

Identifying Overlap, Gaps and Emerging Research Areas Using Multi-Level Science Maps

Katy Börner

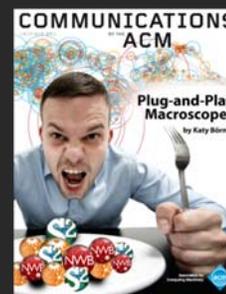
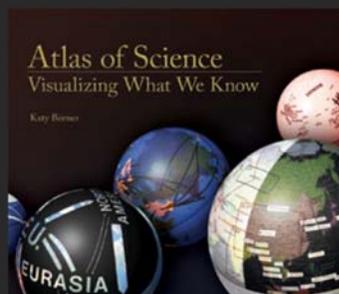
Cyberinfrastructure for Network Science Center, Director
Information Visualization Laboratory, Director
School of Library and Information Science
Indiana University, Bloomington, IN, USA and
Royal Netherlands Academy of Arts and Sciences (KNAW), NL
katy@indiana.edu



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

Portfolio Analysis Symposium
NIH Natcher Auditorium, Bethesda, MD

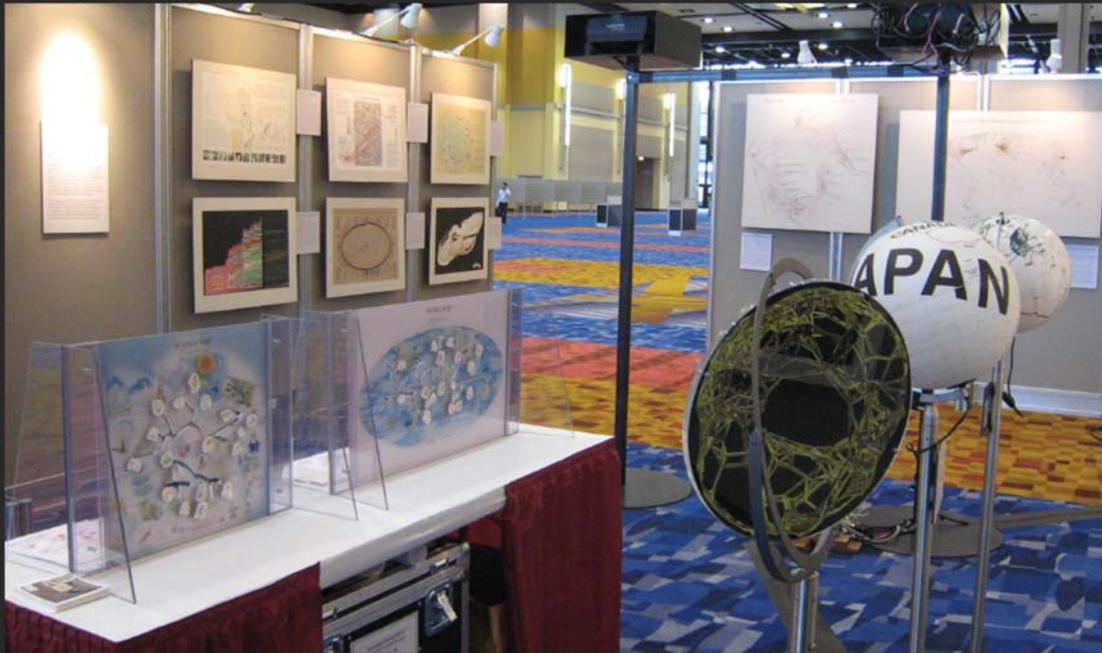
Tuesday July 24, 2012 • 8:45-9:30am



Science Maps

- Different Datasets
- Different Analyses and Visualizations
- Different User Groups

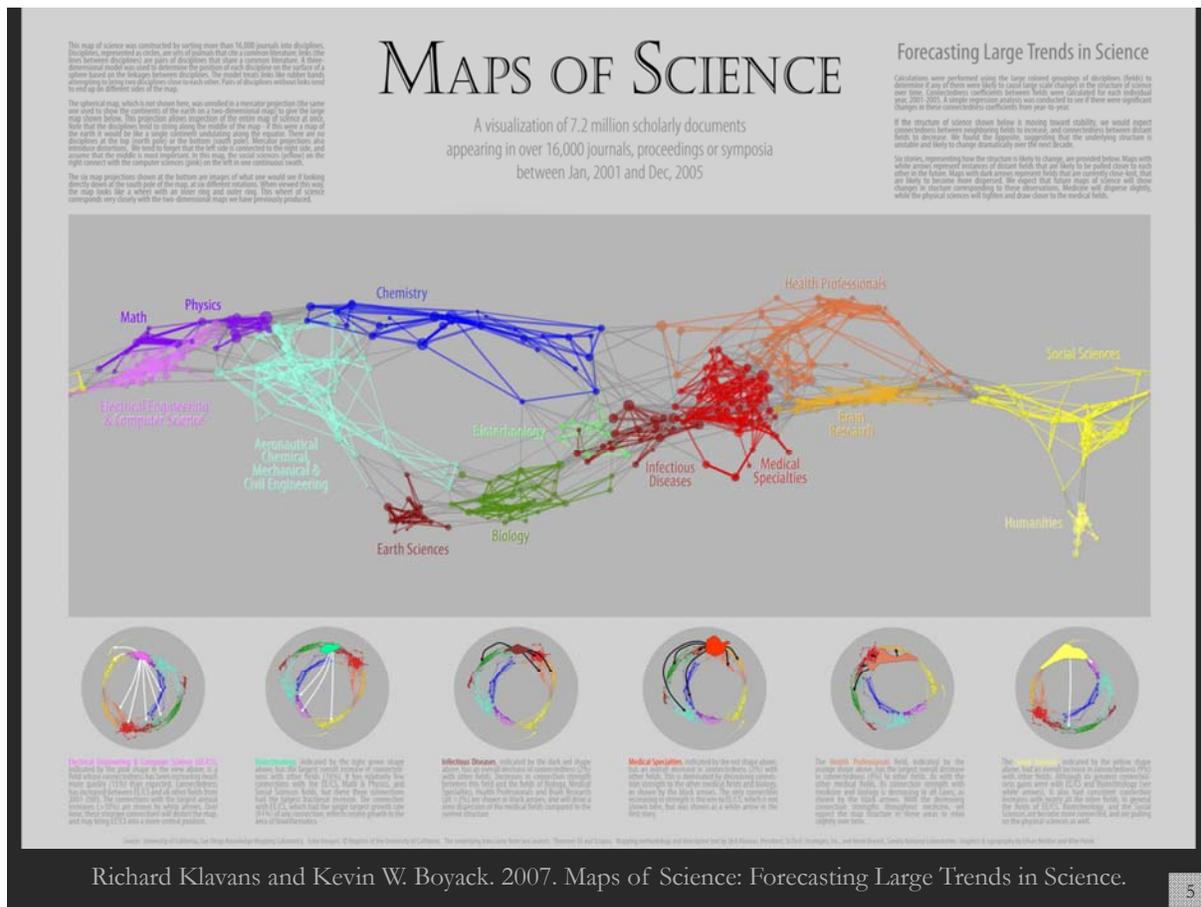
Places & Spaces: Mapping Science Exhibit (<http://scimaps.org>)



After eight years, there now exist 80 out of 100 maps.



Mapping Science Exhibit at MEDIA X, Wallenberg Hall, Stanford University, 2009
<http://mediax.stanford.edu>, <http://scaleindependentibought.typepad.com/photos/scimaps>



Richard Klavans and Kevin W. Boyack. 2007. Maps of Science: Forecasting Large Trends in Science.

The UCSD Map of Science and Classification System

2007 Map:

Data: WoS and Scopus for 2001–2005, 7.2 million papers, >16,000 separate journals, proceedings, series

Similarity Metric: Combination of bibliographic coupling and keyword vectors

Number of Disciplines: 13; **Subdisciplines:** 554

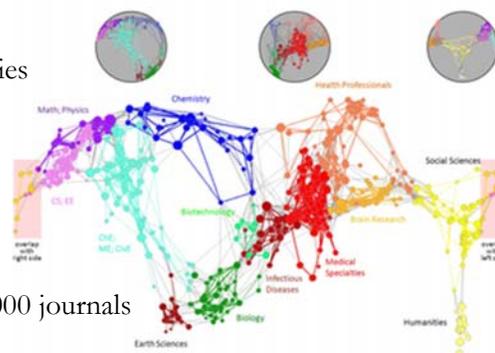
2010 Map:

Data: WoS and Scopus for 2001–2010; about 25,000 journals

Number of Disciplines: 13; **Subdisciplines:** 554

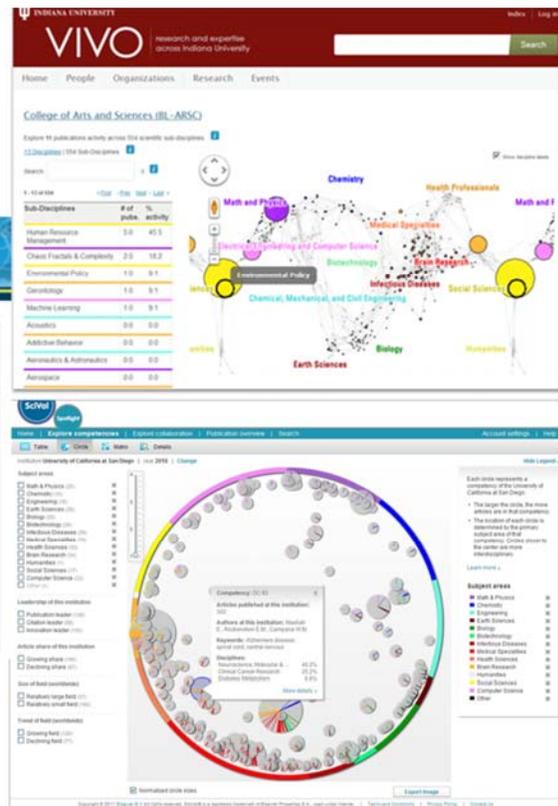
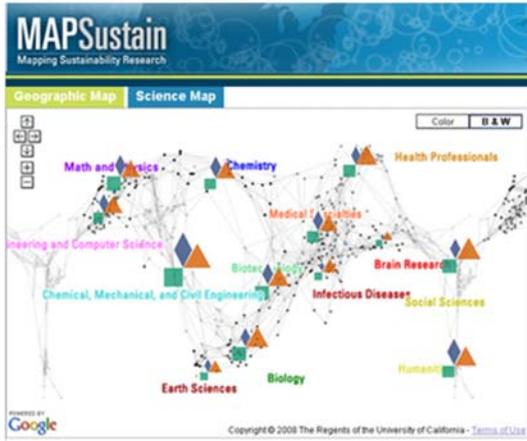
Map Design and Usage:

Map places 554 subdisciplines on the surface of a sphere—those with papers that cite the same base knowledge are placed in closer proximity. The spheric layout is then flattened using a Mercator projection. Each node is labeled and has an extensive list of journal names and key phrases as metadata, which can be used to “science locate” journal publications as well as nonjournal data such as patents or grants.

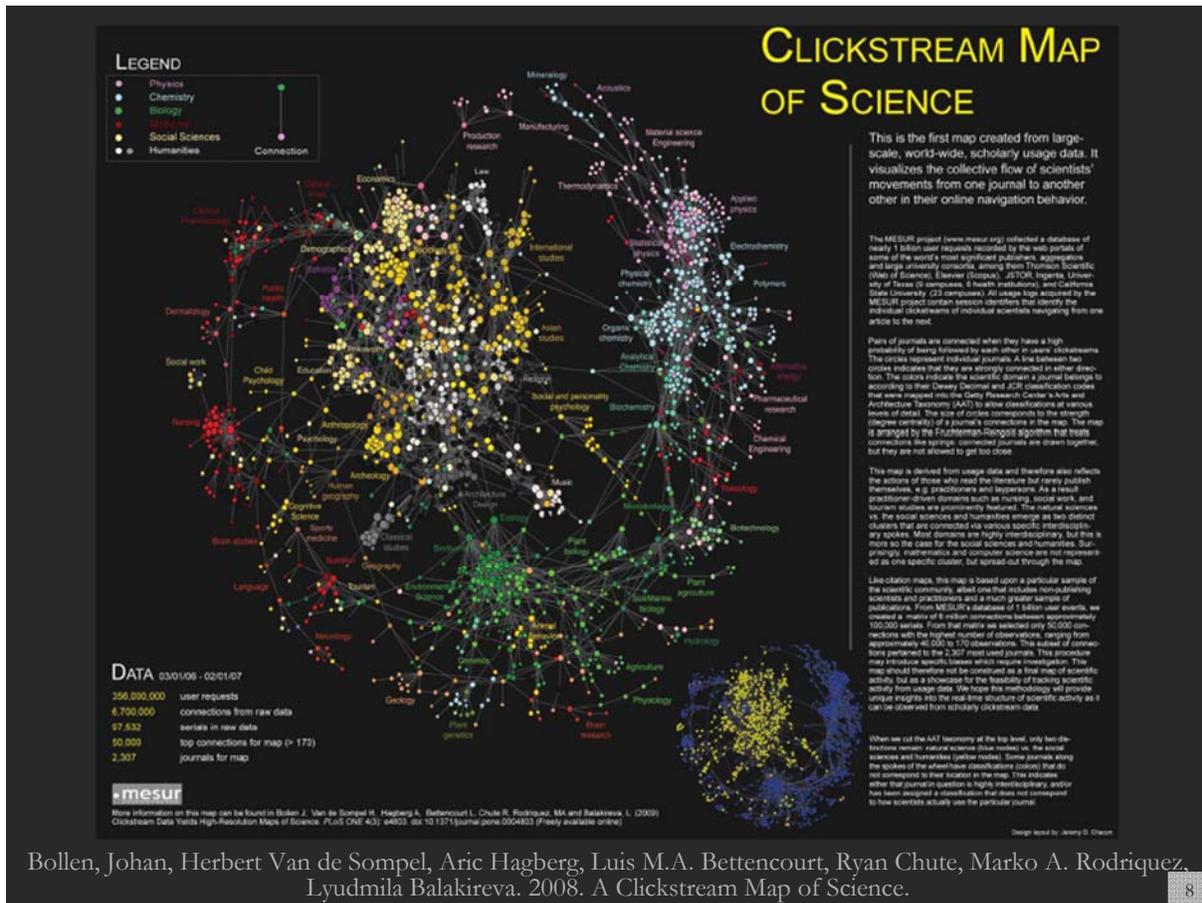


Börner, Katy, Richard Klavans, et al. (2012) *Design and Update of a Classification System: The UCSD Map of Science*. PLoS ONE 7(7): e39464. [doi:10.1371/journal.pone.0039464](https://doi.org/10.1371/journal.pone.0039464)

UCSD Map of Science: Deployments



Börner, Katy, Richard Klavans, et al. (2012) Design and Update of a Classification System: The UCSD Map of Science. PLoS ONE 7(7): e39464. doi:10.1371/journal.pone.0039464

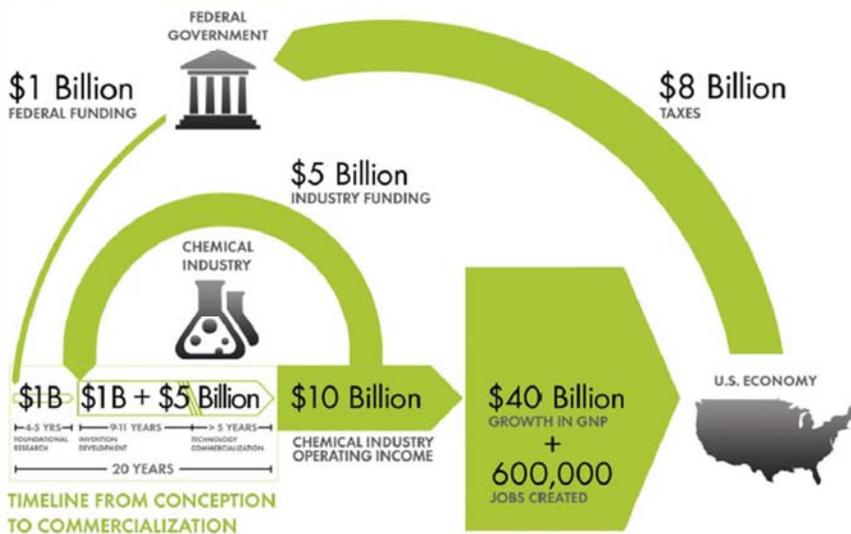


Bollen, Johan, Herbert Van de Sompel, Aric Hagberg, Luis M.A. Bettencourt, Ryan Chute, Marko A. Rodriguez, Lyudmila Balakireva. 2008. A Clickstream Map of Science.

Chemical Research & Development Powers the U.S. Innovation Engine

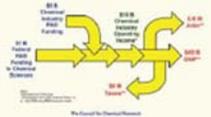
Macroeconomic Implications of Public and Private R&D Investments in Chemical Sciences

INVESTMENT IN CHEMICAL SCIENCE R&D



The Council for Chemical Research (CCR)

has provided the U.S. Congress and government policy makers with important results regarding the impact of Federal Research & Development (R&D) investments on U.S. innovation and global competitiveness through its commissioned 5-year two phase study. To take full advantage of typically brief access to policy makers, CCR developed the graphic below as a communication tool that distills the complex data produced by these studies in direct, concise and clear terms.



The design shows that an input of \$1B in federal investment, leveraged by \$5B industry investment, brings new technologies to market and results in \$10B of operating income for the chemical industry, \$40B growth in the Gross National Product (GNP) and further impacts the US economy by generating approximately 600,000 jobs, along with a return of \$8B in taxes. Additional details, also reported in the CCR studies, are depicted in the map to the left. This map clearly shows the two R&D investment cycles: the shorter industry investment at the innovation stage to commercialization cycle; and the longer federal investment cycle which begins in basic research and culminates in national economic and job growth along with the increase tax base that in turn is available for investment in basic research.

Council for Chemical Research. 2009. Chemical R&D Powers the U.S. Innovation Engine. Washington, DC. Courtesy of the Council for Chemical Research.

The EMERGENCE of NANOTECHNOLOGY

MAPPING THE NANO REVOLUTION

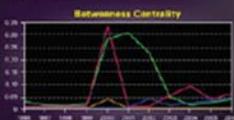
The emergence of nanotechnology has been one of the major interdisciplinary revolutions in the last decade and it led to a structural reorganization of major fields of science. Price (1992) showed that fields of science and their development can be mapped using aggregated citations among the journals in the field and their research organizations.

The frames to the right show the evolving journal citation networks for the years 1998-2003. Distances are proportional to inverse values between the citation patterns of the respective journals. Typical denotations of key events during the development of Nanotechnology are given below each frame. Most notably, leading papers in Science and Nature catalyzed the breakthrough around 2000.

CHANGING ROLES OF DIFFERENT JOURNALS

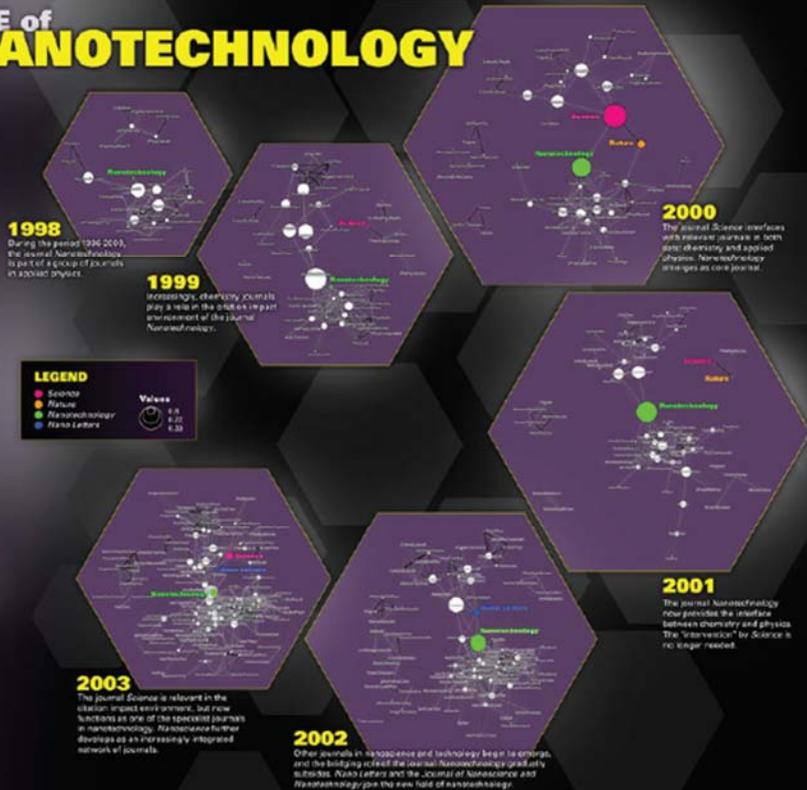
The interdisciplinary of a journal can be measured using betweenness centrality (BC) - journals that occur on many shortest paths between other journals in a network have higher BC values than those that do not. In the maps, sizes of nodes are proportional to the betweenness centrality of the respective journal in the citation network.

From being a specialist journal in applied physics, the journal *Nanotechnology* obtains a high BC value in the years of the transition, ca. 2001. This is preceded by the "invention" of Science. After the transition, the new field of nanotechnology is established, new journals such as *Nano Letters* published by the influential American Chemical Society take the lead, and a new specialty structure with low BC value journals results.



An animated sequence of this evolution is at <http://www.loetleydesdorff.nl/iss/journal/iss/ncsteb>.

References
Leydesdorff, L. and T. Gohari, 2006. Dynamic Animations of Journal Maps: Indicators of Structural Change and Interdisciplinary Development. *Journal of the American Society for Information Science and Technology*, 57(11), 1010-1018.
Price, Daniel J. de Solla (1965). Networks of scientific papers. *Science*, 149, no. 3662, 510-515.



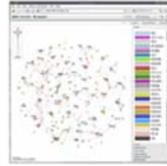
Loet Leydesdorff, Thomas Schank and the Journal of the American Society for Information Science and Technology. 2010. The Emergence of Nanoscience & Technology.

A Topic Map of NIH Grants 2007

ChalkLabs UCLIVNE

Bruce W. Herr II (ChalkLabs & IU), Gully Burns (ISU), David Newman (UCI), Edmund Talley (NIH)

The National Institutes of Health (NIH) is organized as a multitude of Institutes and Centers whose missions are primarily focused on distinct diseases. However, disease ecologies and therapies float scientific boundaries, and thus there is tremendous overlap in the kinds of research funded by each Institute. This creates a daunting landscape for decisions on research directions, funding allocations, and policy formulations. Shown here is devised an interactive topic map for navigating this landscape, online at www.nihmaps.org. Institute abbreviations can be found at www.nih.gov/ics.



Topic modeling, a statistical technique that automatically learns semantic categories, was applied to assess projects in terms used by researchers to describe their work, without the biases of keywords or subject headings. Grant similarities were derived from their topic mixtures, and grants were then clustered on a two-dimensional map using a force-directed simulated annealing algorithm. This analysis creates an interactive environment for assessing grant relevance to research categories and to NIH Institutes in which grants are localized.



- National Cancer Institute (NCI)**
TOP 10 TOPICS
- 1 Oncology Clinical Trials
 - 2 Cancer Treatment
 - 3 Cancer Therapy
 - 4 Carcinogenesis
 - 5 Risk Factor Analysis
 - 6 Cancer Chemotherapy
 - 7 Metastasis
 - 8 Leukemia
 - 9 Public Health Progress
 - 10 Cancer Chemoprevention

- National Institute of General Medical Sciences (NIHAMS)**
TOP 10 TOPICS
- 1 Bioactive Organic Synthesis
 - 2 Drug Pharmacokinetics
 - 3 Protein NMR
 - 4 Computational Models
 - 5 Neural Biology
 - 6 Membrane Protein
 - 7 Epigenetic Mechanisms
 - 8 Protein Complexes
 - 9 Membrane Cell Adhesion Genetics
 - 10 Cell Division

- National Heart, Lung, and Blood Institute (NHLBI)**
TOP 10 TOPICS
- 1 Genetic Factors
 - 2 Pulmonary Injury
 - 3 Genetic Linkage Analysis
 - 4 Cardiovascular Disorder
 - 5 Atherosclerosis
 - 6 Hemostasis
 - 7 Blood Protein
 - 8 Arteriosclerosis/Atherosclerosis
 - 9 Gene Association
 - 10 Lipoproteins

- National Institute of Mental Health (NIMH)**
TOP 10 TOPICS
- 1 Mood Disorders
 - 2 Schizophrenia
 - 3 Behavioral Intervention Studies
 - 4 Mental Health
 - 5 Depression
 - 6 Cognitive Behavioral Therapy
 - 7 ADD/Attention
 - 8 Genetic Linkage Analysis
 - 9 Abstinence
 - 10 Childhood

Bruce W. Herr II, Gully Burns, David Newman, Edmund Talley. 2007. A Topic Map of NIH Grants 2007

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

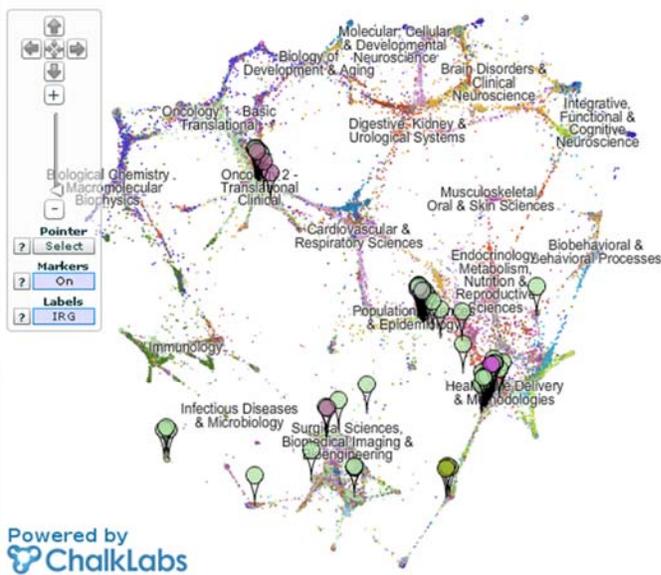
20

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?

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 | 2P20RR011792-10S2-6914 OBESITY, INSULIN RESISTANCE, IGFs, 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 | 3R01CA120562-03 Commonly Used Medications and Breast Cancer Recurrence PI: BOUDREAU, DENISE M | |
| NCI | 3R01CA093772-06 Long-term Survivorship in Older Women with Early Stage Breast | |

Powered by ChalkLabs

<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 Topi | # 1 Topic Worc | NIH Inst | # Grants | Count |
|-----|----------|------------------------|---|---------------------|-----------|----------------|----------|----------|-------|
| | NCRR | 3P20RR011792-10S2 6914 | OBESITY, INSULIN RESISTANCE, IGF'S, AND BREAST CANCER RISK IN AFRICAN AMERICANS | CUI, YONG | 686 (50%) | cancer brea... | NCI | 116 | |
| | NCI | 3R01CA120562-03S1 | Commonly Used Medications and Breast Cancer Recurrence | BOUDREAU, DENISE M | 686 (42%) | cancer brea... | NCRR | 10 | |
| | NCI | 5R01CA120562-03 | Commonly Used Medications and Breast Cancer Recurrence | BOUDREAU, DENISE M | 686 (42%) | cancer brea... | NIHHS | 5 | |
| | NCI | 5R01CA093772-06 | Long-term Survivorship in Older Women with Early Stage Breast Cancer | SILLIMAN, REBECCA A | 686 (42%) | cancer brea... | NCMHD | 1 | |
| | NCI | 5R01CA064277-11 | Shanghai Breast Cancer Study | ZHENG, WEI | 686 (41%) | cancer brea... | NIA | 1 | |

Topics

Similar Grants

Show Top 100 on Map

| % | Topic | Topic Words | Title Words | Similar C | NIH Inst | Grant |
|-------|-------|---|-------------------------------------|-----------|----------|--|
| 25.91 | 686 | cancer breast | cancers cancer_risk cancer_patients | 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 | 1K07CA136758-01A1 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 UTMACC 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>

13



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>

14



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 lectern 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

Copyright © 2009 The Regents of the University of California

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.

Interact

Select any location on the Geographic Map location (by brushing your finger over an area on the lectern's touch screen) and topics studied in that area will highlight on the Science Map: the brighter a topic glows, the more papers on that topic originated in the selected area. Conversely, touching a scientific area in the Science Map illuminates places on the Geographic Map where that topic is studied. People and topic buttons support the exploration of publication output by selected Noble laureates and particular lines of research using MEDLINE data from 2000-2009.

<http://scmmaps.org>

Cancer

Cloning

HIV

Robert G. Edwards

Roger D. Kornberg

Elinor Ostrom

Obesity

Quality of Life

Smoking

Stanley B. Prusiner

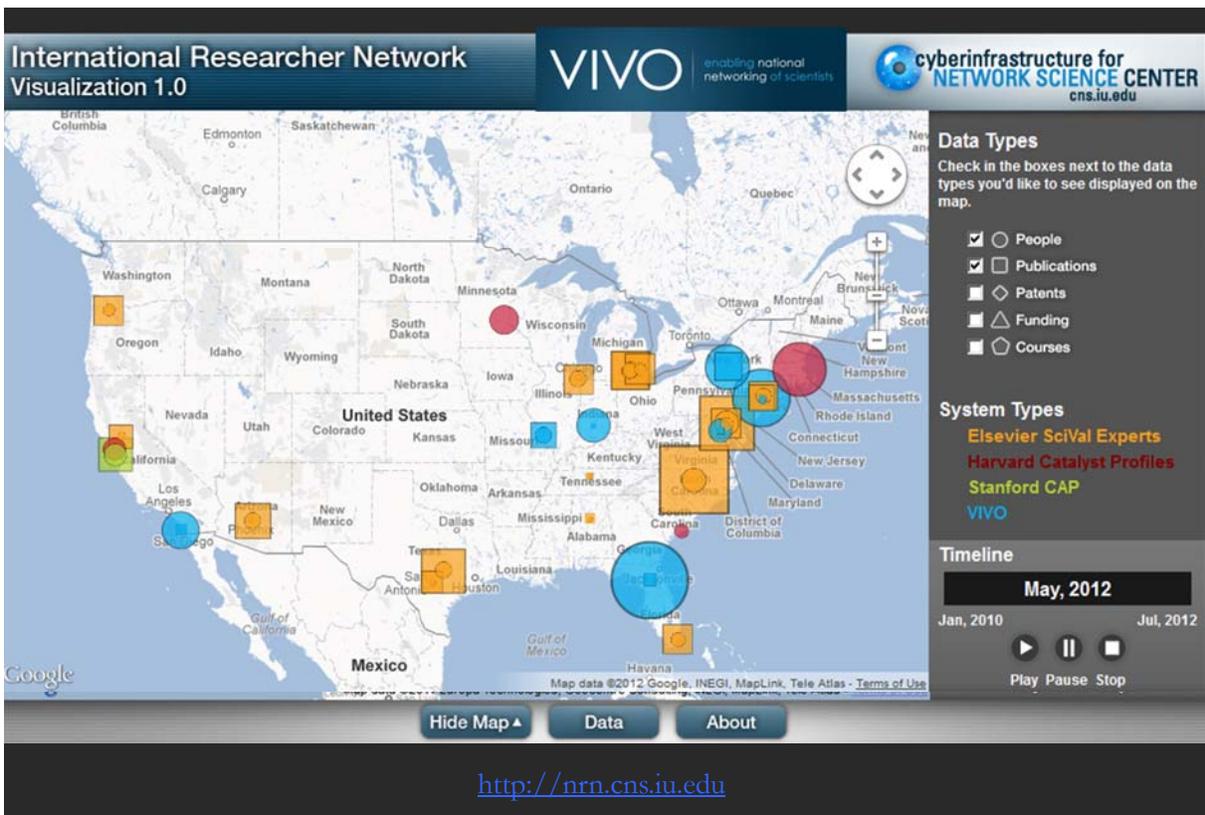
Ahmed H. Zewail

View All

Keyword Search

Multi-Level Science Maps

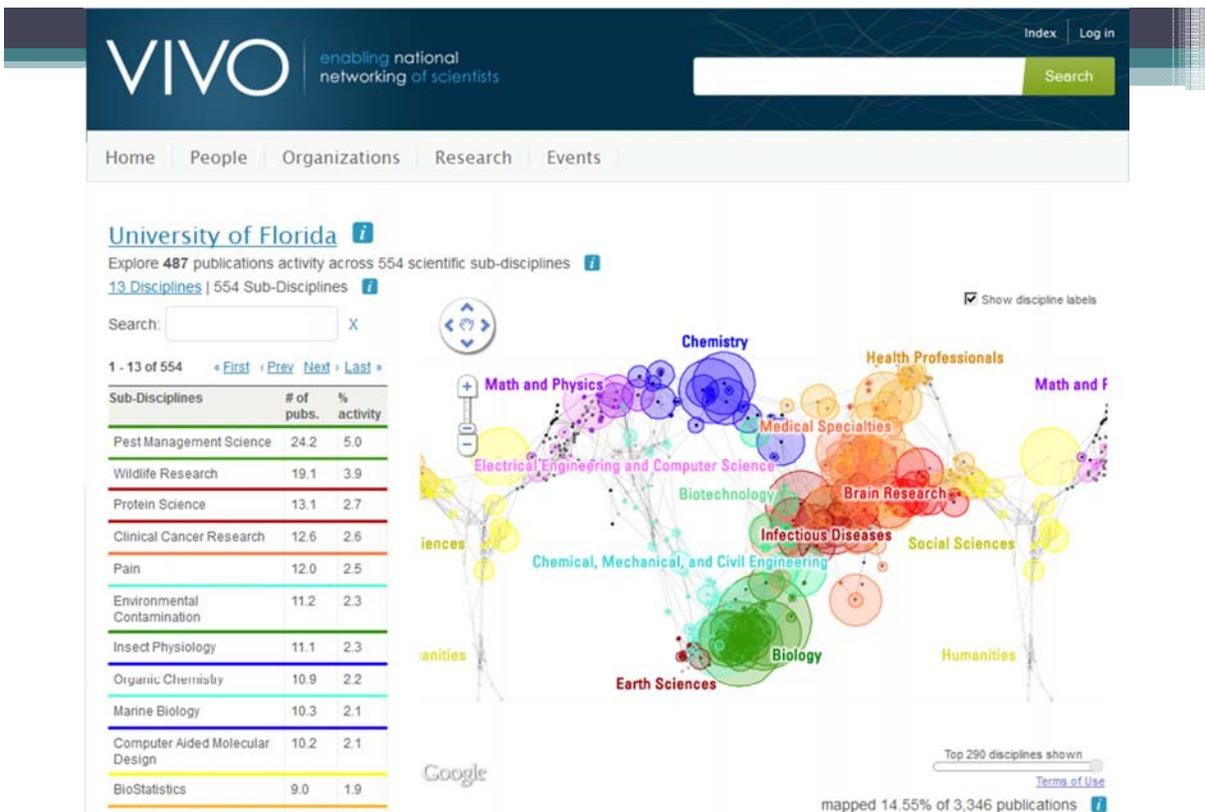
- VIVO International Researcher Network
- Sustainability Research Map
- Gene Therapy Research Map



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

Geospatial Analysis (Where) A geospatial map of the US is used to show where what science is performed by whom.

19



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

20

Geographic Map Science Map



Funding
 NIH
 NSF
 USDA

Publications
 DOE
 ISI
 Medline

Patents
 USPTO

Citations Count

Amount Count

From year 1901 to year 2009

Search by keyword

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.

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

Geographic Map Science Map



Funding Patents

NIH DOE USPTO

NSF ISI

USDA Medline

Maps Detail Data About

Datasets

The dataset covers 13,528 records on "biomass" and "biofuel" research and technology from seven different publication, patent, funding datasets for the years 1901 to 2010.

Funding

National Institutes of Health (NIH) awards retrieved from the Scholarly Database (<http://sdb.slis.indiana.edu>) at Indiana University on 11/20/2010. Search query used was biomass OR biofuel OR "bio mass" OR "bio fuel" in the 'All Text' field.

National Science Foundation (NSF) awards retrieved from the Scholarly Database (<http://sdb.slis.indiana.edu>) at Indiana University on 11/20/2010. Search query used was biomass OR biofuel OR "bio mass" OR "bio fuel" in the 'All Text' field.

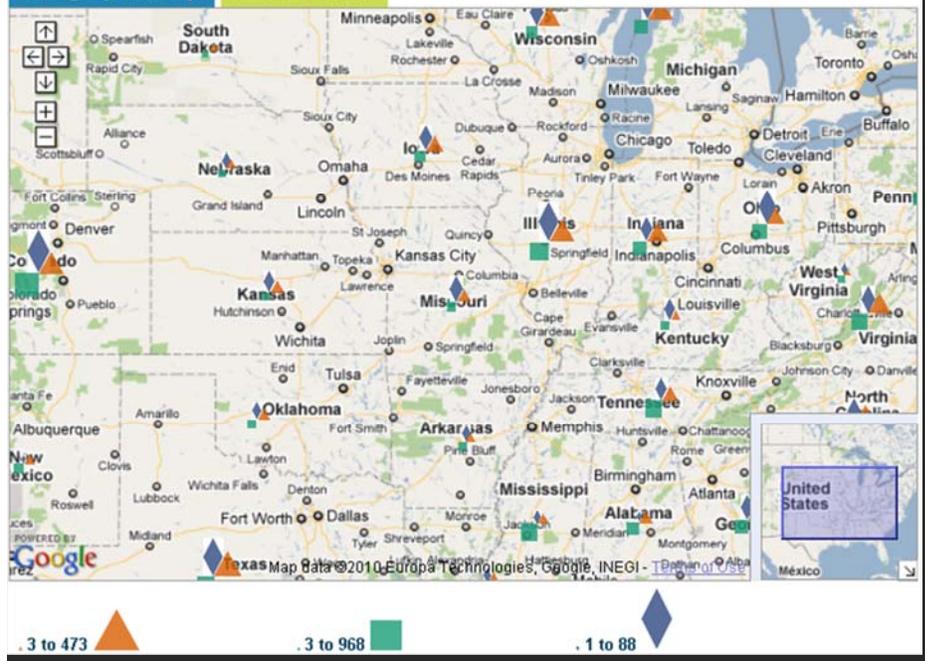
US Department of Agriculture (USDA) awards made available by a staff member of the Office of Scientific and Technical Information from the US Department of Energy (DOE).

Publications

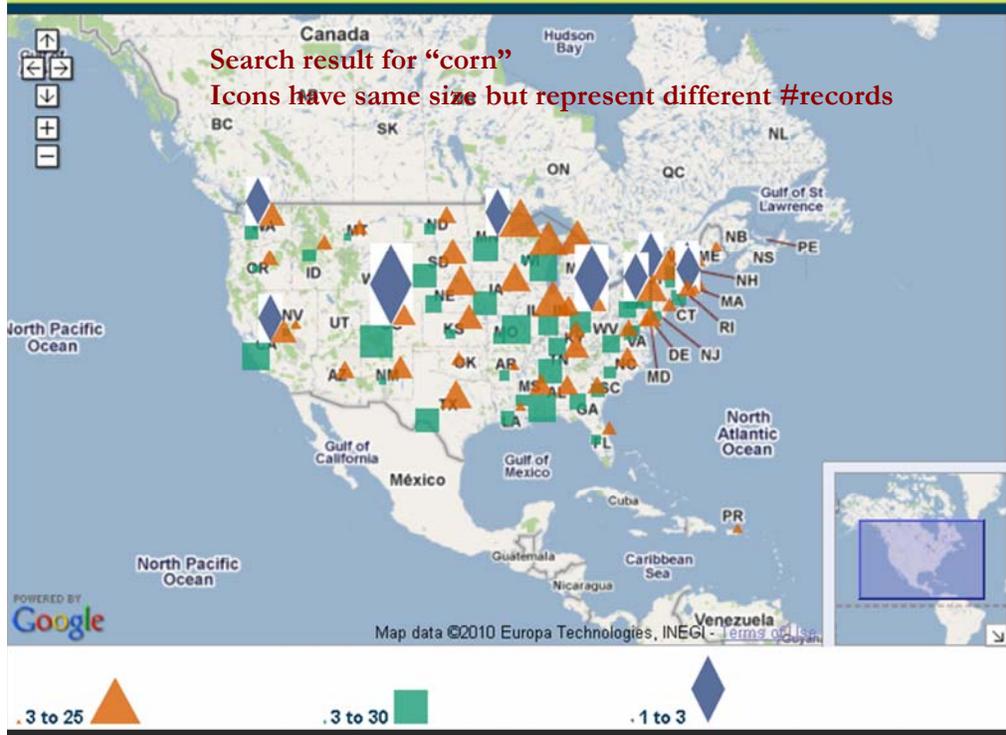
MEDLINE papers by the National Library of Medicine retrieved from the Scholarly Database (<http://sdb.slis.indiana.edu>) at Indiana University on 11/20/2010. Search query used was biomass OR biofuel OR "bio mass" OR "bio fuel" in the 'All Text' field.

The geographic map at state level.

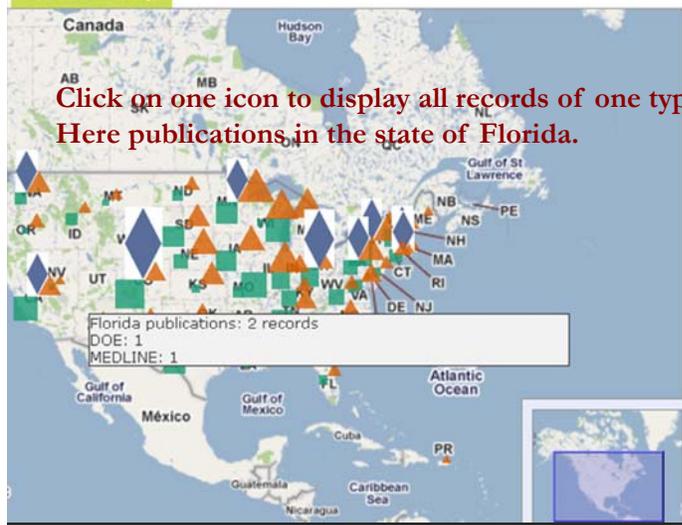
Geographic Map **Science Map**



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.

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

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

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

DOE Scientific and Technical Information

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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: BIBA

Resource Type Journal Article

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

Research Org Univ. of Florida, Gainesville

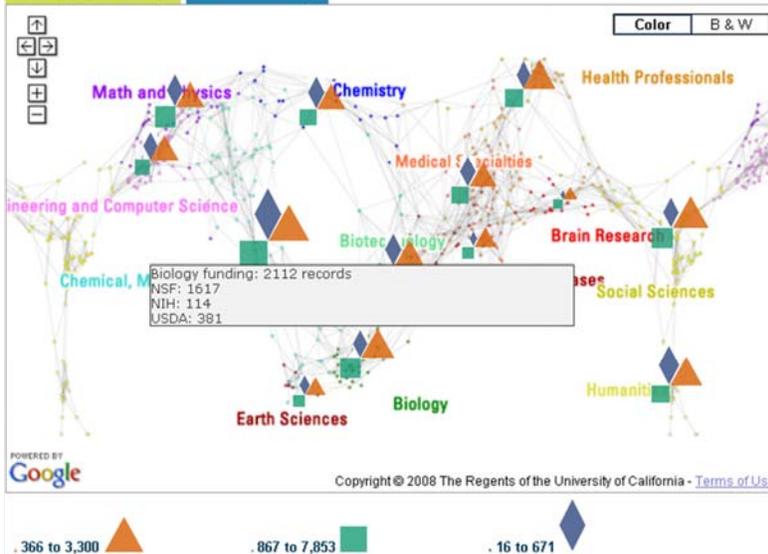
Subject 09 BIOMASS FUELS; 32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION; ETHANOL FUELS; BIOSYNTHESIS; MAIZE; ENZYMATIC HYDROLYSIS; FERMENTATION; PRODUCTIVITY; COST; ENERGY EFFICIENCY; EXPERIMENTAL DATA; WASTE PRODUCT UTILIZATION; ALCOHOL FUELS; BIOCONVERSION; CEREALES; CHEMICAL REACTIONS; DATA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

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

Done

Geographic Map

Science Map



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



Maps

Detail

Data

Ab

> Biology

NIH

2009

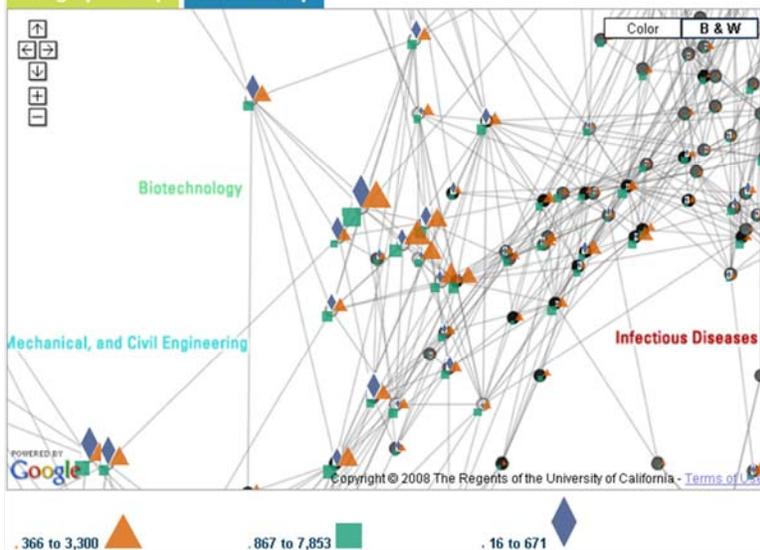
- [Label-Free And Simultaneous Detection Of Multiple Bacterial Pathogens And Virulen](#)
- [Mechanism Of Psp Mediated Adhesion](#)
- [Label-Free And Simultaneous Detection Of Multiple Bacterial Pathogens And Virulen](#)
- [Novel Mechanism Of Uranium Reduction Via Microbial Nanowires](#)
- [Nano-Scale 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](#)
- [Cookstove 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](#)
- [Cookstove Replacement For Prevention Of Ari And Low Birthweight In Nepal](#)

Geographic Map

Science Map



The science map at 554 sub-disciplines level.

Maps

Detail

Data

Abou

> Chemistry

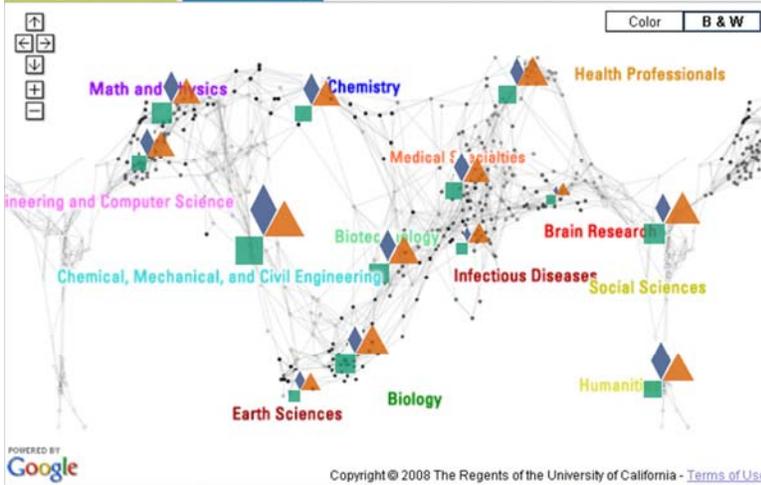
USPTO

2009

- [Automated Accelerated Extraction Of Trace Elements From Biomass](#)
- [Biomass Based Michael Addition Compositions](#)

2008

- [Thermal Tolerant Avicelase From](#)
- [Chitosan And Method Of Preparing Chitosan](#)
- [Process For Pyrolytic Heat Recovery Enhanced With Gasification Of Organic Material](#)
- [Chitosan And Method Of Preparing Chitosan](#)
- [Self-Contained Microelectrochemical Bioassay Platforms And Methods](#)
- [Highly Active Xylose Reductase From](#)
- [Process For The Solvent-Based Extraction Of Polyhydroxyalkanoates From Biomass](#)
- [Process For The Solvent-Based Extraction Of Polyhydroxyalkanoates From Biomass](#)
- [Process For The Solvent-Based Extraction Of Polyhydroxyalkanoates From Biomass](#)
- [Light Sensing Instrument With Modulated Polychromatic Source](#)
- [Method For Purifying Water](#)
- [Synthesis Of Caprolactam From Lysine](#)



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366 to 3,300

867 to 7,853

16 to 671

- | | | |
|---|--|--|
| ■ Math & Physics | ■ Biotechnology | ■ Medical Specialties |
| ■ Chemistry | ■ Earth Sciences | ■ Brain Research |
| ■ Computer Science & EE | ■ Biology | ■ Health Professionals |
| ■ Other Engineering | ■ Infectious Diseases | ■ Social Sciences |
| | ■ Humanities | |

United States Patent: 7364890 - Mozilla Firefox

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MapSustain United States Patent: 7364890 United States Patent: 7364890 Information Bridge: DOE Scientific...

USPTO PATENT FULL-TEXT AND IMAGE DATABASE

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[View Cart](#) [Add to Cart](#)
[Images](#)

(1 of 1)

United States Patent 7,364,890
 Ding, et al. April 29, 2008

Thermal tolerant avicelase from *Acidothermus cellulolyticus*

Abstract

The invention provides a thermal tolerant (thermostable) cellulase, AvIII, that is a member of the glycoside hydrolase (GH) family. AvIII was isolated and characterized from *Acidothermus cellulolyticus* and, like many cellulases, the disclosed polypeptide and/or its derivatives may be useful for the conversion of biomass into biofuels and chemicals.

Inventors: **Ding; Shi-You** (Golden, CO), **Adney; William S.** (Golden, CO), **Vinzant; Todd B.** (Golden, CO), **Himmel; Michael E.** (Littleton, CO)
 Assignee: **Midwest Research Institute** (Kansas City, MO)
 Appl. No.: 09/017,226
 Done



[About/Contact/Search](#)

Information

Gene Therapy Data Maps

Archiving Services

Insertion Site Analysis

Pharm/Tox Resources

Clinical Trial Testing

Reagent Repository

Educational Resources

My NGVB

LOG IN

user name:

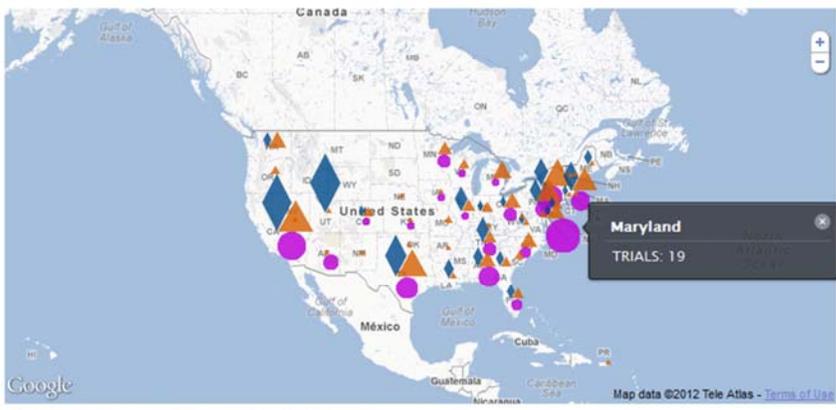
password:

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[Can't remember your password?](#)

Gene Therapy Geographic Data Map



Funding
 NH
 NSF

Publications
 Medline

Patents
 USPTO

Clinical Trials

From year: 1972 to year: 2011

Search by: cancer


2 to 468


0 to 0


0 to 28


0 to 19

[Export Data to CSV](#)

Maps Detail Data About

Geographic Visualization

This map shows provides a tool to locate site of gene therapy research in the US. The map is searchable by publication, patent application, federal grants and clinical trials. The maps also include controls to select subsets of the entire gene therapy data set. Checkboxes allow users to limit data sources by institution or by source type (i.e., funding, publications, patents, or clinical trial). Radio buttons toggle the markers between representing a count of the records or another relevant numerical representation (dollar amount for funding, citations for publications and patents). Records can also be limited by date by specifying start and end years for the query. A

<http://kongchong.siu.edu/genethrapy/geomaps.html>

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[About/Contact/Search](#)

Information

Gene Therapy Data Maps

Archiving Services

Insertion Site Analysis

Pharm/Tox Resources

Clinical Trial Testing

Reagent Repository

Educational Resources

My NGVB

LOG IN

user name:

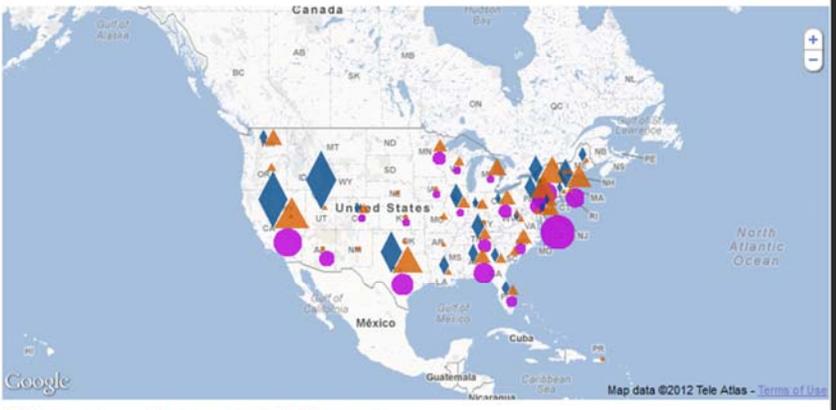
password:

Login

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Gene Therapy Geographic Data Map



Funding
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Clinical Trials

From year: 1972 to year: 2011

Search by: cancer


2 to 468


0 to 0


0 to 28


0 to 19

[Export Data to CSV](#)

Maps Detail Data About

> Maryland

TRIALS
2011

- [Phase III Study Of Metastatic Cancer That Expresses Mage-A3/12 Using Lymphodepleting Conditioning Followed By Infusion Of Anti-Mage-A3/12 Tcr-Engineered Lymphocytes](#)
- [Phase III Study Of Metastatic Cancer That Expresses Nv-Eso-1 Using Lymphodepleting Conditioning Followed By Infusion Of Gene Engineered Lymphocytes Cotransduced With Genes Encoding IL-12 And Anti-Nv-Eso-1 Tcr](#)
- [A Phase III Study Of The Safety And](#)

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[Full Text View](#)

[Tabular View](#)

[No Study Results Posted](#)

[Related Studies](#)

MAGE-A3/12 Metastatic Cancer Treatment With Anti-MAGE-A3/12 TCR-Gene Engineered Lymphocytes

This study has been suspended.

First Received on January 7, 2011. Last Updated on March 14, 2012 [History of Changes](#)

| | |
|--------------------------------|--|
| Sponsor: | National Cancer Institute (NCI) |
| Information provided by: | National Institutes of Health Clinical Center (CC) |
| ClinicalTrials.gov Identifier: | NCT01273181 |

► Purpose

Background:

- MAGE-A3/12 is a type of protein commonly found on certain types of cancer cells, particularly in metastatic cancer. Researchers have developed a process to take lymphocytes (white blood cells) from cancer patients, modify them in the laboratory to target cancer cells that contain MAGE-A3/12, and return them to the patient to help attack and kill the cancer cells. These modified white blood cells are an experimental treatment, but researchers are interested in determining their safety and effectiveness as a possible treatment for cancers that involve MAGE-A3/12.

Objectives:

- To evaluate the safety and effectiveness of anti-MAGE-A3/12 lymphocytes as a treatment for metastatic cancers that have not responded to standard treatment.

Eligibility:

- Individuals at least 18 years of age who have been diagnosed with metastatic melanoma, renal cell cancer, or another type of metastatic cancer that has not responded to standard treatment.

Design:

- Participants will be screened with a full medical history and physical examination, as well as blood and urine tests, tumor samples, and imaging studies.
- Participants will have leukapheresis to collect enough white blood cells for modification in the laboratory.
- Seven days before the start of anti-MAGE-A3/12 treatment, participants will have chemotherapy with cyclophosphamide and fludarabine to suppress the immune system in preparation for the treatment.

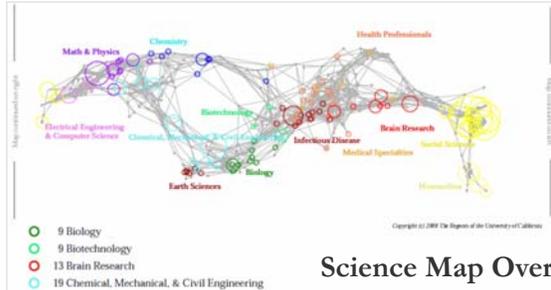
Science of Science (Sci2) Tool

- Use your own data
- Run your own analysis
- Identify overlap, gaps and emerging areas
- Interpret results to improve decision making

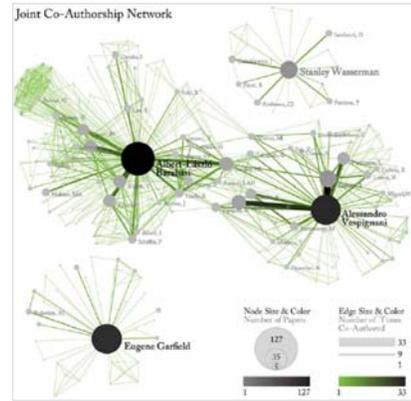


Science of Science (Sci²) Tool – Open Code for S&T Assessment

OSGi/CIShell powered tool with NWB plugins and many new scientometrics and visualizations plugins.



Science Map Overlays



Network Visualizations



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

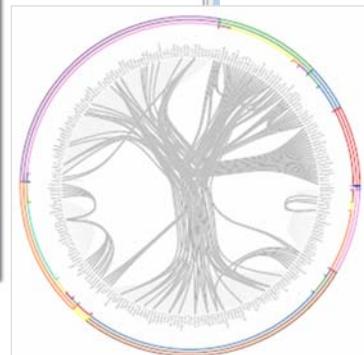
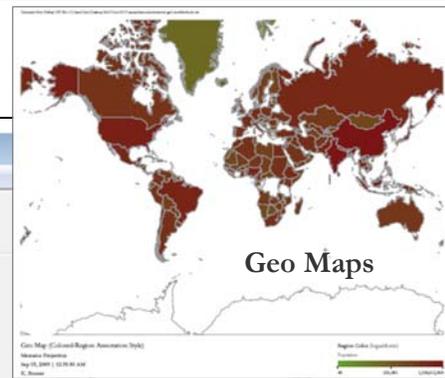


Sci² Tool cont.

Visualization Menu:

- GUESS
- GnuPlot
- Radial Tree/Graph (prefuse alpha)
- Radial Tree/Graph with Annotation (prefuse beta)
- Tree View (prefuse beta)
- Tree Map (prefuse beta)
- Force Directed with Annotation (prefuse beta)
- Fruchterman-Reingold with Annotation (prefuse beta)
- DrL (VxOrd)
- Specified (prefuse beta)
- Horizontal Line Graph
- Circular Hierarchy
- Geo Map (circle annotations)
- Geo Map (region coloring annotations)
- Image Viewer
- RefMapper

| ! | Algorithm Name | Date | Time | % Con |
|---|---------------------------|------------|-------------|-------|
| ✓ | Extract Co-Author Netw... | 09/03/2009 | 00:15:20 AM | 100% |
| ✓ | Load and Clean ISI File | 09/03/2009 | 00:15:05 AM | 100% |





Sci² Tool – 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 < records)</i> |
|---------------------------------------|--|---|---|
| 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 PNAS | 113 Years of Physics Research |
| Geospatial Analysis (Where) | Career trajectory of one individual | Mapping a states intellectual landscape | PNAS 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 |

39



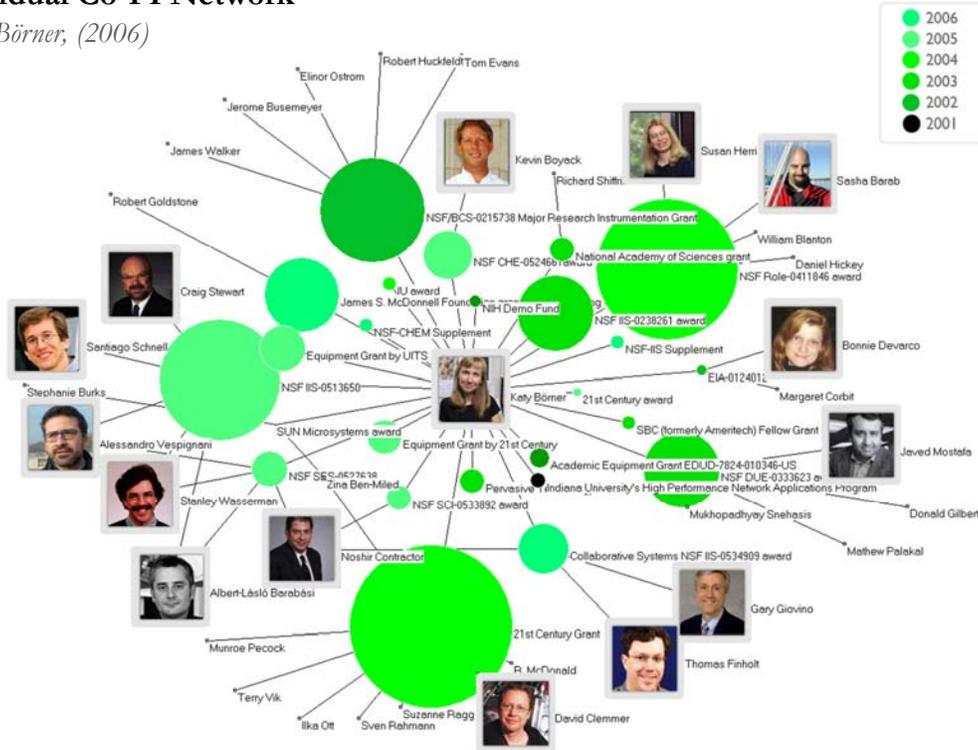
Sci² Tool – Type of Analysis vs. Level of Analysis

| | <i>Micro/Individual (1-100 records)</i> | <i>Meso/Local (101–10,000 records)</i> | <i>Macro/Global (10,000 < records)</i> |
|---------------------------------------|--|---|---|
| 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 PNAS | 113 Years of Physics Research |
| Geospatial Analysis (Where) | Career trajectory of one individual | Mapping a states intellectual landscape | PNAS publications |
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| Network Analysis (With Whom?) | NSF Co-PI network of one individual | Co-author network | NIH's core competency |

40

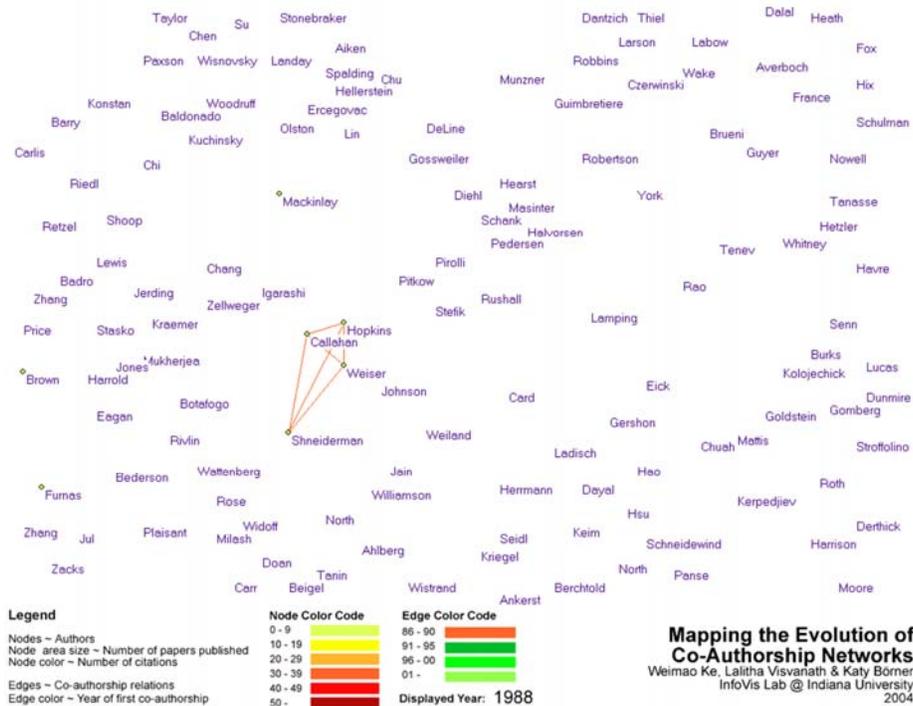
Individual Co-PI Network

Ke & Börner, (2006)



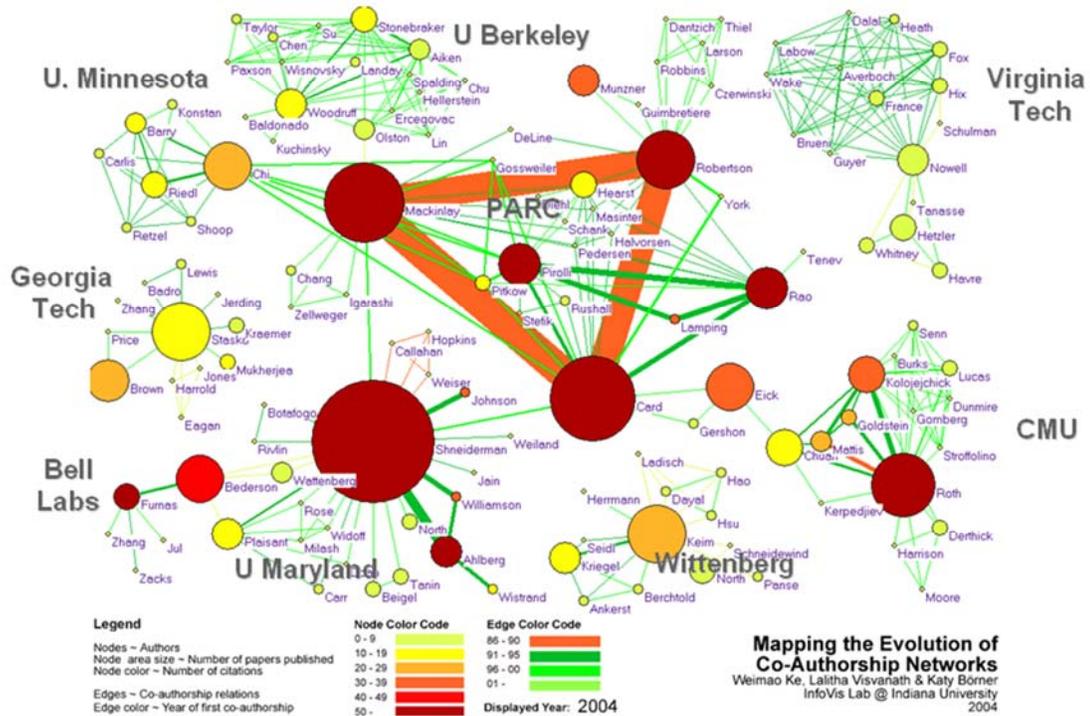
Mapping the Evolution of Co-Authorship Networks

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



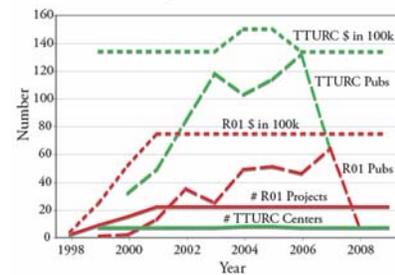
Mapping Transdisciplinary Tobacco Use Research Centers Publications

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

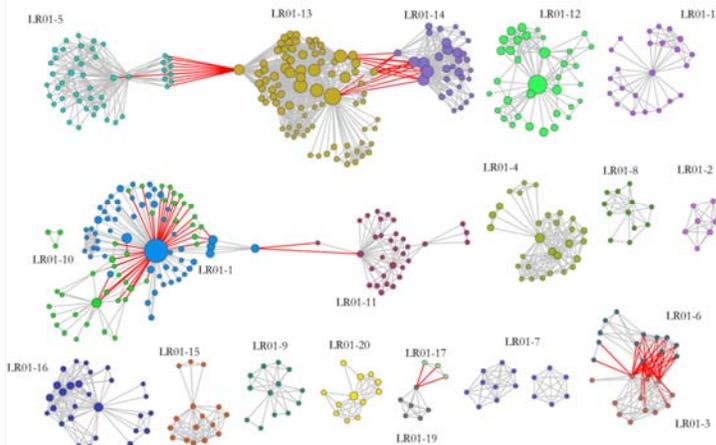
Zoss & Börner, forthcoming.

Supported by NIH/NCI Contract HHSN261200800812

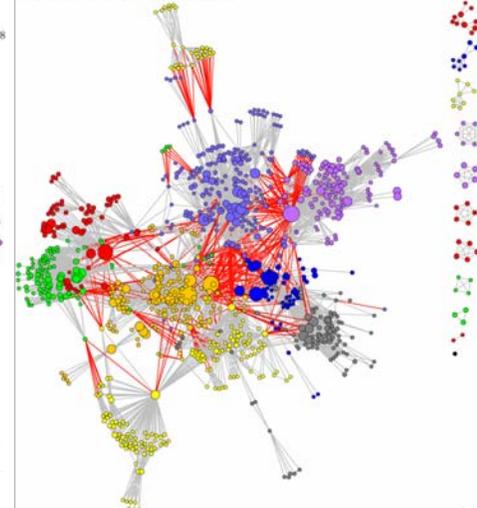
R01 & TTURC Project Information



Longitudinal R01 Co-Authorship Network

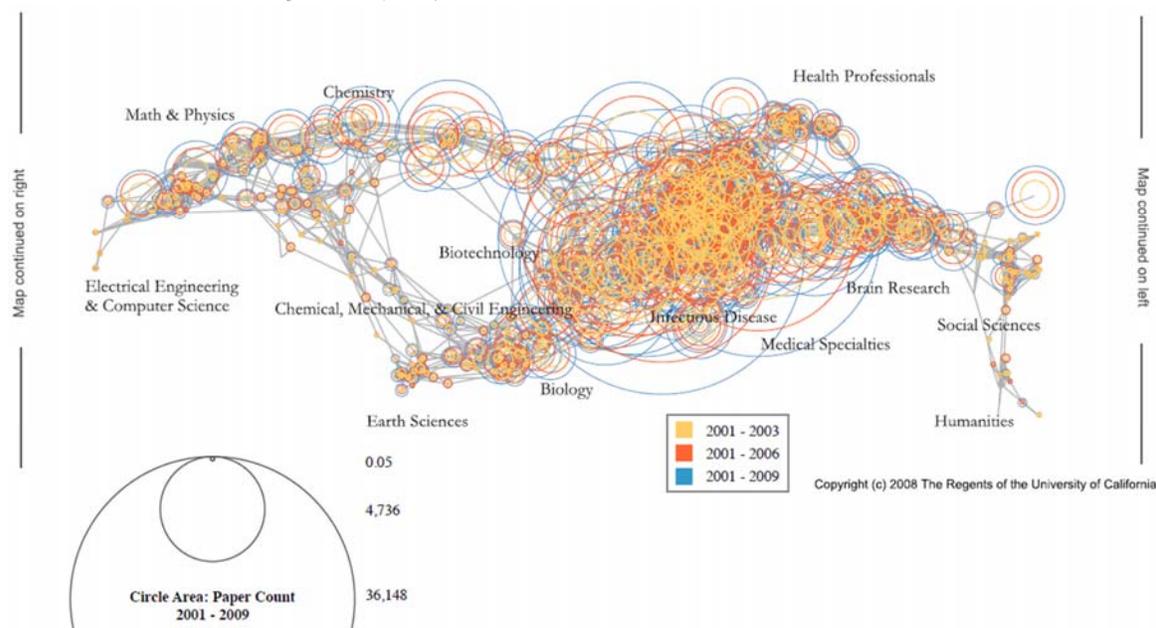


TTURC Co-Authorship Network



MEDLINE Publication Output by The National Institutes of Health (NIH) Using Nine Years of ExPORTER Data

Katy Börner, Nianli Ma, Joseph R. Biberstine, Cyberinfrastructure for Network Science Center, SLIS, Indiana University, Robin M. Wagner, Rediet Berhane, Hong Jiang, Susan E. Ivey, Katrina Pearson and Carl McCabe, Reporting Branch, Division of Information Services, Office of Research Information Systems, Office of Extramural Research, Office of the Director, National Institutes of Health (NIH), Bethesda, MD.

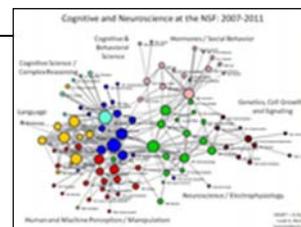


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Sci² Tool Usage at National Science Foundation

Topic co-occurrence network of the 2885 cognitive and neuroscience NSF projects funded between 2007 and 2011. Statistical text mining (Topic model) was used to identify topics from NSF awards and proposals from 2000-2011.



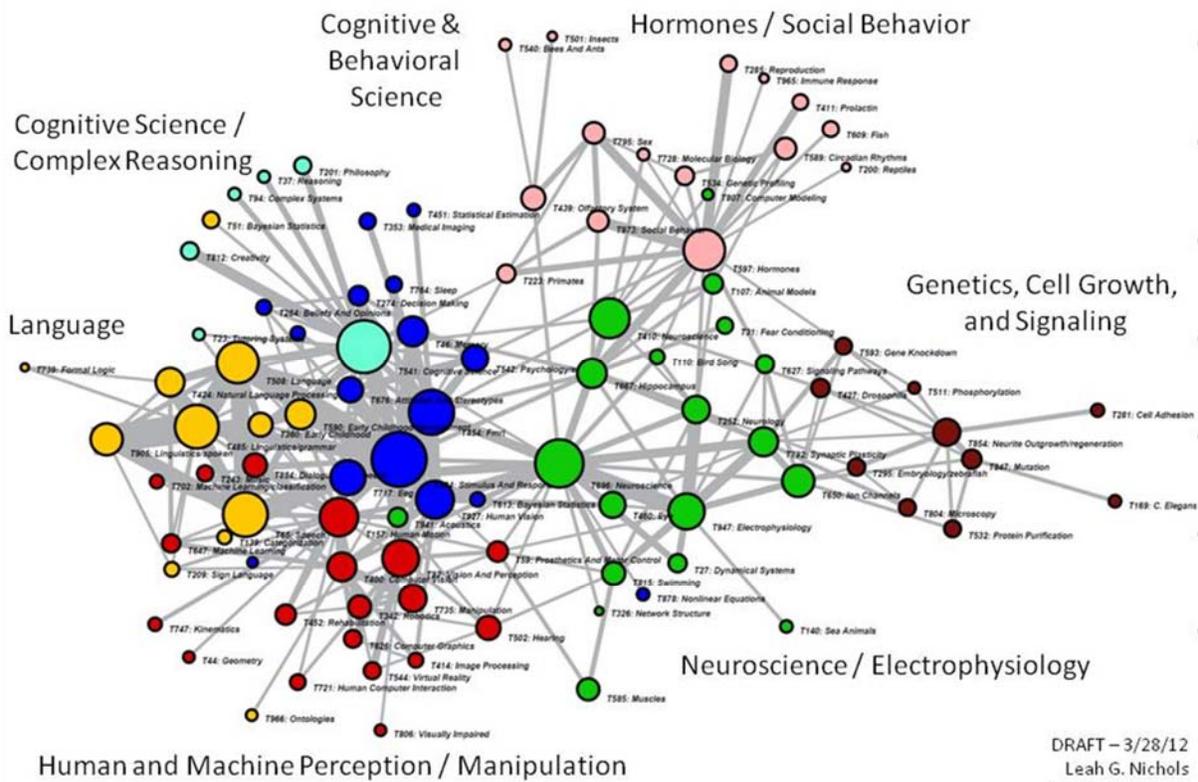
Each award is tagged with up to 4 topics. Lines represent the co-occurrence of the connected topics within an award(s). The nodes are scaled by number of awards (max = 355) and the lines are scaled on number of co-occurrences (max = 91). The node colors differentiate the nodes via the level-0 Blondel communities.

This is ... an **entirely new way of characterizing and understanding the NSF portfolio**. This is in part because this enables **analysis of the content of the awards/proposals independent of the institutional structure**. One can quickly identify ALL of the Cog/Neuro awards throughout the entire NSF portfolio – so it captures research in all of the unexpected institutional places. This method also allows one to **easily identify areas of parallel or potentially collaborative research being funded by different institutional structures** and ... to identify potential areas for advancing science by facilitating collaborations.

Leah G. Nichols, NSF

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Cognitive and Neuroscience at the NSF: 2007-2011



DRAFT - 3/28/12
Leah G. Nichols
lenichol@nsf.gov



Sci2 Tool Usage at National Institutes of Health

Sci2 Tool now supports Web services and serves as a visual interface to publicly available NIH RePORT Expenditure and Results (RePORTER)/ RePORTER data provided by NIH.

NETE[®] AV
ANALYZER | VISUALIZER

TEMPORAL ANALYSIS GEOSPATIAL ANALYSIS TOPICAL ANALYSIS NETWORK ANALYSIS

“Where”¹³
GEOSPATIAL ANALYSIS

“When” questions are commonly addressed via temporal analyses
 “Where” questions often involve the application of geospatial methods
 “What” questions require topical analyses
 “With whom” questions are often answered via network studies

W H E N
 W H E R E
 W H A T
 W H O M



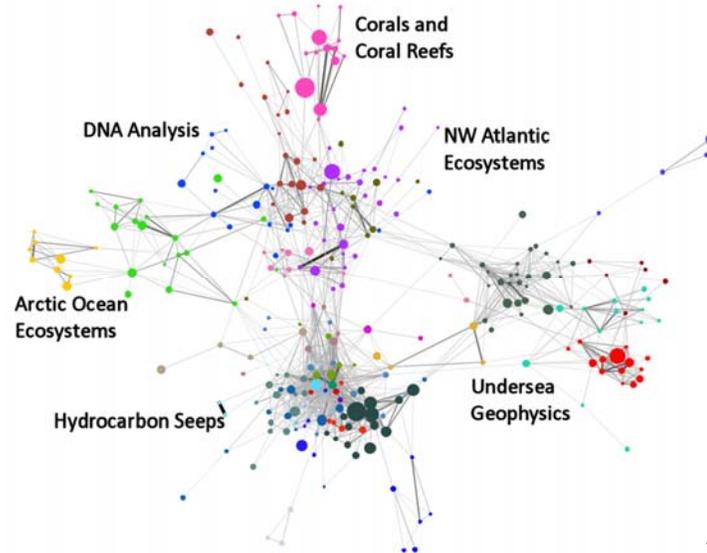
Sci² Tool Usage at the National Oceanic and Atmospheric Administration (NOAA)

Co-author network generated from publications supported by NOAA's Office of Ocean Exploration and Research (OER). Nodes are sized based on the number of publications produced and colored to highlight clustering. Edges are sized and colored based on the number of collaborations between authors.

For details, see "Visualizing Networks of Scientific Research"

by Chris Belter

<http://www.infotoday.com/online/may12/Belter-Visualizing-Networks-of-Scientific-Research.shtml>



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Sci² Tool Usage at James S. McDonnell Foundation

How did cognitive neuroscience of attention emerge from neurobiology and psychology, 1980–2005? Author co-citation analysis and Pfnets is used to **trace prospectively the development of the field from its precursor disciplines:** cognitive psychology, single cell neurophysiology, neuropsychology, and evoked potential research.

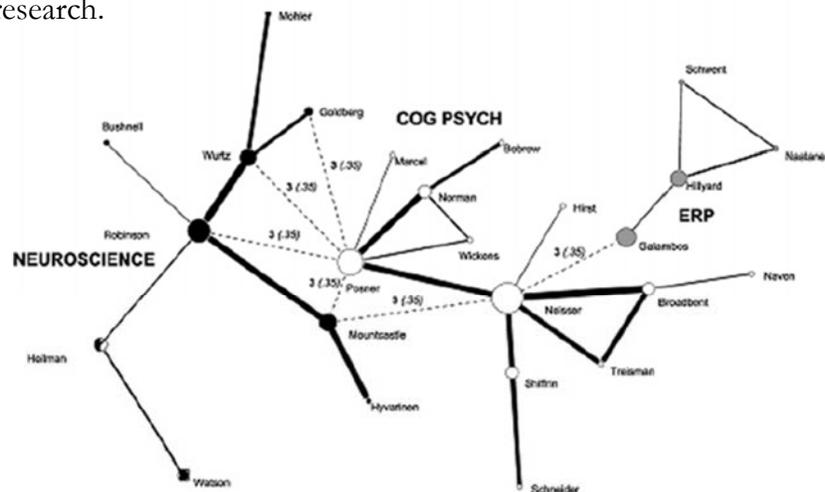


Fig. 1 In the 1980 net, neuroscience (black nodes and black–white nodes) and cognitive psychology (white nodes) develop as clusters with high internal co-citation rates. ERP (grey nodes) develops later in net construction. These clusters are connected by secondary edges at very low levels of co-citation

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By 1990 a distinct cognitive neuroscience specialty cluster emerges, dominated by authors engaged in brain imaging research.

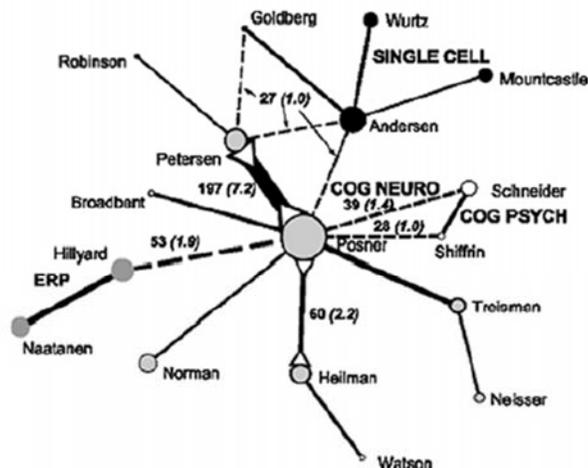


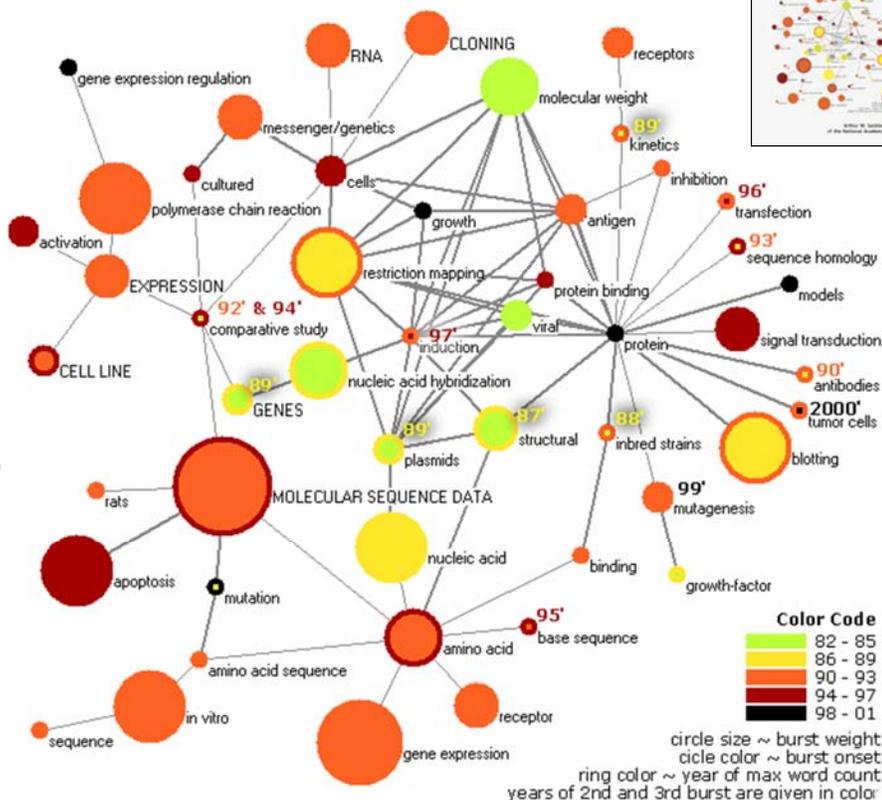
Fig. 5 The strongest link in the 1995 net is a primary edge linking Posner and Petersen. ERP and single cell neurophysiology are linked to cognitive neuroscience cluster by secondary edges

Bruer, John T. (2010). *Can we talk? How the cognitive neuroscience of attention emerged from neurobiology and psychology, 1980.2005*. *Scientometrics*, 83(3), 751-764. <http://inl.cns.iu.edu/km/tools/2010-bruer-scientometrics.pdf>

Mapping Topic Bursts

Co-word space of the top 50 highly frequent and bursty words used in the top 10% most highly cited PNAS publications in 1982-2001.

Mane & Börner. (2004) *PNAS*, 101(Suppl. 1): 5287-5290.



Mixed-Indicators Model for Identifying Emerging Research Areas

Guo, Hanning, Scott B. Weingart, and Katy Börner. 2011. *Scientometrics* 89 (1): 421-435.

Three indicators are combined:

- sudden increases in the frequency of specific words,
- number and speed by which new authors are attracted to an emerging area,
- changes in the interdisciplinarity of cited references.

The model is validated using four emerging research areas and two datasets:

“RNAi”, “Nano”, “h-Index”, and “Impact Factor” research using papers published in the *PNAS* (1982–2009) and *Scientometrics* (1978–2009).

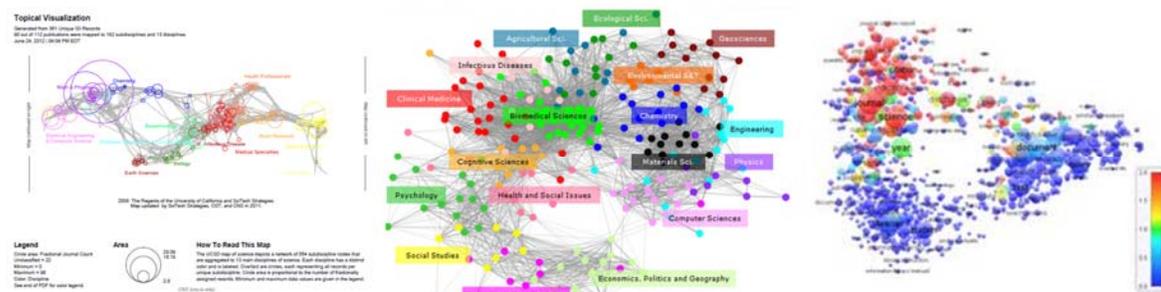
Results:

- Keyword bursts occurred 8 years later for “Nano*,” 7 years later for “RNAi” and only 1 year later for “h-Index.” (*different from full text words*)
- Appearance of new authors always signifies the beginning of an emerging area.
- In “Nano*,” “RNAi” and “h-Index” datasets, a sudden increase in the diversity of cited references occurred with the appearance of new authors simultaneously. The correlation between increasing new authors and diversity of cited references suggests that new authors are coming from diverse established areas rather than some already nascent cohort with a pre-existing body of research.

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Aligning Science Basemaps using the Sci2 Tool



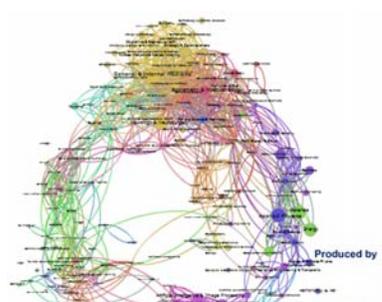
UCSD Map

Loet et al science maps ISI categories

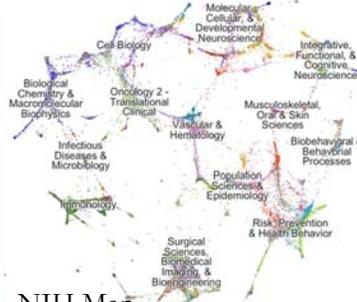
<http://vosviewer.com>



Elsevier's SciVal Map



Science-Metrix.com



NIH Map

<https://app.nihmaps.org>

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References

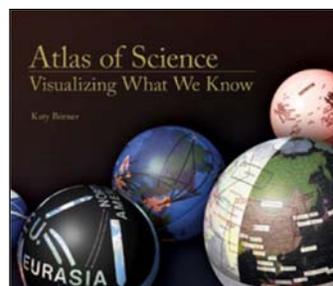
Börner, Katy, Chen, Chaomei, and Boyack, Kevin. (2003). **Visualizing Knowledge Domains**. In Blaise Cronin (Ed.), *ARIST*, Medford, NJ: Information Today, Volume 37, Chapter 5, pp. 179-255.
<http://ivl.slis.indiana.edu/km/pub/2003-borner-arist.pdf>

Shiffrin, Richard M. and Börner, Katy (Eds.) (2004). **Mapping Knowledge Domains**. *Proceedings of the National Academy of Sciences of the United States of America*, 101(Suppl_1).
http://www.pnas.org/content/vol101/suppl_1/

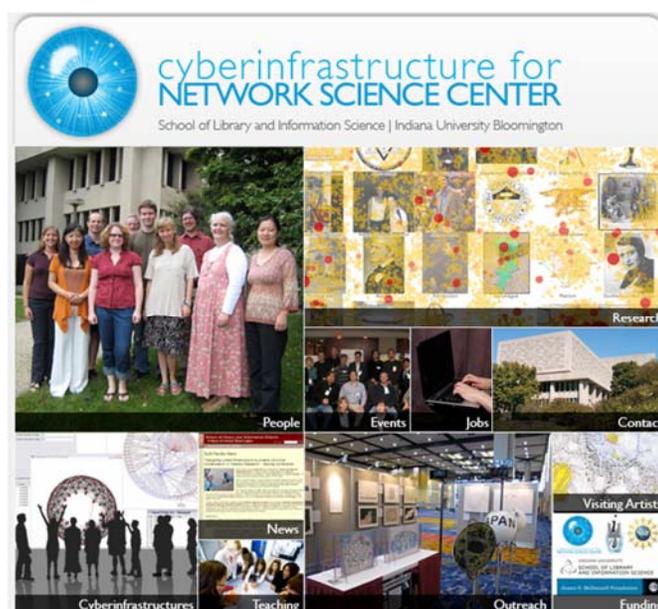
Börner, Katy, Sanyal, Soma and Vespignani, Alessandro (2007). **Network Science**. In Blaise Cronin (Ed.), *ARIST*, Information Today, Inc., Volume 41, Chapter 12, pp. 537-607.
<http://ivl.slis.indiana.edu/km/pub/2007-borner-arist.pdf>

Börner, Katy (2010) **Atlas of Science**. MIT Press.
<http://scimaps.org/atlas>

Scharnhorst, Andrea, Börner, Katy, van den Besselaar, Peter (2012) **Models of Science Dynamics**. Springer Verlag.



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All papers, maps, tools, talks, press are linked from <http://cns.iu.edu>

CNS Facebook: <http://www.facebook.com/cnscenter>

Mapping Science Exhibit Facebook: <http://www.facebook.com/mappingscience>

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