that field. You can put AND between terms to combine with "AND". Thus "breast AND cancer" would only match records that contain both terms. Double quotation can be used to match compound terms, e.g., "breast cancer" retrieves records with the phrase "breast cancer", and not records where "breast" and "cancer" are both present, but the exact phrase.

Input your search query here.

Q	W	E	R	T	Y	U	I	O	P
A	S	D	F	G	H	J	K	L	"
Z	X	C	V	B	N	M			
Space									Go

<http://scimaps.org>

People & Topics

Geographic Map: Where Science Gets Done

Science Map: How Scientific Disciplines Relate

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About

This Illuminated Diagram display adds the flexibility of an interactive program to the incredibly high data density of a print. This technique is generally useful when there is too much pertinent data to be displayed on a screen but the data is relatively stable. The computer can direct the eye to what's important by using projectors or screens as smart spotlights, animating the research impact of individuals, giving a "grand tour" of science, or highlighting query results (as when you touch the lectern or use the keyboard) with an overlay of moving light.

Elinor Ostrom - Nobel Prize in Economic Sciences 2009

Born: 7 August 1933, New York, NY, USA
Affiliation at the time of the award: Indiana University, Bloomington, IN, USA, Arizona State University, Tempe, AZ, USA
Prize motivation: "for her analysis of economic governance, especially the commons"
Field: Economic governance
Contribution: Challenged the conventional wisdom by demonstrating how local property can be successfully managed by local commons without any regulation by central authorities or privatization.

Cancer	Cloning	HIV	Robert G. Edwards	Roger D. Kornberg	Elinor Ostrom
Obesity	Quality of Life	Smoking	Stanley B. Prusiner	Ahmed H. Zewail	View All

Keyword Search

5

12-Tokyo-Worldprocessor

Ingo Gunther's Worldprocessor globe design on display at the Giant Geo Cosmos OLED Display at the Museum of Emerging Science and Innovation in Tokyo, Japan

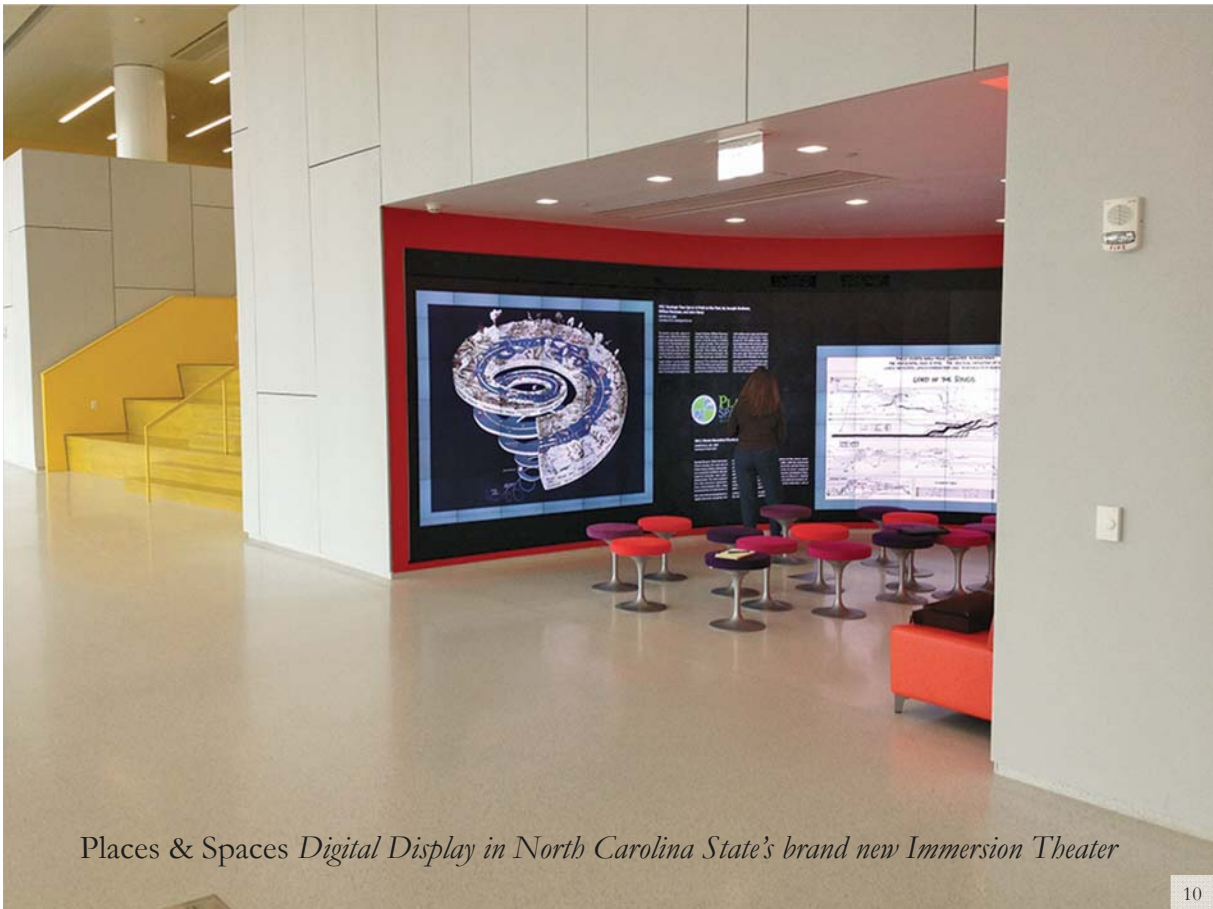
6



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



Debut of 5th 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>



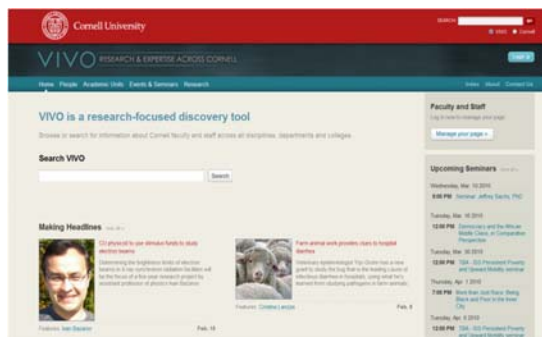
Places & Spaces *Digital Display* in North Carolina State's brand new *Immersion Theater*

VIVO International Research Network

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

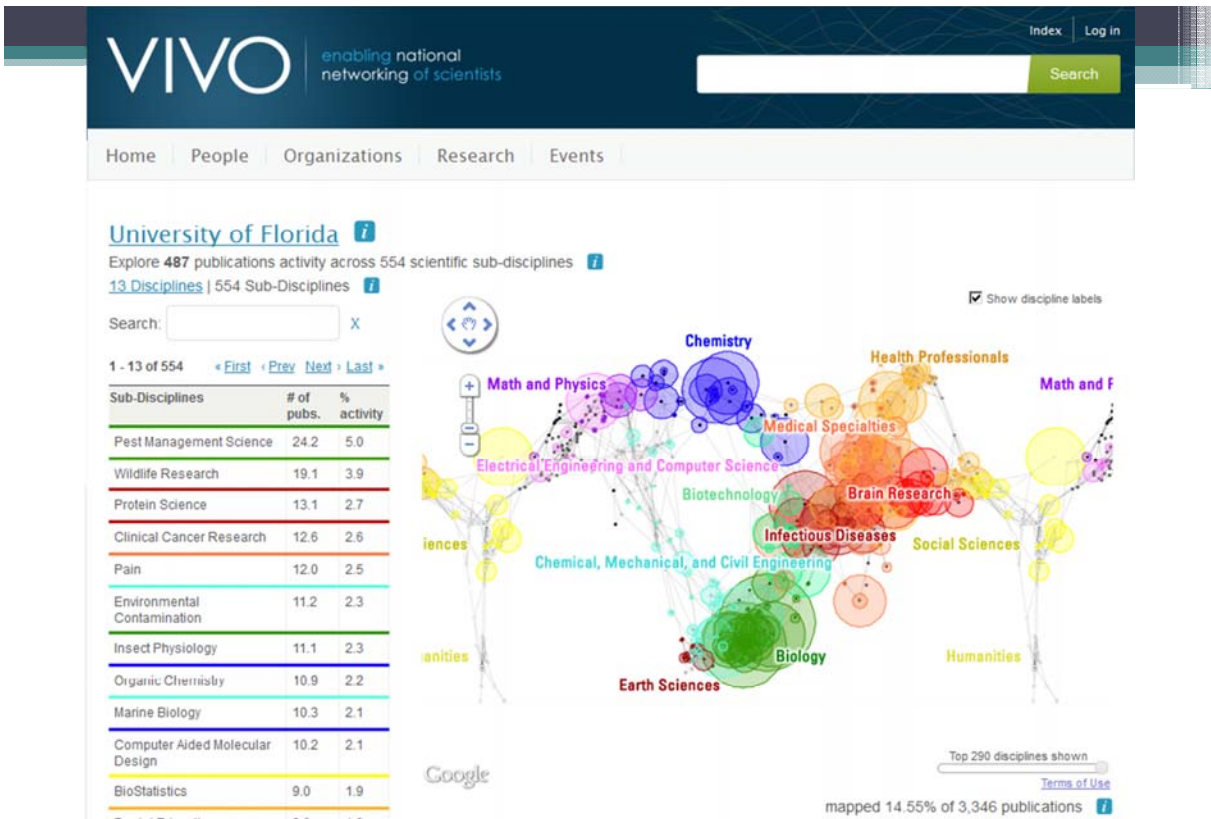


- Semantic web application and ontology editor originally developed at Cornell U.
- Integrates research and scholarship info from systems of record across institution(s).
- Facilitates research discovery and cross-disciplinary collaboration.
- Simplify reporting tasks, e.g., generate biosketch, department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

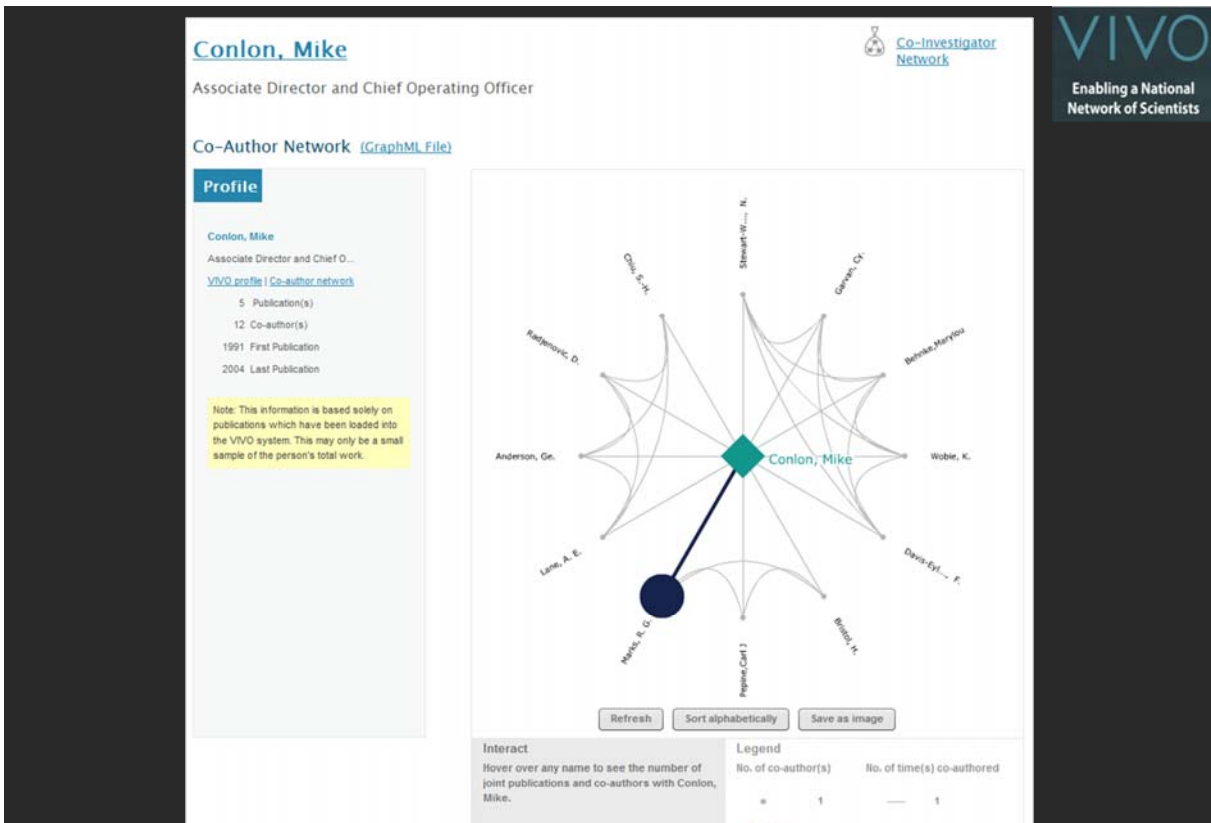


Funded by \$12 million NIH award.

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.



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



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

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



Online Interactive Maps for Sustainability Research and NIH

MAPSustain
Mapping Sustainability Research

Geographic Map Science Map

Detail About

Geographic Visualization

Here we have a more traditional view of the records - a geographic overlay. Featured here are the records that list both a city and state in the United States. Feel free to search, zoom, pan, and click for descriptions.

Funding
 NIH
 NSF
 USDA

Publications
 DOE
 ISI
 Medline

Patents
 USPTO

Citations Count

Amount Count

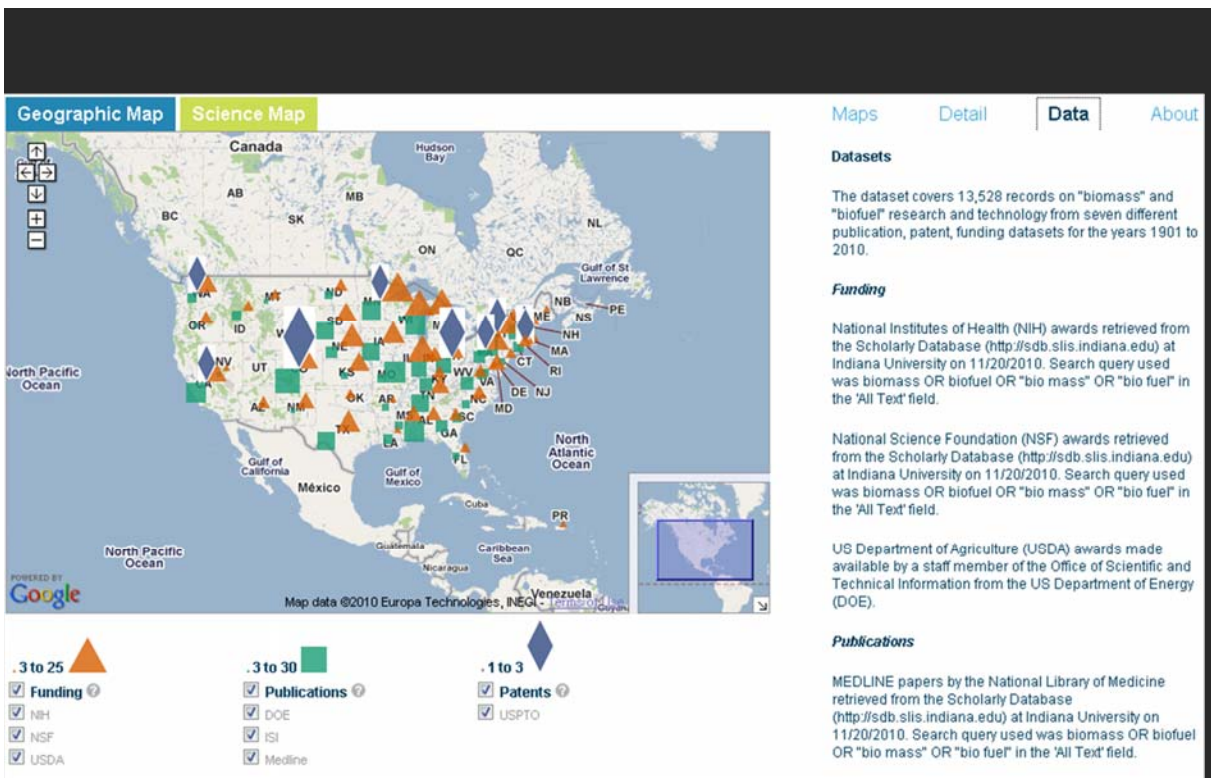
From year 1901 to year 2009

Search by keyword

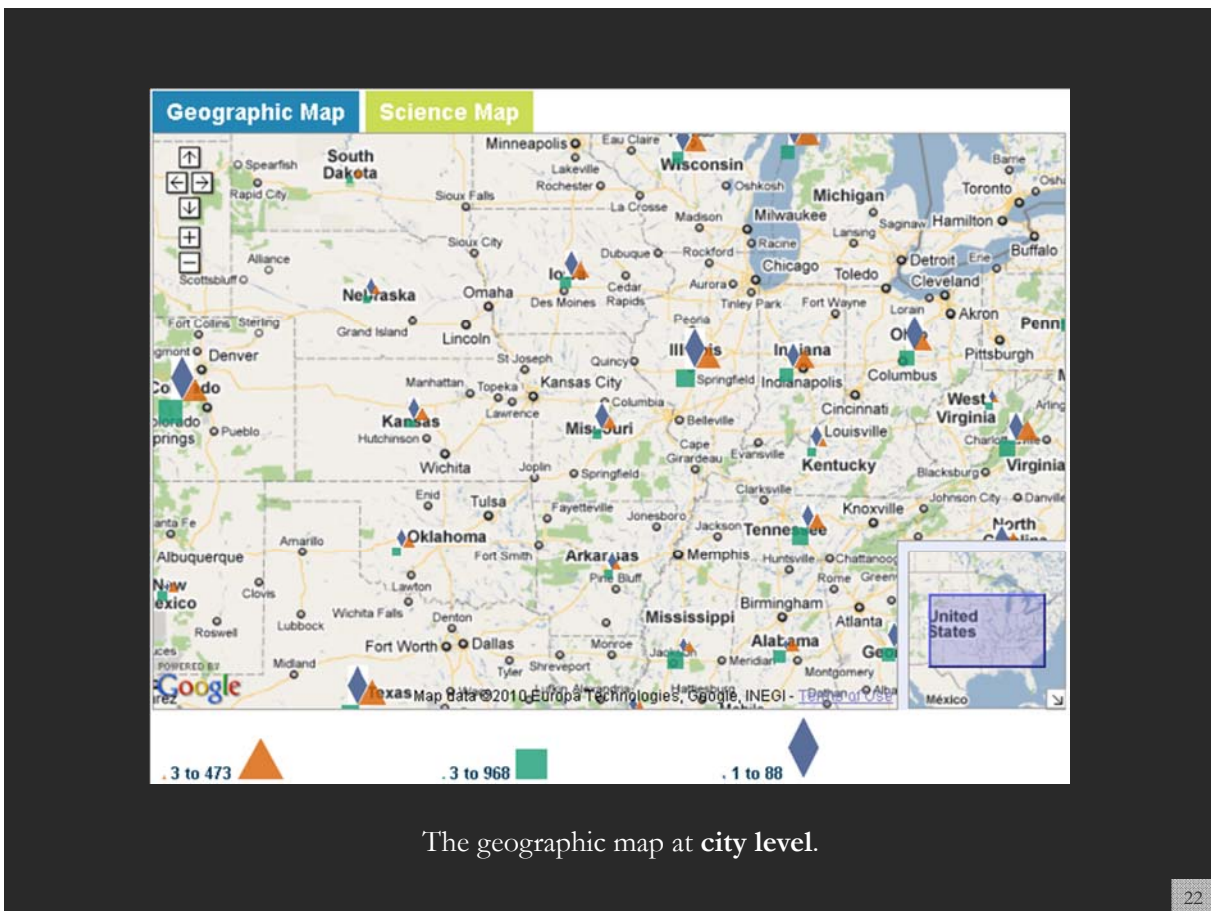
<http://mapsustain.cns.iu.edu>

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

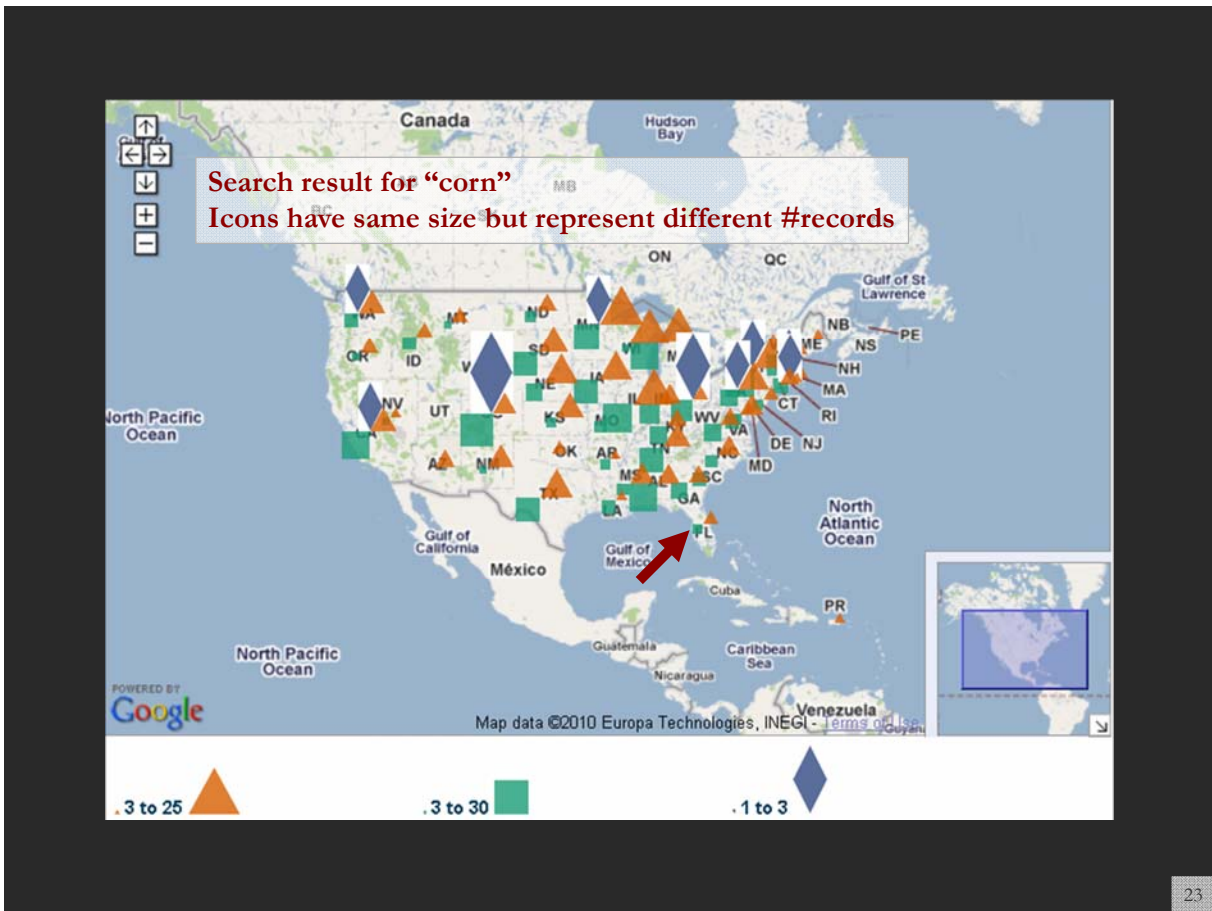
20



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](#)

24

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.

25

Geographic Map Science Map

Color B & W

Math and Physics Chemistry Health Professionals

Engineering and Computer Science Medical Societies

Biotechnology Brain Research

Chemical, Materials Sciences Social Sciences

Earth Sciences Biology Humanities

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

POWERED BY Google

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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

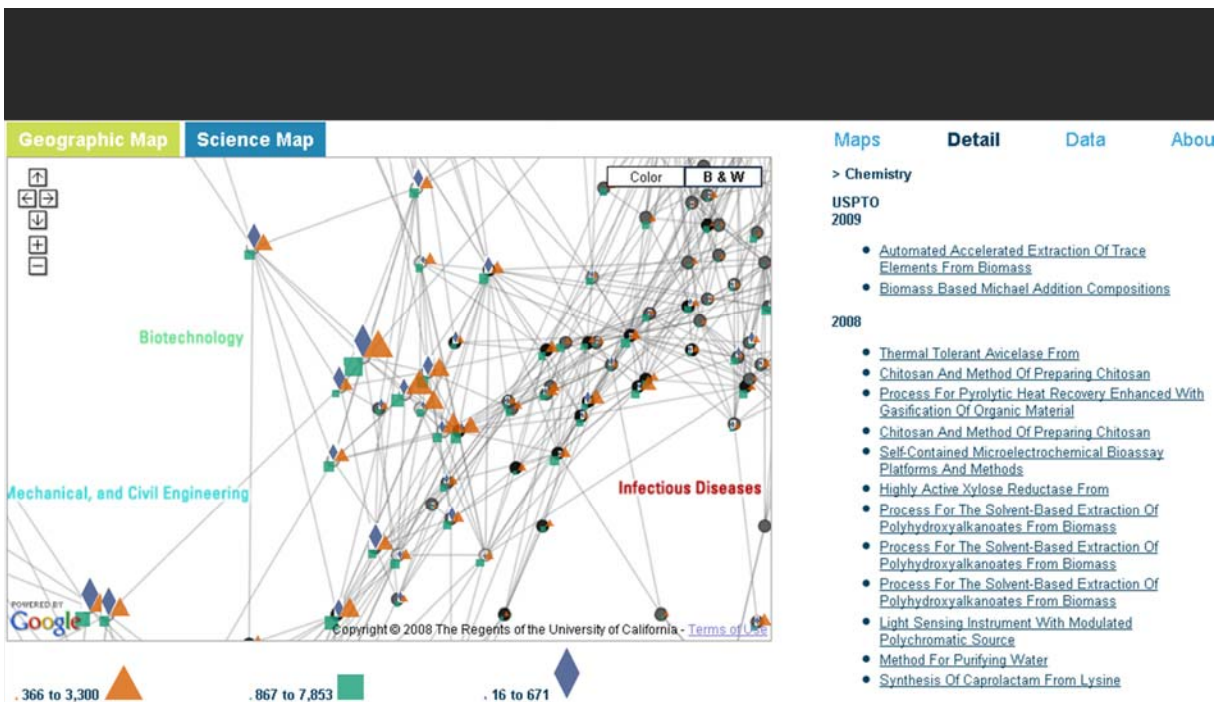
2008

- 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

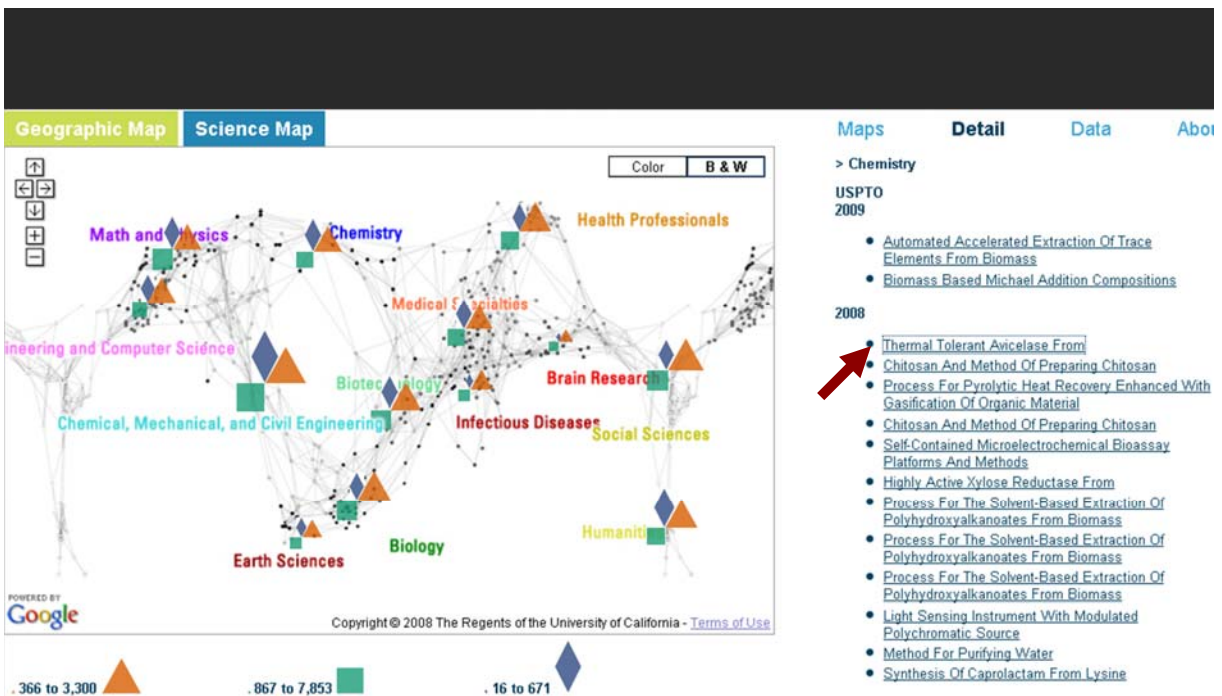
The science map at 13 top-level scientific disciplines level.

26



The science map at 554 sub-disciplines level.

27



28

NIH TOPIC MAPS

A Topic Database of NIH-Funded Grants

NIH Topic Browser - Institute Information

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

Institute: NCI - National Cancer Institute

Export Data

Top Topics

%	Topic	Topic Words	Title Words	Phrases
4.05	210	cancer cancer_center program cancer_research	cancer_center, program, cancer, core, spore, tre	anderson cancer_center, shared resource, canc
2.42	597	cancer tumor tumorigenesis tumors myc tumor_	cancer, tumorigenesis, myc, tumor_suppressor,	tumor progression, malignant transformation, tu
2.28	430	cancer treatment therapy patients tumor diseas	cancer, therapy, treatment, tumor, prostate, bre	cancer treatment, treatment cancer, metastatic
1.73	16	metastasis invasion tumor metastatic progressi	metastasis, cancer, invasion, breast, tumor, pro	tumor progression, invasion metastasis, cancer
1.47	345	clinical_trials trials oncology cancer treatment cli	clinical_trials, clinical_oncology, oncology, unit, p	clinical_trials unit, phase_j clinical_trials, cancer
1.43	686	cancer breast cancers cancer_risk cancer_patie	breast, cancer, cancer_risk, women, cancer_sur	breast cancer, breast cancer_risk, breast cancer
1.41	370	tumor immunotherapy t_cells t_cell immunity an	tumor, immunotherapy, t_cell, immunity, t_cells,	antitumor immunity, adoptive immunotherapy, t
1.14	480	therapeutic agents treatment therapies targets	therapeutic, targeting, agents, treatment, there	therapeutic agents, therapeutic targets, therap
1.08	346	biomarkers markers biomarker disease patients	biomarkers, biomarker, markers, disease, cancer	disease progression, biomarker validation, seru
0.98	660	prostate cancer pca cancer_cells incap androge	prostate, cancer, cancer_cells, androgen_recep	prostate cancer, prostate cancer_cells, prostate
0.90	171	scientific committee administrative management	core, administrative, administration, planning, a	steering committee, internal external, institutor
0.87	182	breast cancer her2 cancer_cells human mcf7 neu	breast, cancer, cancer_cells, her2, human, estre	breast cancer, breast cancer_cells, her2 neu, br
0.85	437	risk risk_factors cases cohort prospective high_r	risk, risk_factors, cancer, prospective, women, e	cases controls, prospective cohort_study, modif
0.85	23	tumor tumors tumor_growth mice treatment tun	tumor, tumors, cancer, tumor_growth, targeting	tumor regression, tumor burden, tumor progres
0.85	695	core statistical projects biostatistics investigat	core, biostatistics, data_management, bioinform	biostatistics core, projects core, data_managem
0.79	603	intervention interventions program prevention p	intervention, prevention, interventions, program	randomized_controlled trial, intervention reduce

<https://app.nihmaps.org>

NIH TOPIC MAPS

A Topic Database of NIH-Funded Grants

NIH Topic Browser

Show Map Viewer ?

Export Data

Methods

Feedback

Topics by NIH Institute

Topics by Category

2009

?

add

delete

AND

Exact Text

cancer

Search

Clear Search

2009 Grants (137)

Institutes (9)

Col	NIH Inst	Project/Subproj#	Title	Investigator(s)	# 1 Topic	# 1 Topic Word	NIH Inst	# Grants	Count
	NCRR	3P20RR011792-10S2-6914	OBESITY, INSULIN RESISTANCE, IGF'S, AND BREAST CANCER RISK IN AFRICAN AMERICANS	CUI, YONG	686	cancer brea...	NCI	116	
	NCI	3R01CA120562-03S1	Commonly Used Medications and Breast Cancer Recurrence	BOUDREAU, DENISE M	686	cancer brea...	NCRR	10	
	NCI	5R01CA120562-03	Commonly Used Medications and Breast Cancer Recurrence	BOUDREAU, DENISE M	686	cancer brea...	NIEHS	5	
	NCI	5R01CA093772-06	Long-term Survivorship in Older Women with Early Stage Breast Cancer	SILLIMAN, REBECCA A	686	cancer brea...	NCMHD	1	
	NCI	5R01CA064277-11	Shanghai Breast Cancer Study	ZHENG, WEI	686	cancer brea...	NIA	1	
							NCCAM	1	
							NICHD	1	
							NINR	1	
							NHGRI	1	

Topics

Similar Grants

Show Top 100 on Map

%	Topic	Topic Words	Title Words	Similar	NIH Inst	Grant
25.91	686	cancer breast cancers cancer_risk cancer_patients	breast, cancer, car	6.51	NCI	1R01CA129639-01A2 Genome-Wide Association Study of Radiation Exposure and Bilateral Breast Cancer PI: BERNSTEIN, JONINE LISA
3.86	437	risk risk_factors cases cohort prospective high_ris	risk, risk_factors, v	6.46	NCI	1M07CA136758-01A1 Genetic variants in the PI3K pathway in mammographic density and breast cancer PI: THOMPSON, CHERYL L.
3.76	544	snps snp genome_wide_association cases genes	genome_wide_ass	6.31	NCI	5P50CA116199-05 UTMADACC SPORE in Breast Cancer PI: HORTOBAGYI, GABRIEL N.
3.70	173	genetic genes risk susceptibility polymorphisms g	genetic, genetics,	6.02	NCI	2R01CA050385-21A1 Risk Factors for Breast Cancer in Younger Nurses PI: WILLETT, WALTER C.
2.62	252	treatment patients management patient outcom	management, tre	4.6	NCI	5R01CA127617-02 Who Cares For Older Breast Cancer Survivors And How Does It Affect Quality? PI: MANDELBLATT, JEANNE
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			

<https://app.nihmaps.org>

NIH TOPIC MAPS

A Topic Database of NIH-Funded Grants

3P20RR011792-10S2 6914

Map Viewer

Topic Browser

Export Data

Methods

Feedback

2009 NCCR CUI, YONG

NIH RePORTer

Map Similar Grants

Highlight on Map

Show Parent/Other Subs

OBESITY, INSULIN RESISTANCE, IGF'S, AND BREAST CANCER RISK IN AFRICAN AMERICANS

The purpose of this study is to better understand how lifestyle factors and their interaction with genetic factors influence a women's risk of developing breast cancer. In order to learn more about the causes of breast cancer, we need to compare the lifestyles of people who have breast cancer with those who do not. 600 women are expected to be enrolled.

Top Topics

50.00	686	cancer breast cancers cancer_risk cancer_patients women cancer_surv...
11.54	378	african_american white ethnic racial african_americans black race white...
11.54	348	obesity weight bmi obese overweight weight_loss body_mass_index kg

Tags

NIH Reporting Categories
Breast Cancer... Cancer... Obesity
NIH Concept Keywords
African American... cancer risk... Clinical Research... Computer Retrieval of Information on...

Similar Grants

Similar	Co NIH Insti	Project/Subprojec	Title	Investigator(s)	# 1 Topic	# 1 Topic Words
0.54	NCI	3K22CA127519-03S1	Beyond Adiposity: Insulin and Inflammation in Postmenopausal Breast Cancer	NUNEZ, NOMEI PANIAGUA	686 (33%)	cancer breast...
0.54	NCI	5K22CA127519-03	Beyond Adiposity: Insulin and Inflammation in Postmenopausal Breast Cancer	NUNEZ, NOMEI PANIAGUA	686 (33%)	cancer breast...
0.48	NCI	5R01CA128799-02	Mechanisms for Increased Breast Cancer Risk in Type 2 Diabetes	LEROITH, DEREK	66 (17%)	diabetes diab...
0.48	NCI	3P30CA013696-36S2 0007	BREAST CANCER RESEARCH	PARSONS, RAMON E	210 (40%)	cancer cancer...
0.48	NCI	3P30CA013696-36S3 0007	BREAST CANCER RESEARCH	PARSONS, RAMON E	210 (40%)	cancer cancer...

<https://app.nihmaps.org>

33

NIH TOPIC MAPS

A Topic Database of NIH-Funded Grants

NIH Map Viewer

Show Topic Browser

Export Data

Methods

Feedback

2009

add

delete

AND

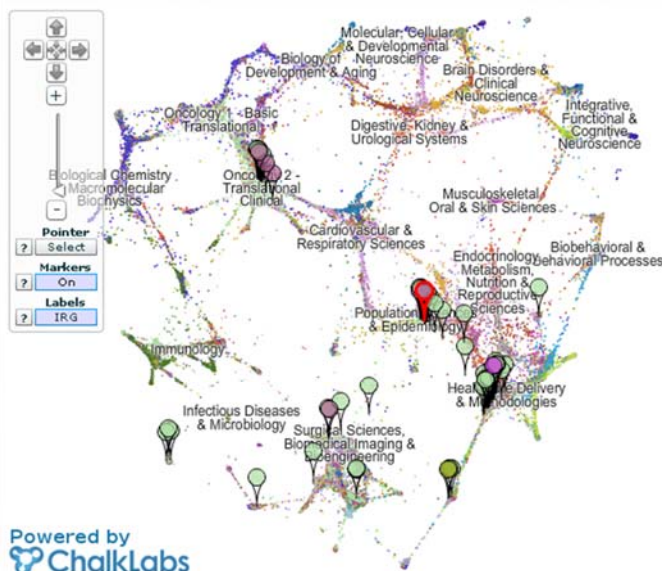
Related Grants

7960745

Top 100

Search

Clear Search



Powered by ChalkLabs

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

Institutes (3)

NIH Inst	#Grants	Count
NCI		94
NCCR		6
NCMHD		1

Topics

%	Title	Words
14.7%	breast, cancer, cancer_risk, women, cancer_sui	
11.0%	breast, mammography, mammographic, canc	
9.60%	risk, risk_factors, cancer, prospective, women,	
3.23%	genome_wide_association, lod, genome_wide,	

Grants (101)

Co NIH Inst	Grant
NCCR	3P20RR011792-10S2 6914 OBESITY, INSULIN RESISTANCE, IGF'S, AND BREAST CANCER RISK IN AFRICAN AMERICANS P1: CUI, YONG
NCI	5R01CA120562-03S1 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

<https://app.nihmaps.org>

34

Anyone Can Cook & Anyone Can Map

35

Information Visualization MOOC

INDIANA UNIVERSITY CNS



Overview

This course provides an overview about the state of the art in information visualization. It teaches the process of producing effective visualizations that take the needs of users into account.

Among other topics, the course covers:

- Data analysis algorithms that enable extraction of patterns and trends in data
- Major temporal, geospatial, topical, and network visualization techniques
- Discussions of systems that drive research and development.

Please watch the introduction video to get better acquainted with the course.

Everybody who registers gains free access to the Scholarly Database (26 million paper, patent, and grant records) and the Sci2 Tool (100+ algorithms and tools).

Katy Börner, Ph.D.
Indiana University

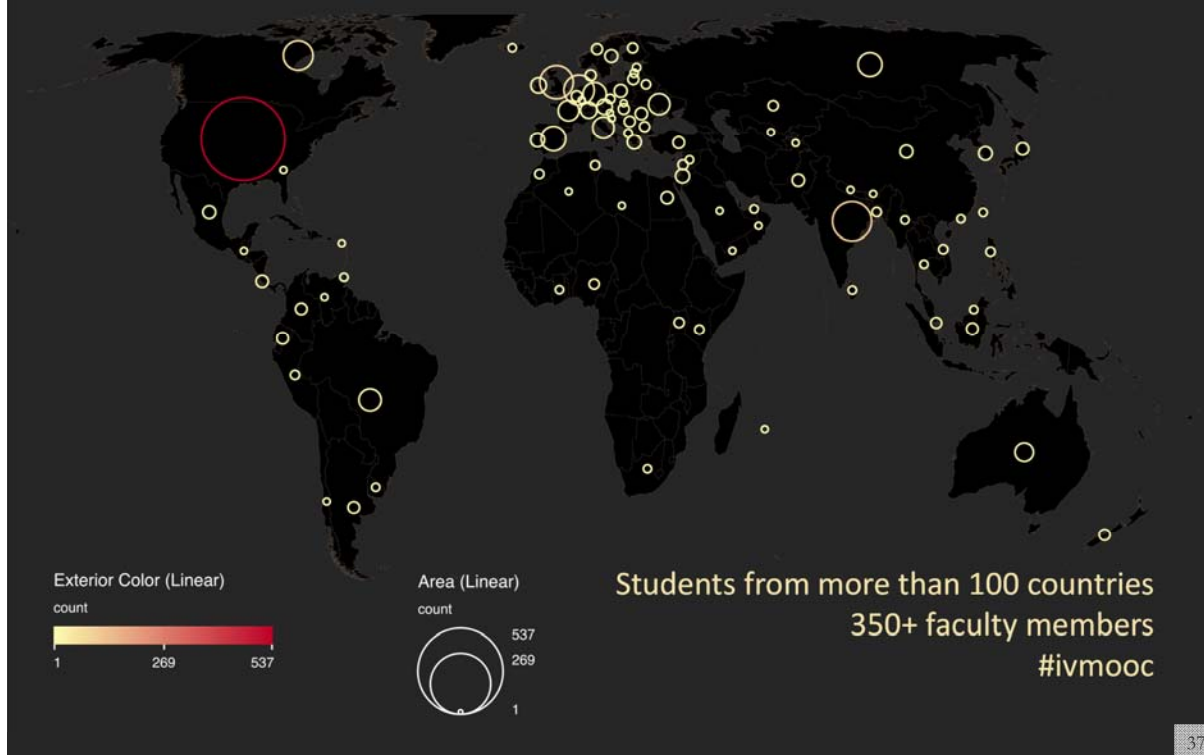


Go To The Course

ivmooc.cns.iu.edu

36

The Information Visualization MOOC
ivmooc.cns.iu.edu



Instructors

Katy Börner – Theory Parts

Instructor, Professor at SLIS



David E. Polley – Hands-on Parts

CNS Staff, Research Assistant with MIS/MLS
Teaches & Tests Sci2 Tool



Scott B. Weingart – Client Work

Assistant Instructor, SLIS PhD student



Course Schedule

- **Session 1** – Workflow design and visualization framework
- **Session 2** – “When:” Temporal Data
- **Session 3** – “Where:” Geospatial Data
- **Session 4** – “What:” Topical Data

Mid-Term

Students work in teams with clients.

- **Session 5** – “With Whom:” Trees
- **Session 6** – “With Whom:” Networks
- **Session 7** – Dynamic Visualizations and Deployment

Final Exam

39

Grading

All students are asked to create a personal profile to support working in teams.



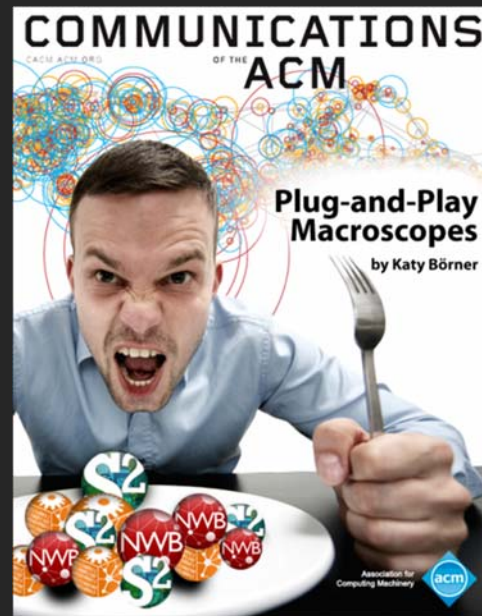
Final grade is based on Midterm (**30%**), Final (**40%**), Client Project (**30%**).

- Weekly self-assessments are not graded.
- Homework is graded automatically.
- Midterm and Final test materials from theory and hands-on sessions are graded automatically.
- Client work is peer-reviewed via online forum.

All students that receive more than **80%** of all available points get an official certificate/badge.

40

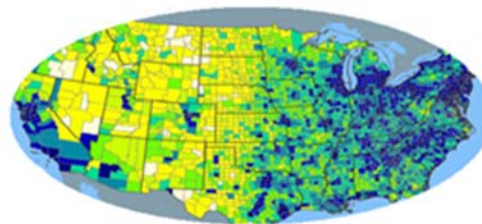
Plug-and-Play Macroscopes
cishell.org



Börner, Katy. (March 2011). Plug-and-Play Macroscopes. *Communications of the ACM*, 54(3), 60-69. <http://www.scivee.tv/node/27704>

Different Levels of Abstraction/Analysis

Macro/Global
Population Level



Meso/Local
Group Level



Micro/Individual
Individual Level

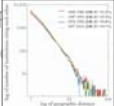

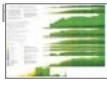

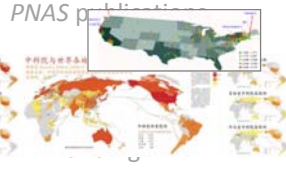
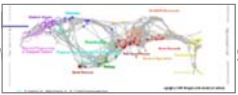



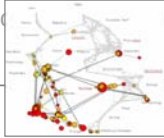


Type of Analysis vs. Level of Analysis

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

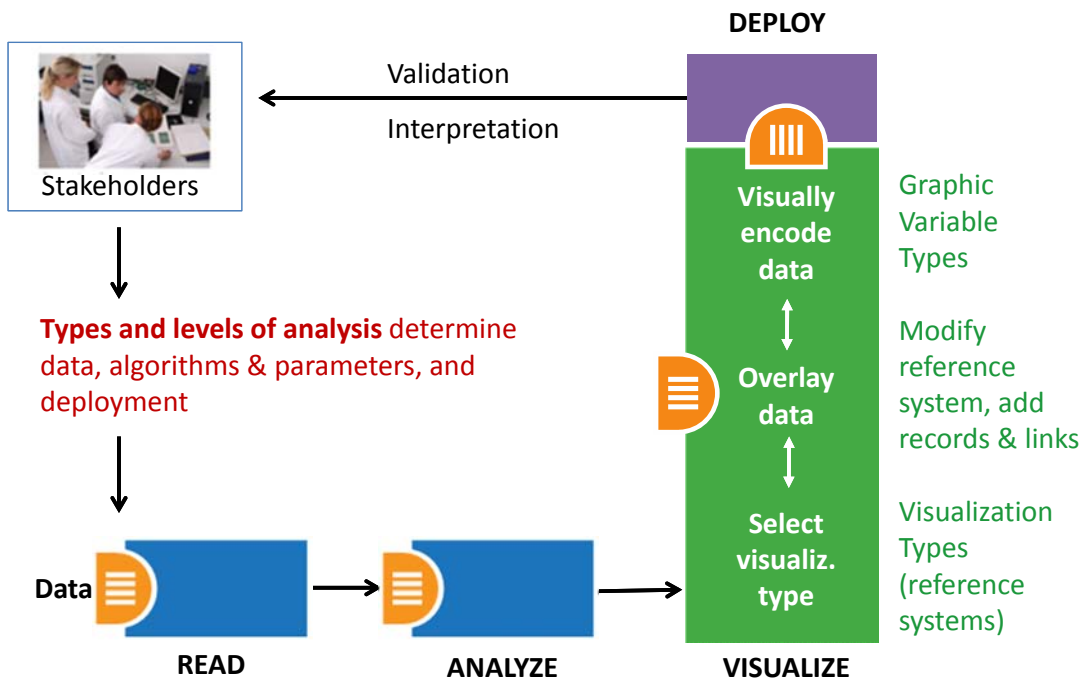
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Type of Analysis vs. Level of Analysis

	Micro/Individual (1-100 records)	Meso/Local (101–10,000 records)	Macro/Global (10,000 < records)
Statistical Analysis/Profiling	Individual person and their expertise profiles	Larger labs, centers, universities, research domains, or states	All of NSF, all of science 
Temporal Analysis (When)	Funding portfolio of one individual	Mapping topic bursts in 20 years of <i>PNAS</i> 	113 years of physics research 
Geospatial Analysis (Where)	Career trajectory of one individual	Mapping a state's intellectual landscape 	<i>PNAS</i> publications 
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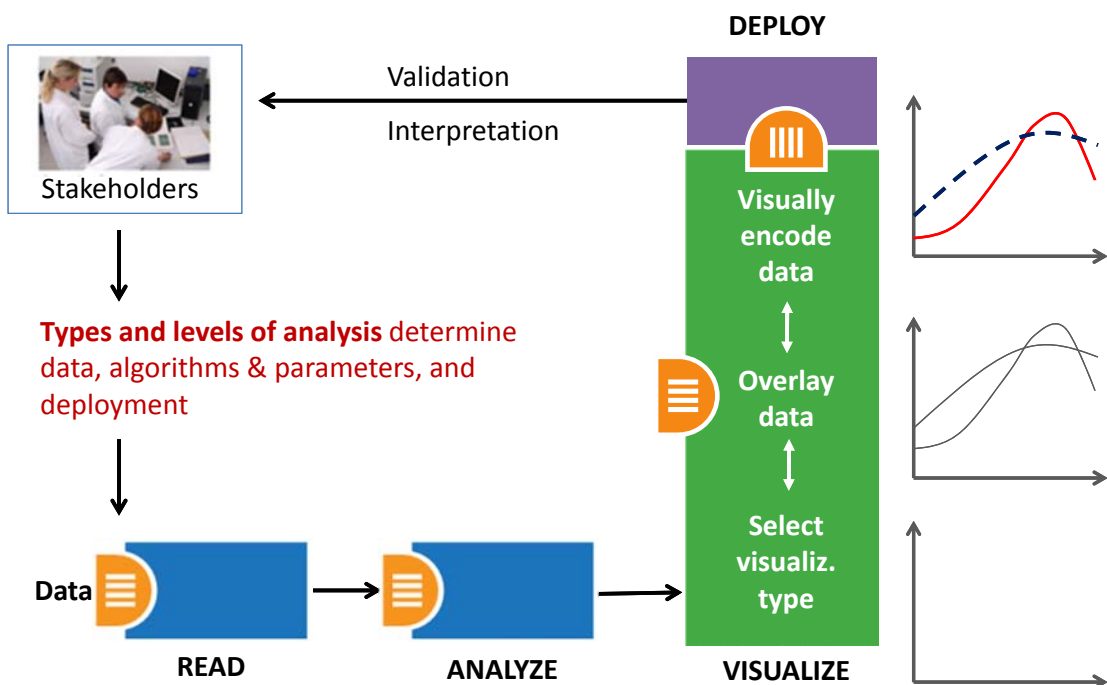
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Needs-Driven Workflow Design



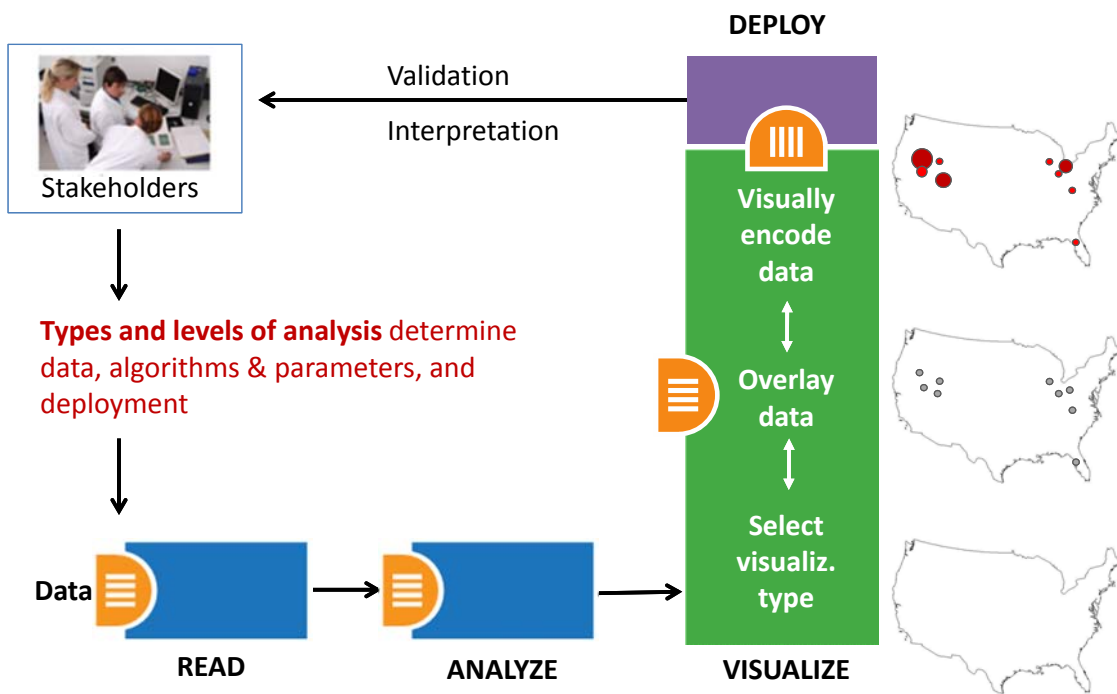
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Needs-Driven Workflow Design



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Needs-Driven Workflow Design



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Clients

Information Visualization MOOC INDIANA UNIVERSITY CNS

List of Clients

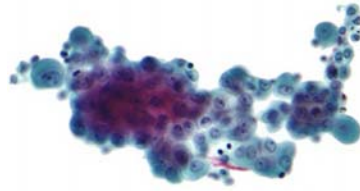
ISIS **Project Title:** Isis: 100 Years
Client Name: Jay Malone
Project goal/scientific or practical value: A visual representation Isis' contributors and locales over the past 100 years. Isis is the journal of the History of Science Society. This representation will provide a dynamic picture of how scholarship in the history of science has shifted over the past century.
Information on dataset(s) to be used: Citation information, author locale, and issue number for Isis publications.
Relevant publications, websites, etc: <http://www.press.uchicago.edu/ucp/journals/journal/isis.html>
Conditions under which students can publish results and/or add project results to their resume: Client would like to approve results.

ycib **Project Title:** e-Xploration
Client Name: Luyi
Project goal/scientific or practical value: e-Xploration is an agent-based model for the ethnographic observation and the registry, analysis, and interpretation of social practices in virtual communities for intervention in the development of collaboration and cooperation. This project will analyze the interactions between subjects and objects in a platform collaborative community called OYCIB, a project based on e-Xploration (e-crick.net).
Information on dataset(s) to be used: I can provide a data base in .graphml format for the students. The file .graphml contains the interactions between subjects and objects in a platform collaborative community called OYCIB. In the level of practice, it is not necessary that students know agent-based models for using the database. But, in another level, for example: the collaborate level for the OYCIB development, it is necessary to have basic knowledge in AMS or MAS and another competences like PHP and MySQL.
Relevant publications, websites, etc: <http://www.e-crick.net/logs>
Conditions under which students can publish results and/or add project results to their resume: If any person or institution use my dataset or another info about eXploration (e-crick.net, oycib.net), I need to approve the results and appear as co-author.

http://ivmooc.cns.iu.edu/ivmooc_clientprojects.html

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Diogo Carmo



Mesothelioma

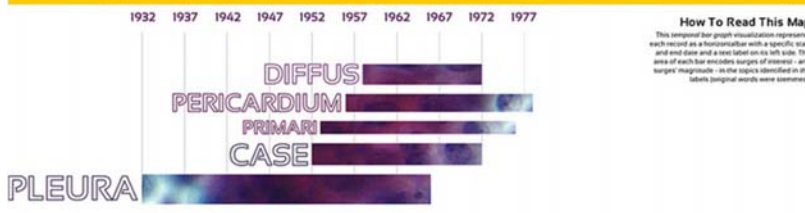
Main title topics in Medline papers

Mesothelioma (a rare form of cancer that develops from transformed cells originating in the mesothelium, the protective lining that covers many of the internal organs of the body) is usually caused by exposure to asbestos.

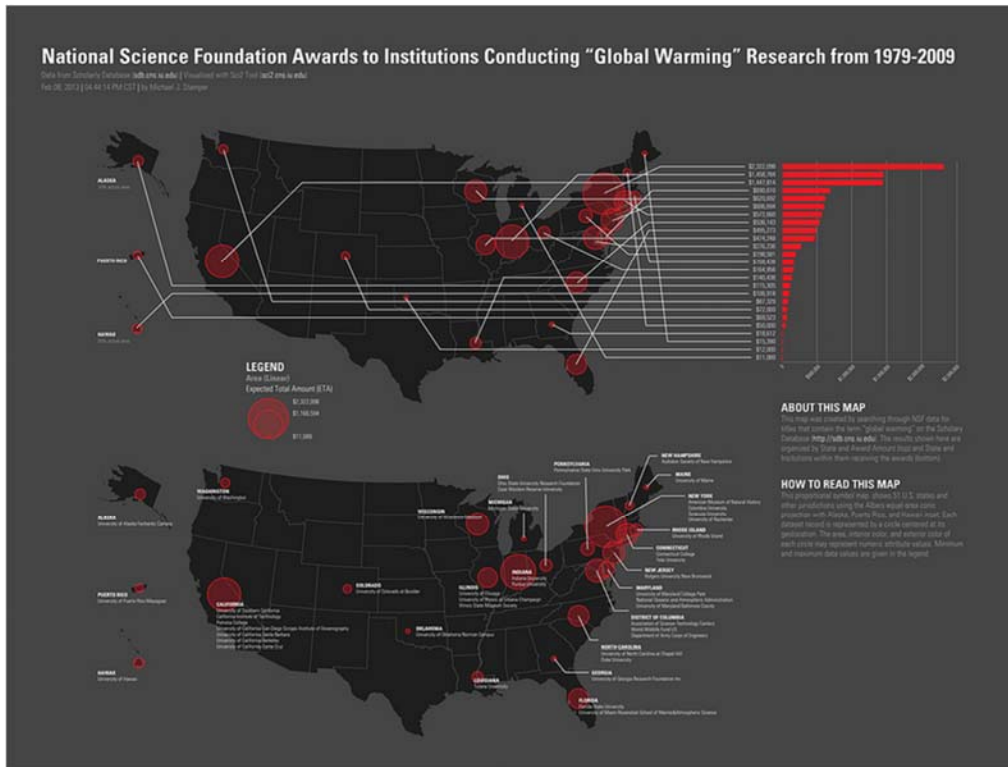
The most common anatomical site for the development of mesothelioma is the pleura (the outer lining of the lungs and internal chest walls, but it can also arise in the peritoneum (the lining of the abdominal cavity), and the pericardium (the sac that surrounds the heart) or the tunica vaginalis (a sac that surrounds the testis).

Most people who develop mesothelioma have worked in jobs where they inhaled asbestos, or were exposed to asbestos dust and fibers in other ways. It has also been suggested that working in a family member who worked with asbestos increases their risk for developing mesothelioma. Unlike lung cancer, there seems to be no association between mesothelioma and tobacco smoking, but smoking greatly increases the risk of other asbestos-induced cancers. Some people who were exposed to asbestos have inherited damage to their asbestos-related disease, including mesothelioma. Compensation via asbestos funds or class action lawsuits is an important issue in law practices regarding mesothelioma.

MALIGNANT PLEURAL CYSTIC BENIGN DIAGNOSIS



Author: Diogo Carmo <http://dx.doi.org/10.1002/mes.1000> | Visualization software: Sci2 Tools, (2009) | Science of Science (Sci2) Tool, Indiana University and SciTech Strategies, <http://sci2.ucis.edu/> | Dataset: Medline Papers, as available in Pubmed Database, <http://pubmed.ncbi.nlm.nih.gov/> | Text and Images: Wikipedia Mesothelioma article, available at <http://en.wikipedia.org/wiki/Mesothelioma> | Font: Sansation, by Bernd Mohr © 2011 - All Rights Reserved. This font family is licensed and available at <http://bit.ly/3j8m8m8>.



mjstampler ivmooc

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Acknowledgments

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Visualizations used in the course come from the Places & Spaces: Mapping Science exhibit, online at <http://scimaps.org>, and from the *Atlas of Science: Visualizing What We Know*, MIT Press (2010).



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10.15 Ted Polley & Google Team present I/MOOC at EDUCAUSE
10.22 Katy Börner presents at the SciELO 15 Years Conference

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