



Genome Canada ABC
Integration Workshop

Introduce your research partner

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Kari Doerksen

Elizabeth Edwards

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Richard Gold

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Nolan Kane

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Terry McIntyre

Alex Mogyoros

Anwar Naseem

Mark Perry

Peter Phillips

Jeremy Rayner

Gordon Rowland

Cami Ryan

Brad Saville

Stuart Smyth

Adrian Tsang

Hank Venema

Gerrit Voordouw

Gregor Wolbring

Purpose of the workshop

- ❖ Bring the ABC community together for the first time
- ❖ Share cross-project information
- ❖ Identify opportunities for, and barriers to, ABC genomics research
- ❖ Share best practices regarding GE3LS integration
- ❖ Structure relationship between VALGEN and S&T projects



Value Addition Through Genomics and GE³LS

Dr. David Castle
Faculty of Arts and Faculty of Law
University of Ottawa

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Johnson-Shoyama Graduate School of Public Policy
University of Saskatchewan

What is VALGEN?

- ❖ VALGEN stands for *Value Addition to Genomics and GE³LS*
- ❖ VALGEN is a \$CDN 5.4 M, 4 year project
- ❖ Funding from Genome Canada
- ❖ Administered through Genome Prairie

What is the Origin of VALGEN?

- ❖ Genome Canada Position Paper Process (2007)
 - ❖ *Life Sciences Innovation in Canada: New Metrics, Methods and Models for Success in Innovation*
- ❖ Genome Canada Position Paper Process (2008)
 - ❖ *Models, Methods and Metrics for Governance of Genomics Innovation in Canada*
- ❖ Genome Canada Competition in Applied Genomics in Bioproducts and Crops (ABC) (2008-2009)

How did the ABC Competition Develop?

60
Letters
of Intent

11
Position
Papers

2
Successful
Position
Papers

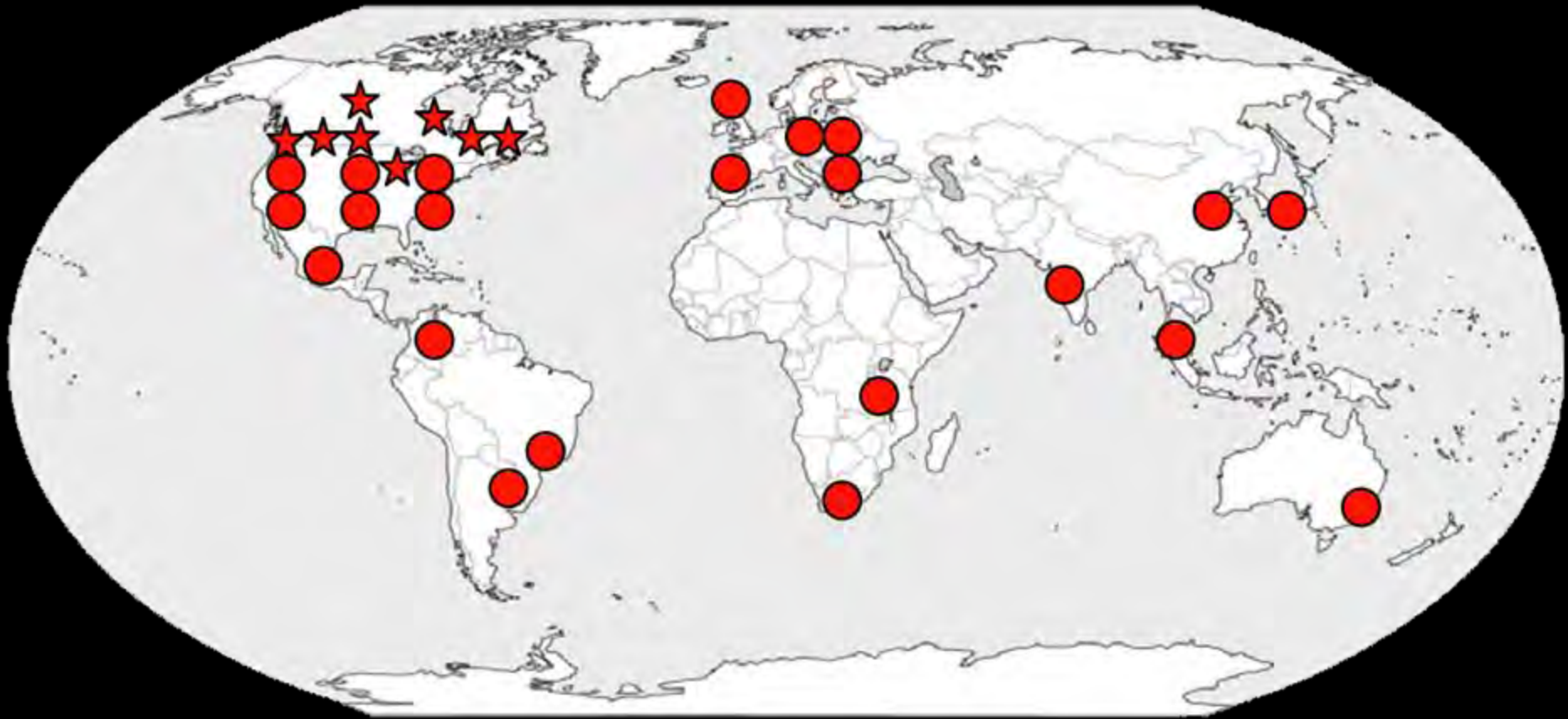
How did the ABC Competition Proceed?

58
Letters
of Intent

VALGEN
27
Full
10
VALGEN
Linkages

12
Successful
Projects

Where are VALGEN Researchers?



- ★ Canadian co-applicants and collaborators
- International collaborators

What is the Vision of VALGEN?

"...to understand and respond to the deep governance challenges and opportunities of applied genomics for bioproducts and crops by focusing on the core issues of

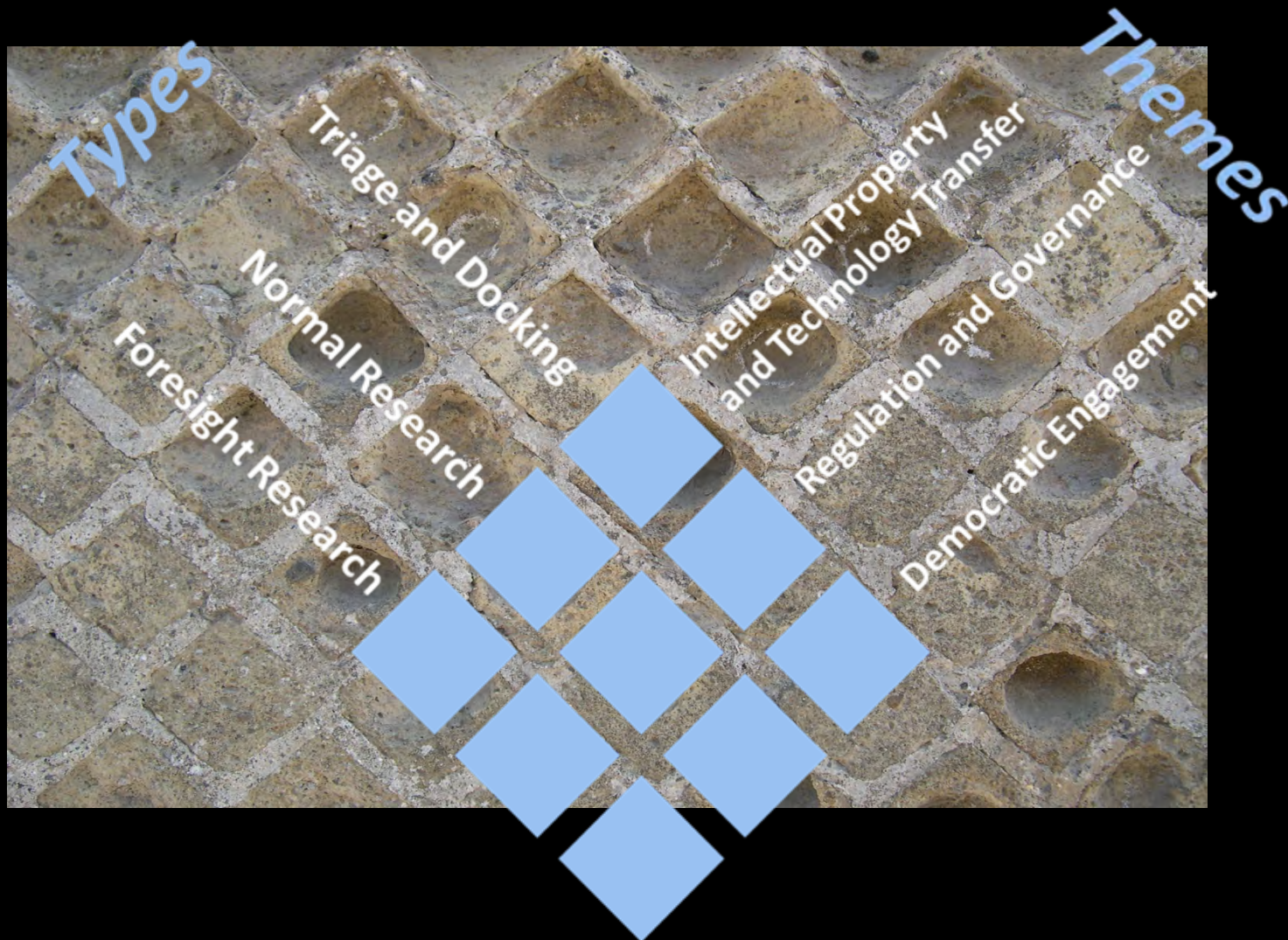
- ❖ intellectual property management
- ❖ regulation and governance
- ❖ democratic engagement

to add value to the genomics science and integrated GE³LS projects."

What are the VALGEN Goals?

- ❖ Remove roadblocks to innovation in Canada's bio-based economy
- ❖ GE³LSCapacity building:
 - ❖ New scholars / practitioners
 - ❖ New domestic and international networks
- ❖ Develop:
 - ❖ New models for IP protection and technology transfer
 - ❖ Faster and more predictable regulatory review processes
 - ❖ Embed public consultation in policy-making and risk assessment frameworks
- ❖ Bridge the science and society gap

How is VALGEN a Research Network?



How Are Research Types Defined?

❖ Priority Setting and Triage

- ❖ selection and prioritization of cases
- ❖ gaps, overlaps, iterative and transformative

❖ Normal research

- ❖ Kuhnian puzzle-solving
- ❖ Models, methods, metrics

❖ Foresight research

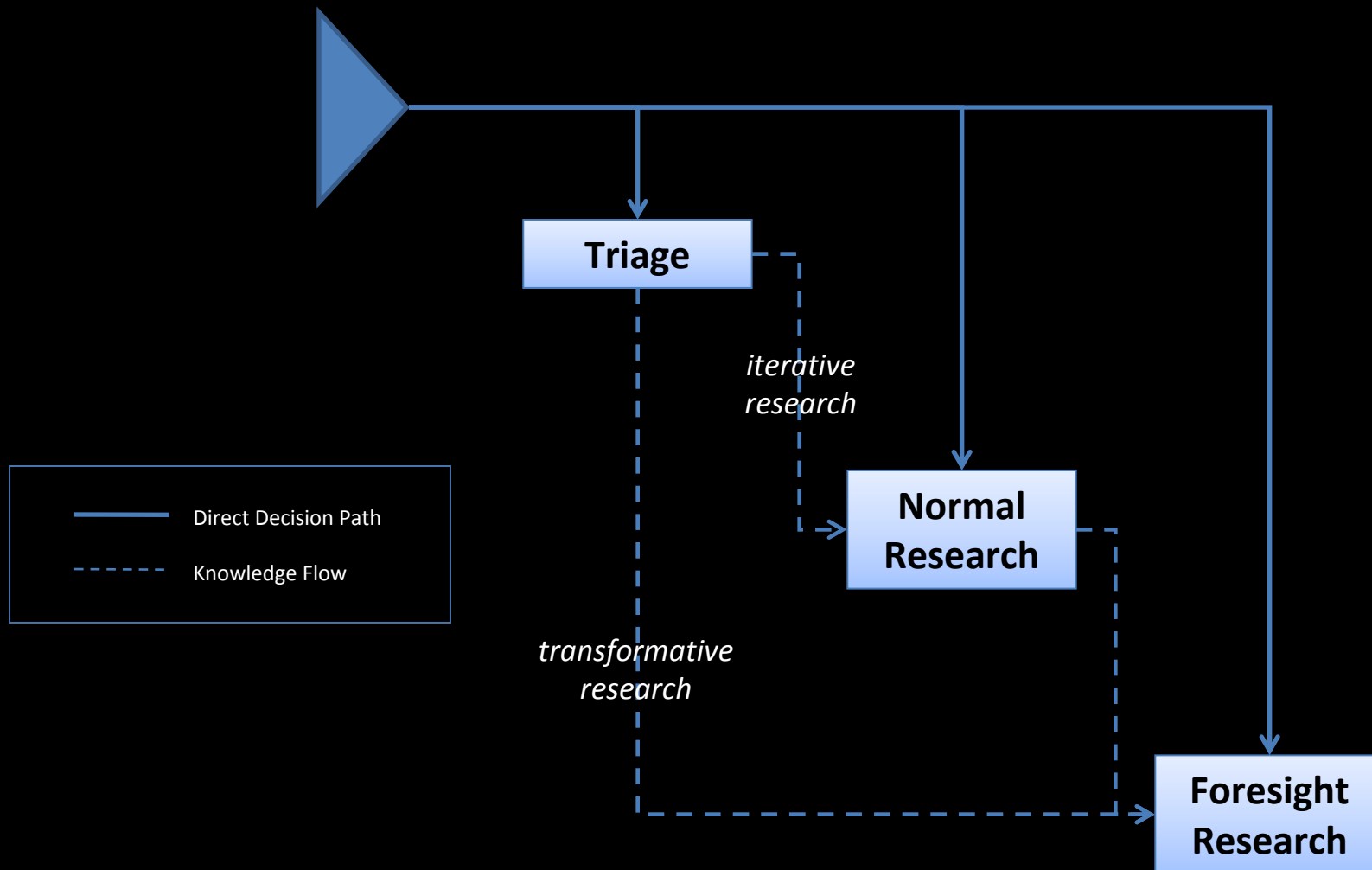
- ❖ Desirable futures to shape
- ❖ Back-cast to present circumstances

		Theory	
		<i>Known</i>	<i>Unknown</i>
Evidence	<i>Known</i>	Triage	Normal Research
	<i>Unknown</i>	Normal Research	Foresight Research

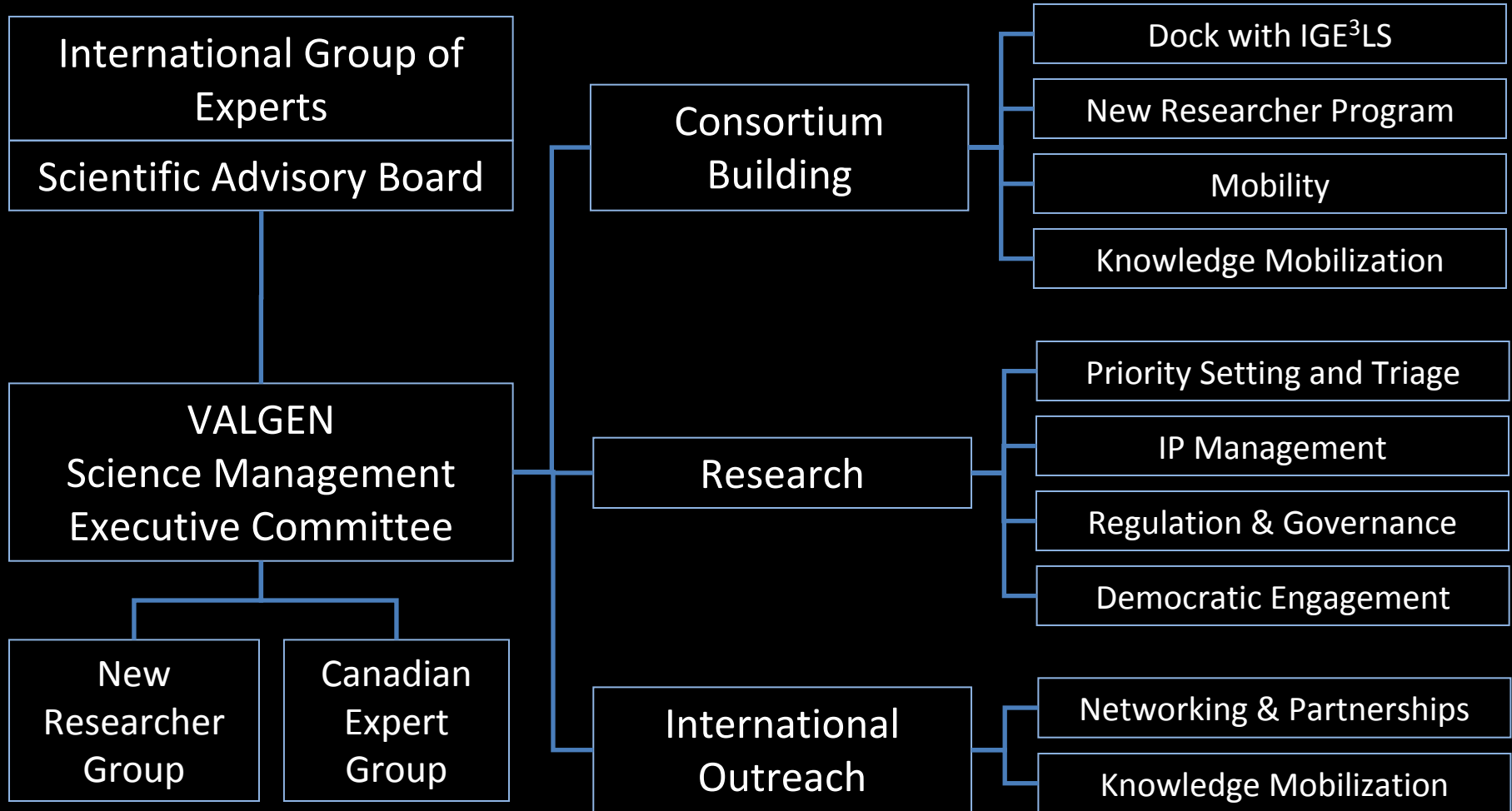
How are Research Themes Defined?

- ❖ Intellectual property management & technology transfer
 - ❖ patents, copyright and trade secrets in combination with public policy, industrial structure and business strategy
 - ❖ effect on commercialization and use of new technologies
- ❖ Regulation and governance
 - ❖ increasingly complex and intertwined domestic and international systems
 - ❖ identification of regulatory bottlenecks and blind spots.
- ❖ Democratic engagement
 - ❖ methods for engaging the public
 - ❖ uses of the outcomes of democratic engagement

How do VALGEN's Activities Flow?



What is VALGEN's Structure?



Who Manages and Advises VALGEN?

SMEC

- ❖ David Castle
- ❖ Keith Culver
- ❖ Kari Doerksen (PM)
- ❖ Edna Einsiedel
- ❖ Richard Gold
- ❖ Peter Phillips
- ❖ Jeremy Rayner
- ❖ Stuart Smyth
- ❖ James Tansey

SAB

- ❖ Jose Falck-Zepeda
- ❖ Julian Kinderlerer
- ❖ Robert Paarlberg (C)
- ❖ Reno Pontarollo (*EO*)
- ❖ Eric Sachs

How does VALGEN Add Value?

- ❖ National network for ABC-focused GE³LS
- ❖ Synergy building and gap / overlap identification
- ❖ International branding
- ❖ Source of integration models and strategy
- ❖ Spanning disciplines, institutions, existing networks
- ❖ New Researcher Group (NRG)
- ❖ Researcher mobility
- ❖ Coordination of partnerships
- ❖ Social networking; information clearing house
- ❖ *Ad hoc* national and international peer groups
- ❖ Enhanced knowledge mobilisation
- ❖ Increased return on ABC investments
- ❖ ...



ROUNDTABLE
Science and Integrated GE3LS
Projects Overview

Project Title: Bridging Comparative, Population and Functional Genomics to Identify and Experimentally Validate Novel Regulatory Regions and Genes for Crop Improvement (VEGI)

Project Lead: Thomas Bureau

Value: \$4.66 M

Genome Centre: Genome Quebec

GE³LS Title: The Integration of Genomics with Plant Breeding

GE³LS Lead: Anwar Naseem

Project Title: Genozymes for Bioproducts and Bioprocesses Development

Project Lead: Adrian Tsang

Value: \$17.42 M

Genome Centre: Genome Quebec

GE³LS Title: A Methodological Approach to Environmental Impacts and Public Engagement

GE³LS Lead: David Secko

Project Title: BEEM: Bioproducts and Enzymes from Environmental Metagenomes

Leads: Elizabeth Edwards and David Major

Value: \$10.99 M

Genome Centre: Ontario Genomics Institute

GE³LS Title: Framing New Bio-technologies to Aid Regulatory Decision-Making

GE³LS Lead: Douglas Reeve

Project Title: Genomics in Agricultural Pest Management (GAP-M)

Project Lead: Miodrag Grbic

Value: \$6.39 M

Genome Centre: Ontario Genomics Institute

GE³LS Project: An Analysis of the Canadian Regulatory Landscape as it Pertains to Biotechnology Research

GE³LS Lead: Mark Perry

Project Title: Microbial Genomics for Biofuels and Co-products from Biorefining Processes

Project Leads: David Levin & Richard Sparling

Value: \$10.57 M

Genome Centre: Genome Prairie

GE³LS Title: The Social and Economic Costs of Large-Scale Biofuel Production

GE³LS Lead: Stuart Smyth

Project Title:	Total Utilization Flax GENomics (TUFGEN)
Project Leads:	Gordon Rowland and Sylvie Cloutier
Value:	\$11.79 M
Genome Centre:	Genome Prairie

GE ³ LS Project:	Assessing the Impact of Canadian Regulations Regarding Plants with Novel Traits (PNTs).
GE ³ LS Leads:	Stuart Smyth

Project Title: Synthetic Biosystems for the Production of High-Value Plant Metabolites

Project Leads: Peter Facchini and Vincent Martin

Value: \$13.60 M

Genome Centre: Genome Alberta

GE³LS Title: The Socio-Economic Impacts of Synthetic Biology

GE³LS Lead: Edna Einsiedel

Project Title: Metagenomics for Greener Production and Extraction of Hydrocarbon Energy

Project Lead: Gerrit Voordouw

Value: \$11.26 M

Genome Centre: Genome Alberta

GE³LS Title: Understanding Issues Related to Metagenomics

GE³LS Lead: Gregor Wolbring

Project Title:	Grape and Wine Genomics
Leads:	Steven Lund & Hennie van Vuuren
Value:	\$3.44 M
Genome Centre:	Genome BC

GE ³ LS Title:	Understanding the Impact of Barriers to Innovation and Producer/Consumer Attitudes on Genomic Technological Innovation in the Canadian Wine Industry
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GE ³ LS Lead:	Michael Howlett and David Laycock
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Project Title: Genomics of Sunflower

Project Lead: Loren Rieseberg

Value: \$10.48 M

Centre: Genome BC

GE³LS Title: Intellectual Property and Regulatory Issues
for Genetically Modified Plants.

GE³LS Lead: Emily Marden

Project Title: Genomics-Enhanced Forecasting Tools to Secure Canada`s Near-Term Lignocellulosic Feedstock Supply for Bioenergy using the Mountain Pine Beetle-Pinus spp. System

Project Leads: Jorg Bohlmann and Janice Cooke

Value: \$7.80 M

Genome Centre: Genome BC

GE³LS Title: A model of the effects of epidemics on forest feedstock

GE³LS Leads: Tim Williamson, Grant Hauer, Brian Aukema, Barry Cooke



GE³LS Integration

David Castle
Stuart Smyth
Lisa Jategaonkar
Cami Ryan

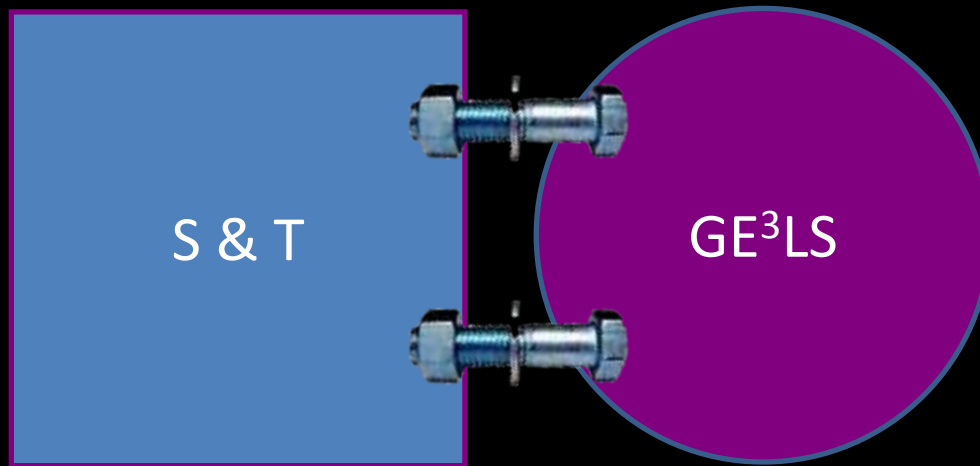
Context of GE³LS Integration

- ❖ Introduced in Genome Canada Competition II-III
- ❖ No formal definition; no substantive guidance; two lexical definitions prior to ABC competition
- ❖ Theory and practice *ad hoc*

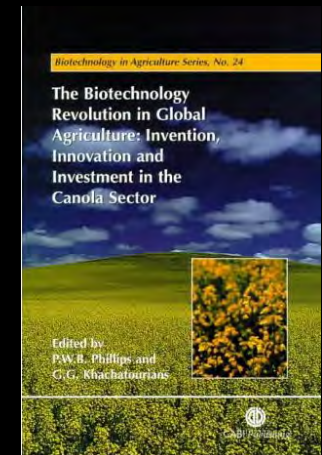
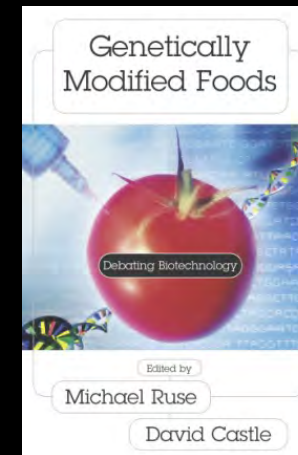
Purposes of GE³LS Integration

- ❖ A form of 'indulgence' or window-dressing
- ❖ Project-based problem solving
- ❖ Strategic partners in priority setting and knowledge mobilisation

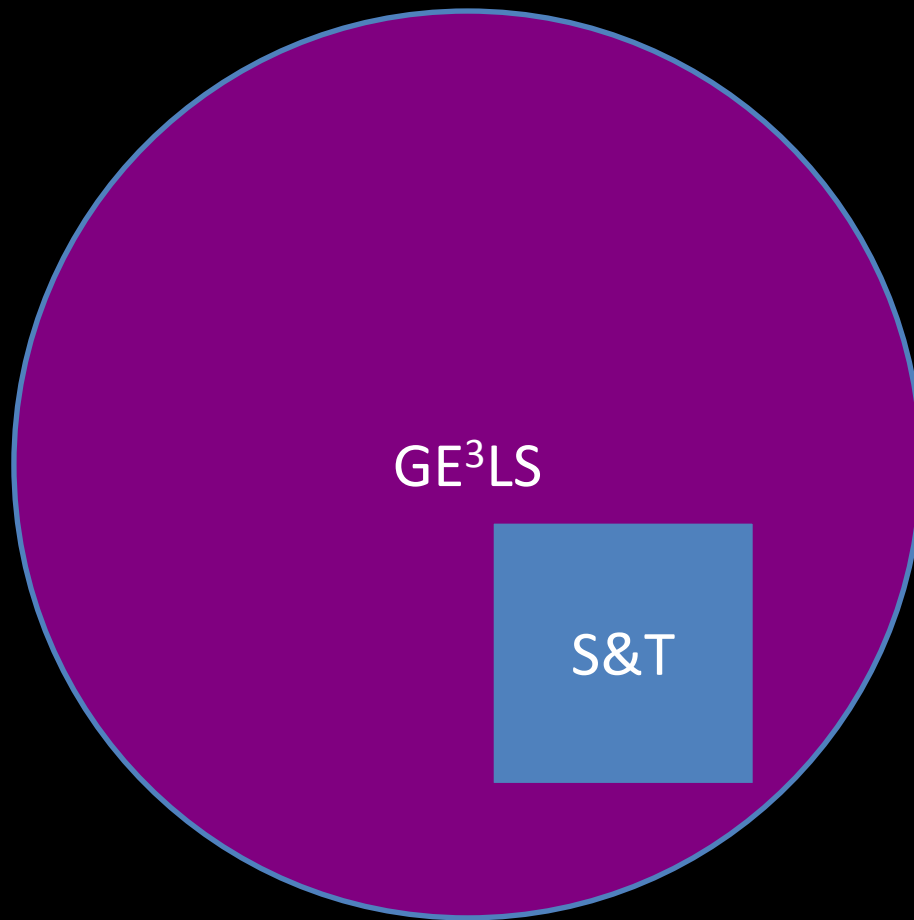
Model 1: "Bolt-on"



- ❖ Related by topic
- ❖ Separate in practice



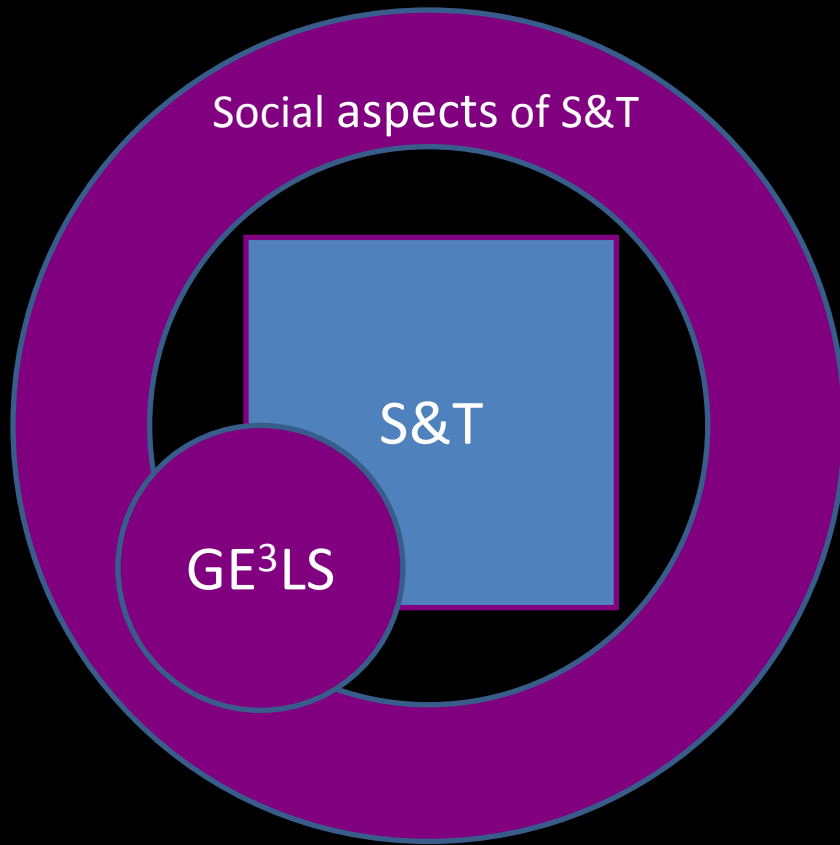
Model 2: S&T in GE³LS Project



- ❖ Scientific advisory board
 - ❖ Access to emerging S&T (pre-pub)
 - ❖ Co-articulation of GE³LS issues
 - ❖ Nutrigenomics



Model 3: "Science *and* Society"



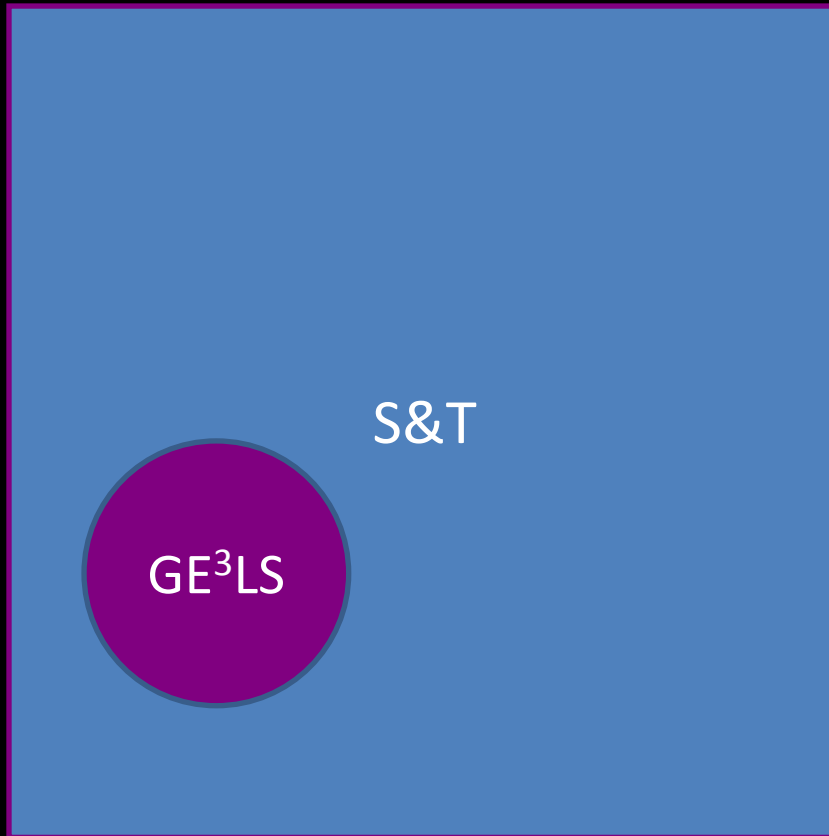
- ❖ S&T 'on tap' not 'on top'
- ❖ Social priorities drive scientific priorities



or



Integration 4: GE³LS into S&T



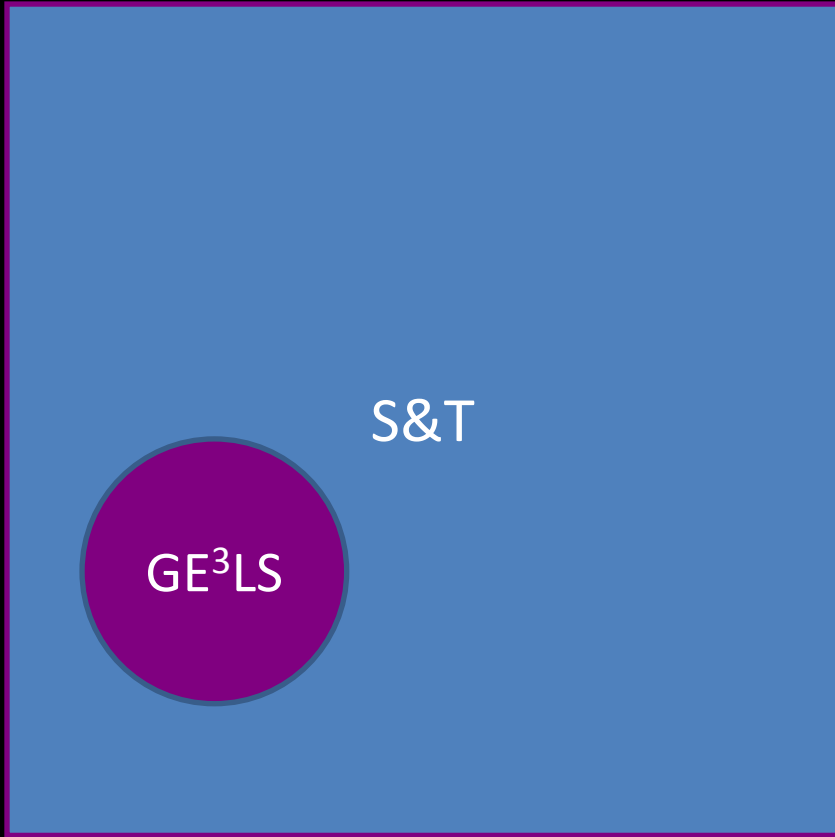
- ❖ Model used in ABC
- ❖ S&T sets domain
- ❖ GE³LS is focused





ABC Science & Technology: Desk Analysis

Lisa Jategaonkar



Objective: Provide an overview of the Projects funded in the ABC Competition.

Objective: Provide an overview of the Projects funded in the ABC Competition.

- Scope
- Species targets
- 'Omics approaches
- Expected outputs

ABC Projects - Scope

Bioproducts - Securing Canada's Future Bio-Based Economy through Genomics	
Feedstock Optimization	1
Microorganisms for Sustainable Processing Technologies	4
Value-Added Bioproducts	3
Crop Genomics for a Healthy Canada	
Basic Plant Genomics	4
Application of Plant Genomics	3
Agriculture and Food Production Sustainability	3

Species targets

Plants	Yeast	Insect	Fungus	Bacteria	# Projects
x					4
x	x				1
x		x			1
x		x	x		1
			x		1
				x	2

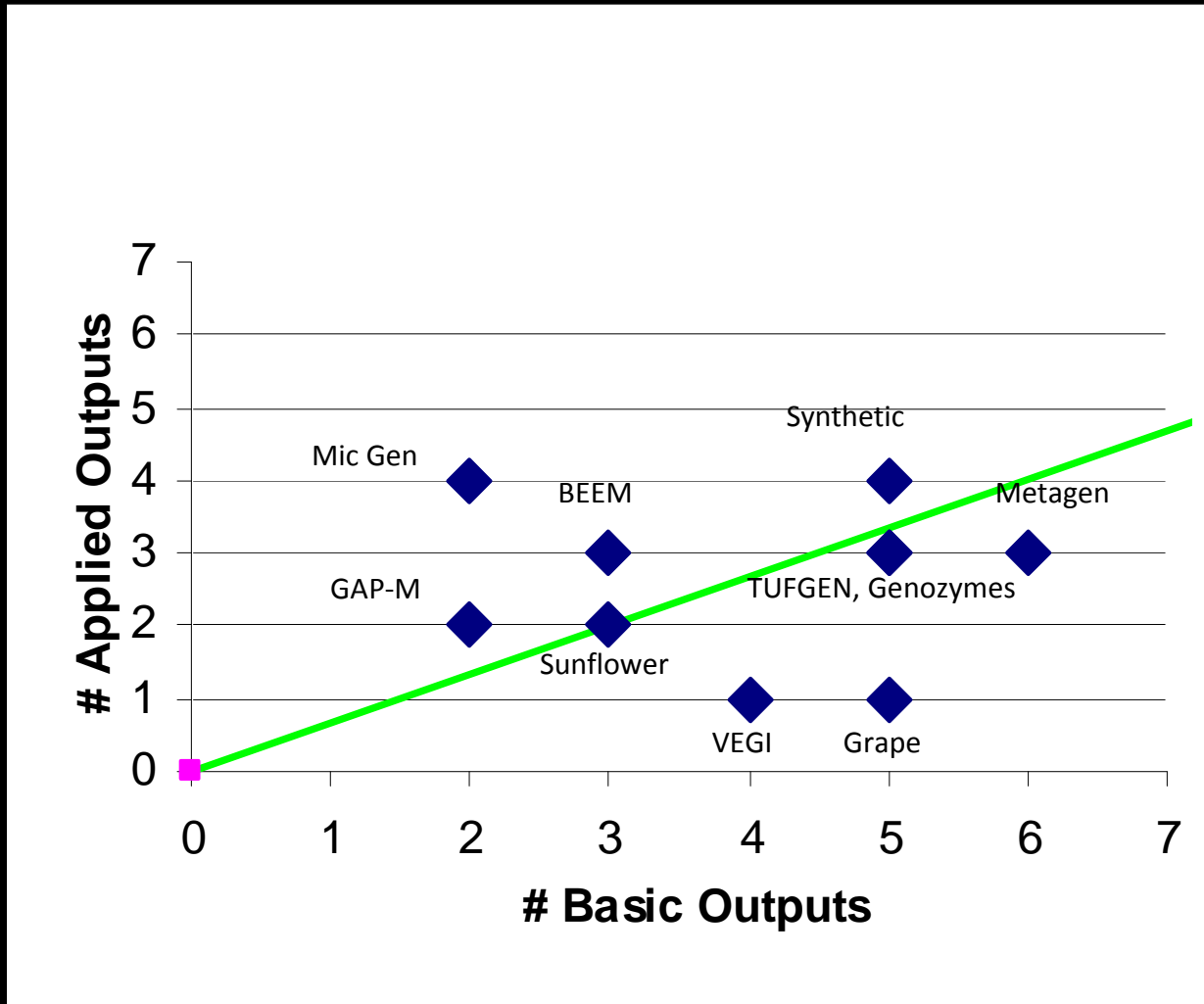
the 'Omics

Genomics	Functional Genomics	Transcriptomics	Proteomics	Metabolomics
9	5	3	2	2

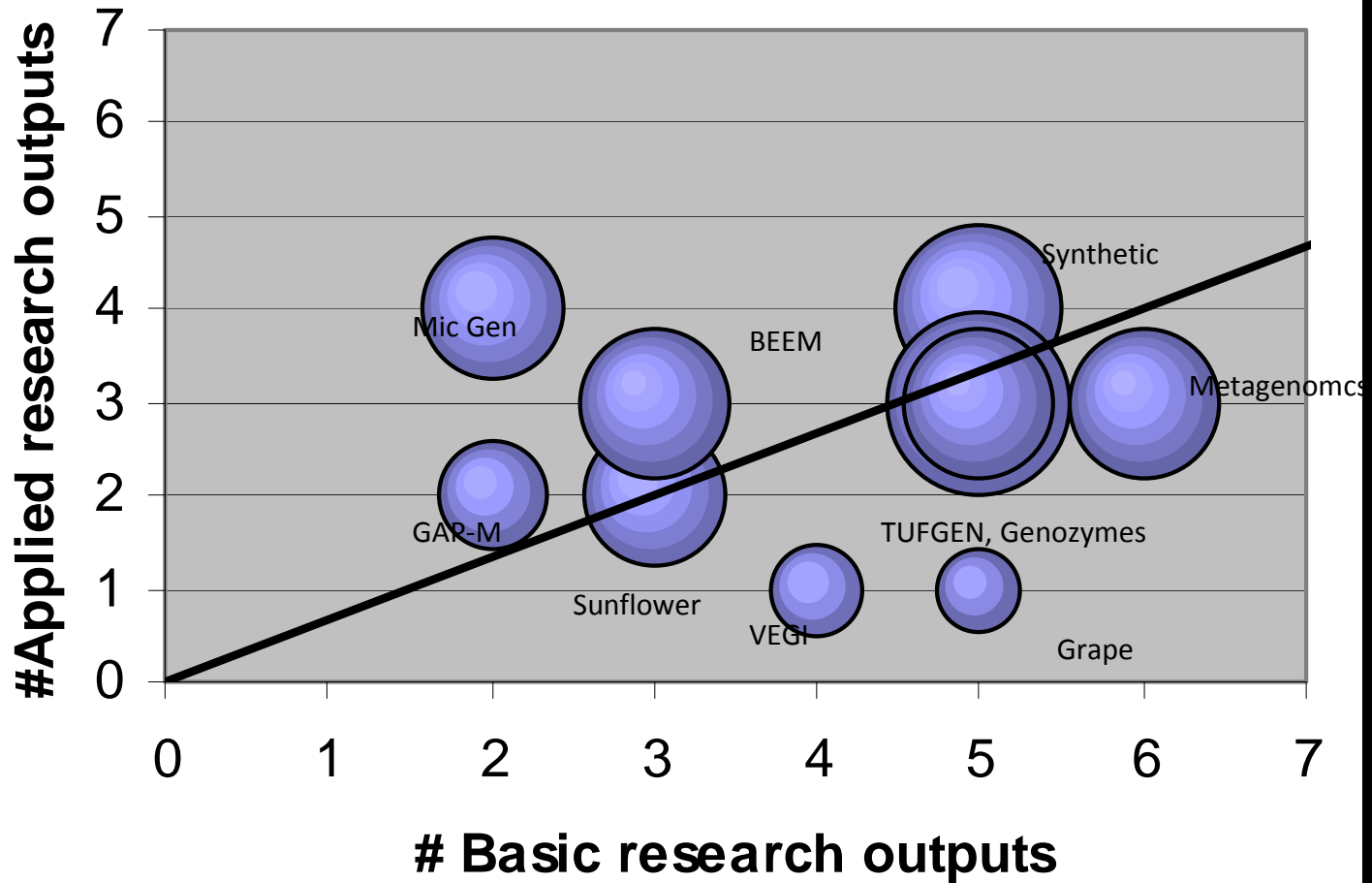
Research Outputs

Basic	Sample Collection	6
	Phenotypic characterization	3
	'Omics	11
	Bioinformatics	4
	Mapping	4
	Functional Genomics	3
Applied	Gene Characterization	6
	Database	4
	Scientific Tool	5
	Tool for Industry	2
	Models for Industry	2
	New Cultures	3
	New Bioproducts	2
	Novel Microbes	2
	Novel Plants	2

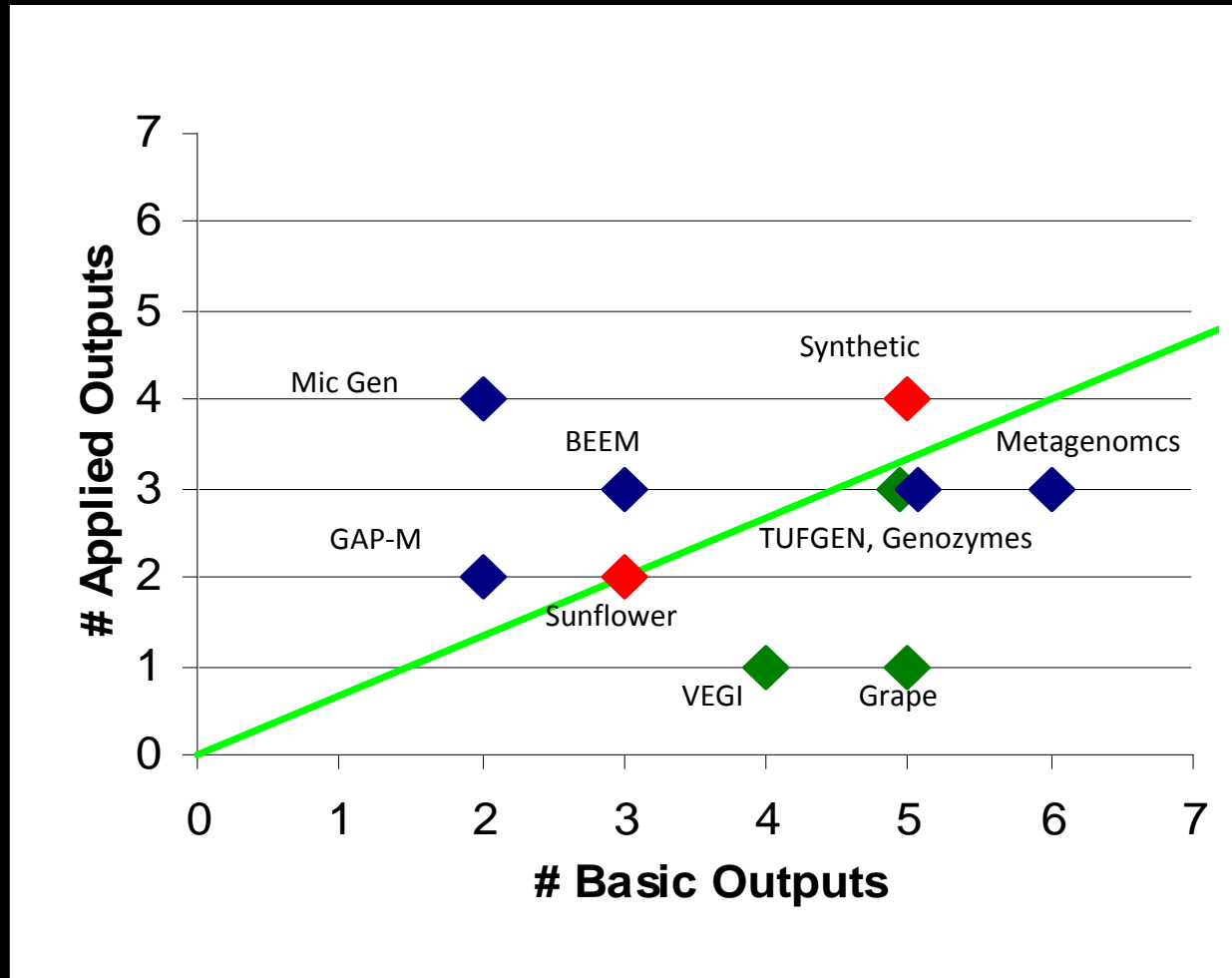
of applied outputs vs. # basic outputs



Applied vs. Basic # outputs



Applied vs. # Basic with Scope





ABC iGE3LS: Desk Analysis

Stuart Smyth

Benchmark Areas

- Intellectual Property
- Regulatory and Governance
- Democratic Engagement
- Economics of Science
- Environmental
- Ethics

IP Related Objectives

- 8 projects engaged in some aspect
- Patent valuation, both to inform other PIs and for TTO collaboration
- Assessing alternative IP approaches
- Landscape assessments for FTO barriers
- Enhancing technology transfer

Regulatory and Governance Objectives

- 7 projects undertaking research in this area
- Most projects trying to gain insights as to how existing Canadian regulations will apply to their project
- Some are taking this to the international level
- Trying to determine how the regulations will impact the resulting products

Democratic Engagement Objectives

- 4 projects proposing research
- A common theme is gaining insights into consumer response towards resulting products
- How to communicate science to society
- How can democratic engagement assist with the development of Canadian genomics policies

Economics of Science Objectives

- Two projects with research intentions
- Determining potential economic value of novel traits
- Estimating the returns to research
- Spatial impact of biofuels

Environmental Objectives

- 3 projects with intended research
- Quantify environmental impacts/footprint
- Assess impacts against other energy options
- Ecological impacts of increased biofuel production

Ethical Objectives

- 1 project with research
- Compare and assess the efficiencies of incentives for biofuels and bioproducts

Methodologies

- Patent landscape assessments – 6 projects
- Public surveys – 3 projects
- Life cycle analysis – 3 projects
- Regulatory impact evaluations – 3 projects
- Data analysis – 5 projects
- Empirical modeling – 2 projects
- Bibliometric/literature scans – 4 projects



Social Network Analysis (SNA): The ABC World

Cami Ryan

Social Network Analysis (SNA) and the ABC World

❖ Bibliometric Analysis

- ❖ Co-publications – good indicator of collaborative activity in science

❖ Source: ISI Thomson

- ❖ Primary search parameters (ABC Leads – Science & GE3LS)

- ❖ Two intervals: 2000-2004; 2005-2009

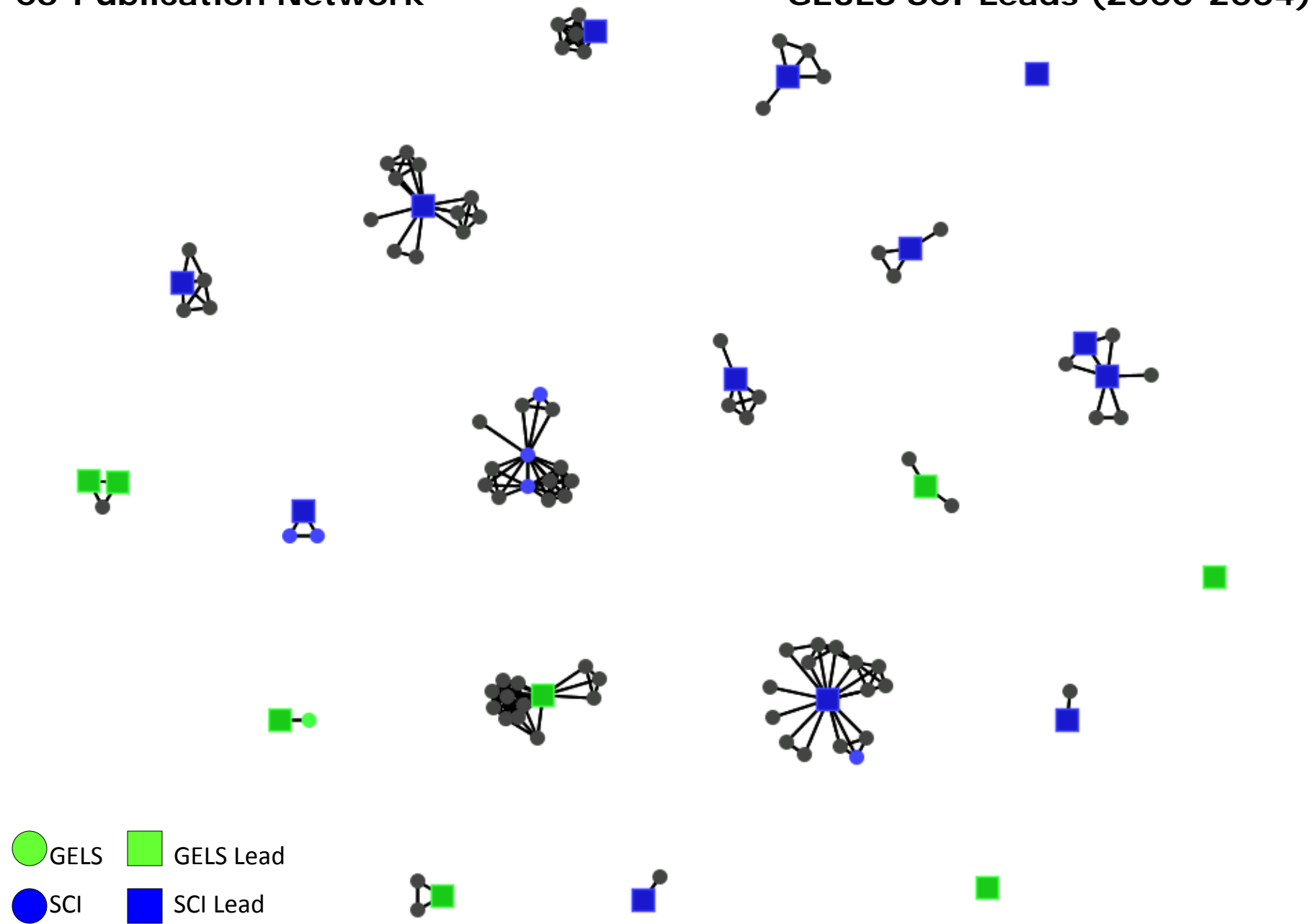
❖ Filtering Methodology

- ❖ Articles only

- ❖ Non-network actors with less than two publications excluded

Co-Publication Network

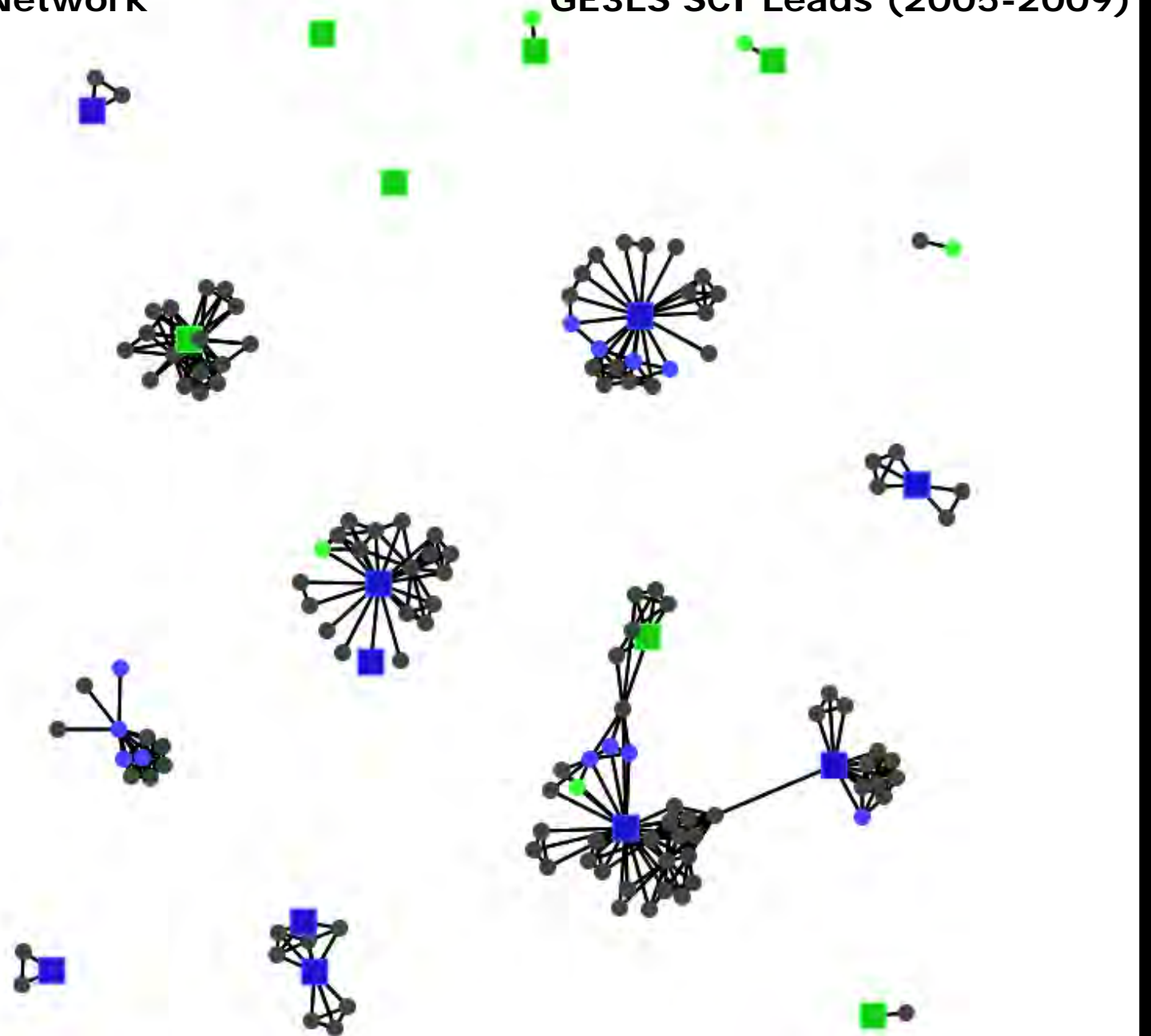
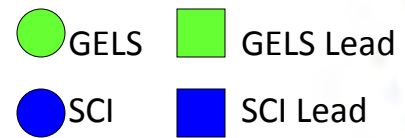
GE3LS SCI Leads (2000-2004)



● GELS ■ GELS Lead
● SCI ■ SCI Lead

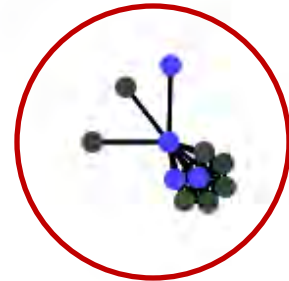
Co-Publication Network

GE3LS SCI Leads (2005-2009)







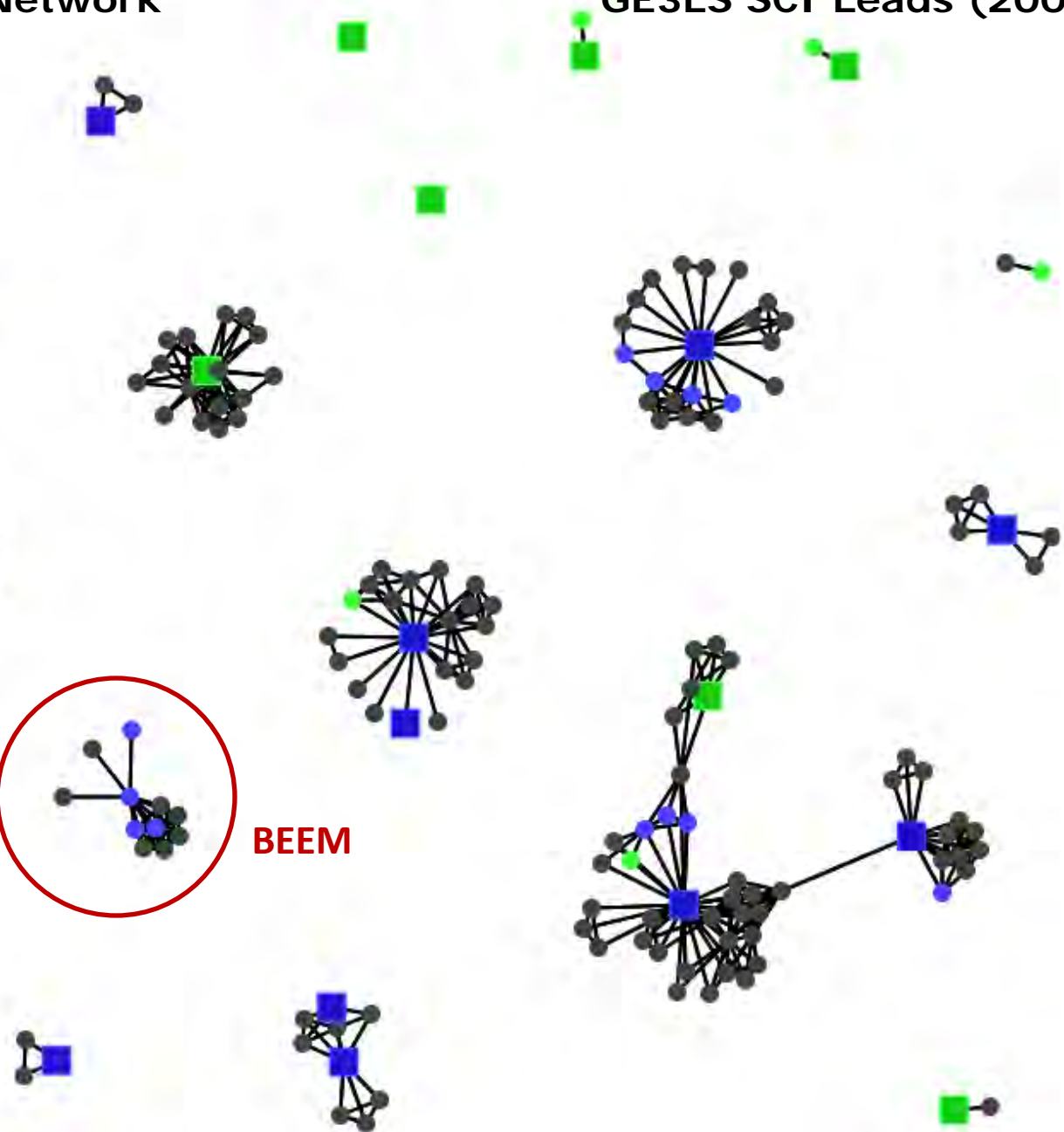
Co-Publication Network

GE3LS SCI Leads (2005-2009)



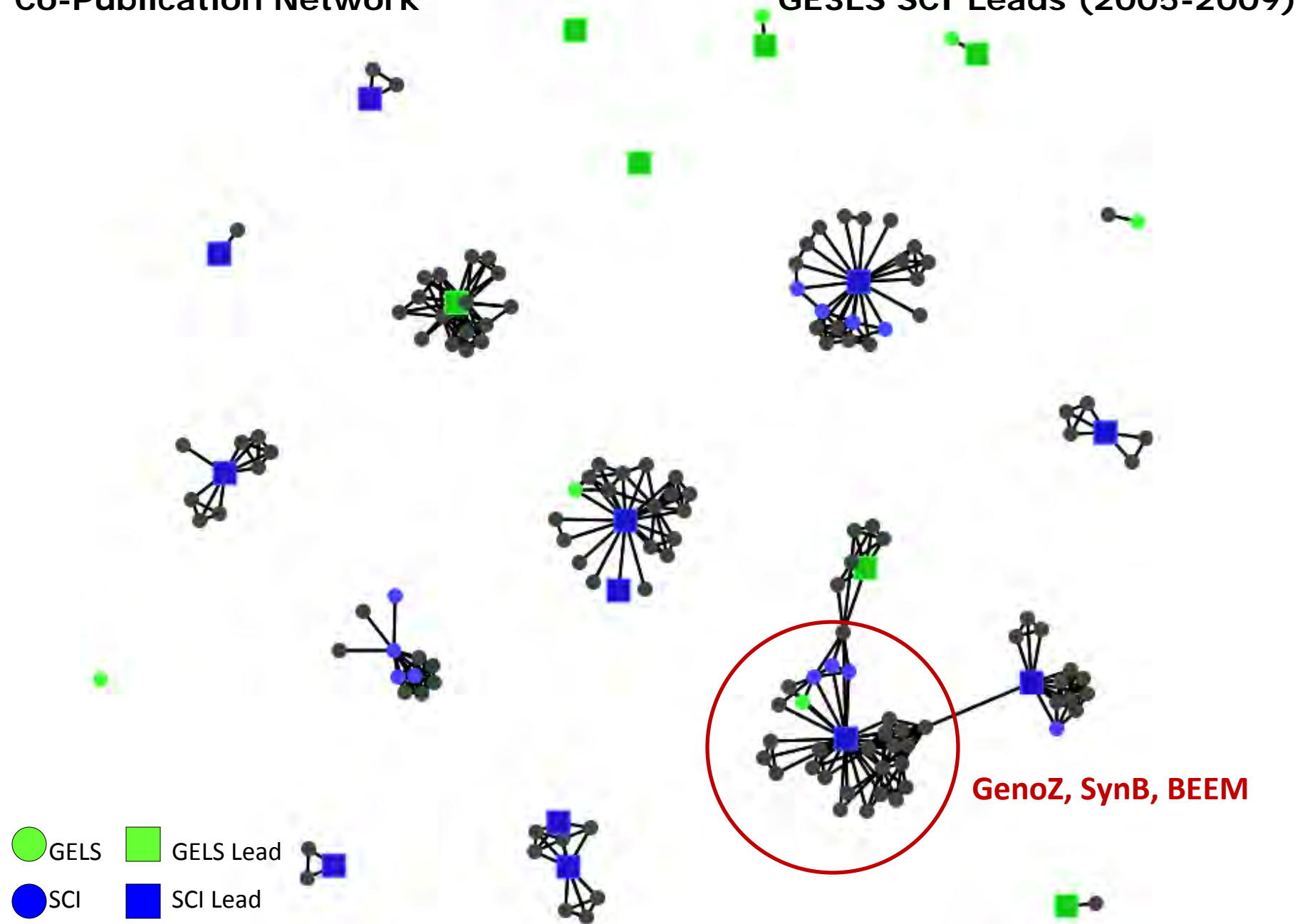
BEEM

-  GELS
-  GELS Lead
-  SCI
-  SCI Lead



Co-Publication Network

GE3LS SCI Leads (2005-2009)

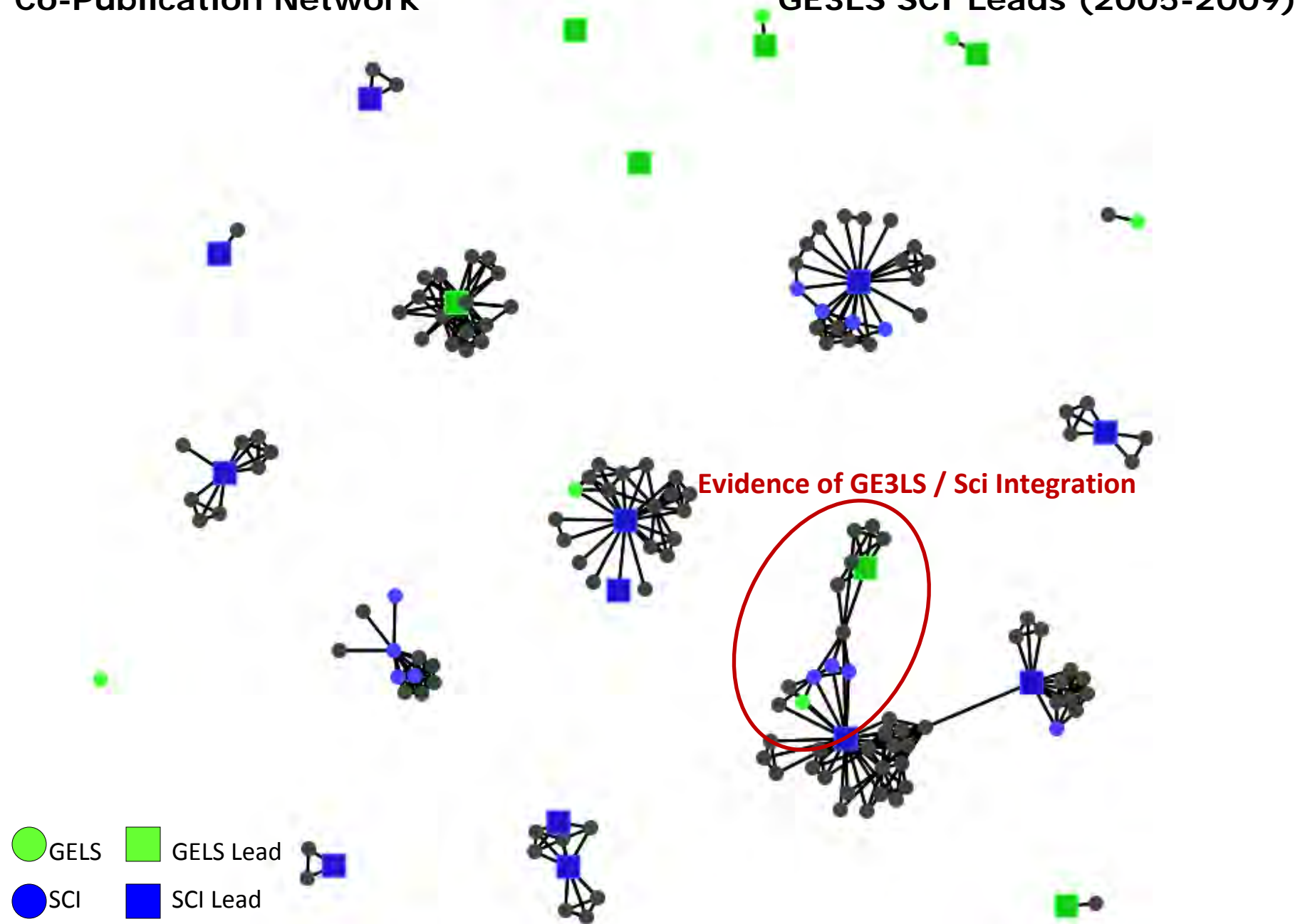





● GELS ■ GELS Lead
● SCI ■ SCI Lead

GenoZ, SynB, BEEM

Co-Publication Network

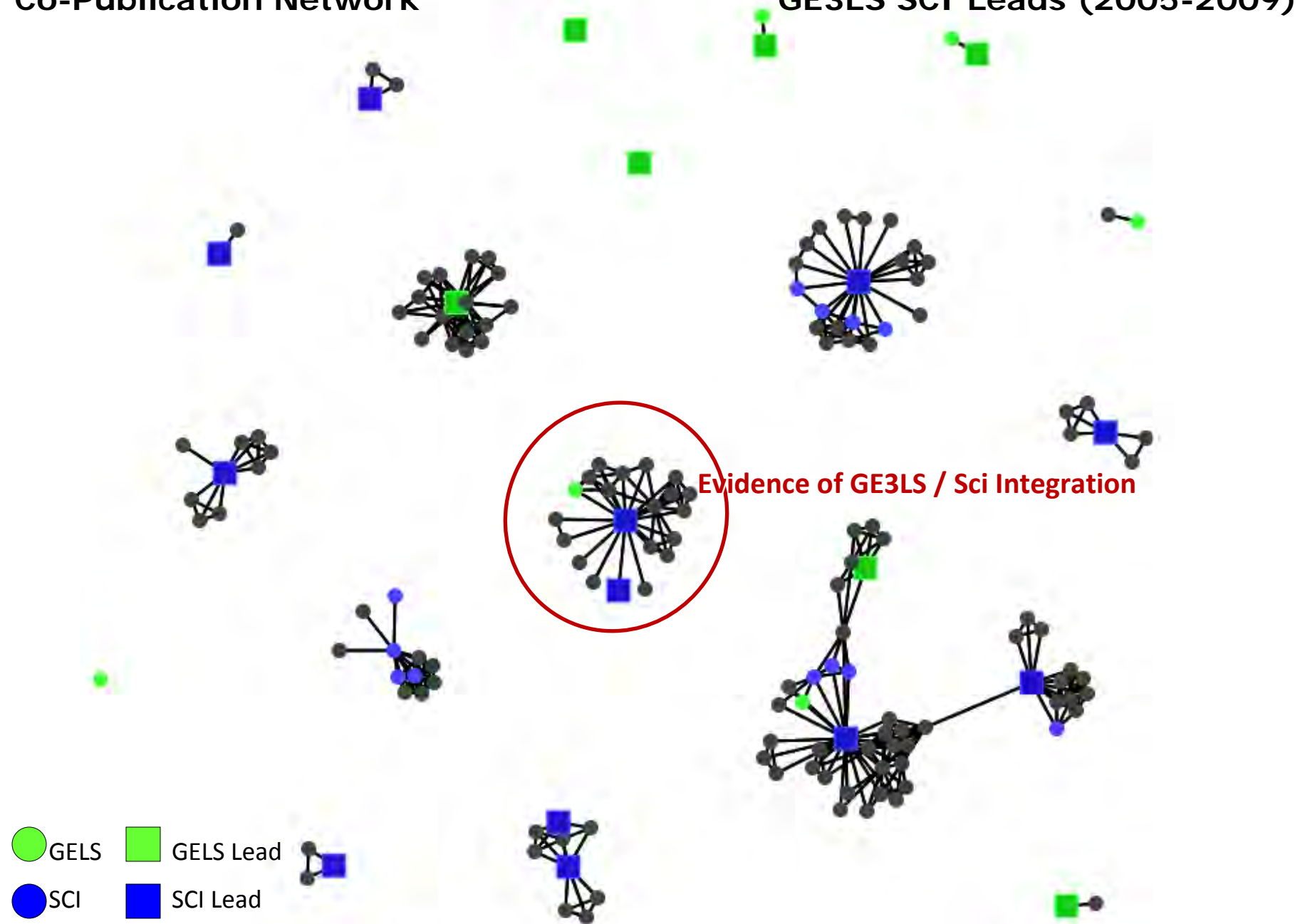
GE3LS SCI Leads (2005-2009)







-  GELS
-  SCI
-  GELS Lead
-  SCI Lead

Co-Publication Network

GE3LS SCI Leads (2005-2009)



-  GELS
-  GELS Lead
-  SCI
-  SCI Lead

GE3LS Integration...

- ❖ Publication output by Subject / Topic
- ❖ Time interval: 2000 – 2009
- ❖ n = 230 articles
 - ❖ Categorized across one or more subjects/fields

GE3LS

Philosophy

Ethics

13%

Sociology

Humanities

Law

Economics

Management & Planning

16%

Business

Political Science/Studies

BASIC

APPLIED

Computational Sciences

Engineering & Materials Science

33%

Chemistry

Genetics & Biological Sciences

Food Sciences

Environmental & Geo Sciences

Clinical

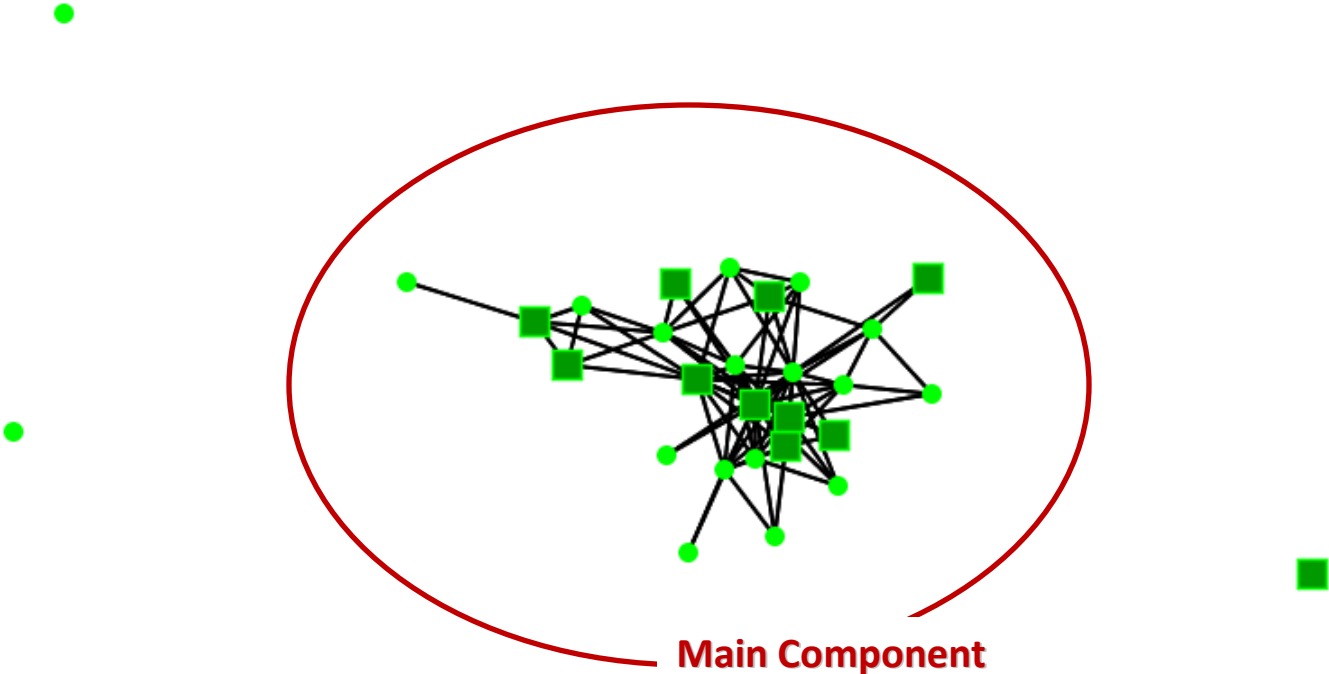
38%

Forestry & Energy

Public Health

SCIENCE

ABC GE3LS Actor Network

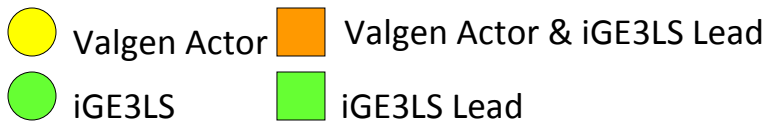
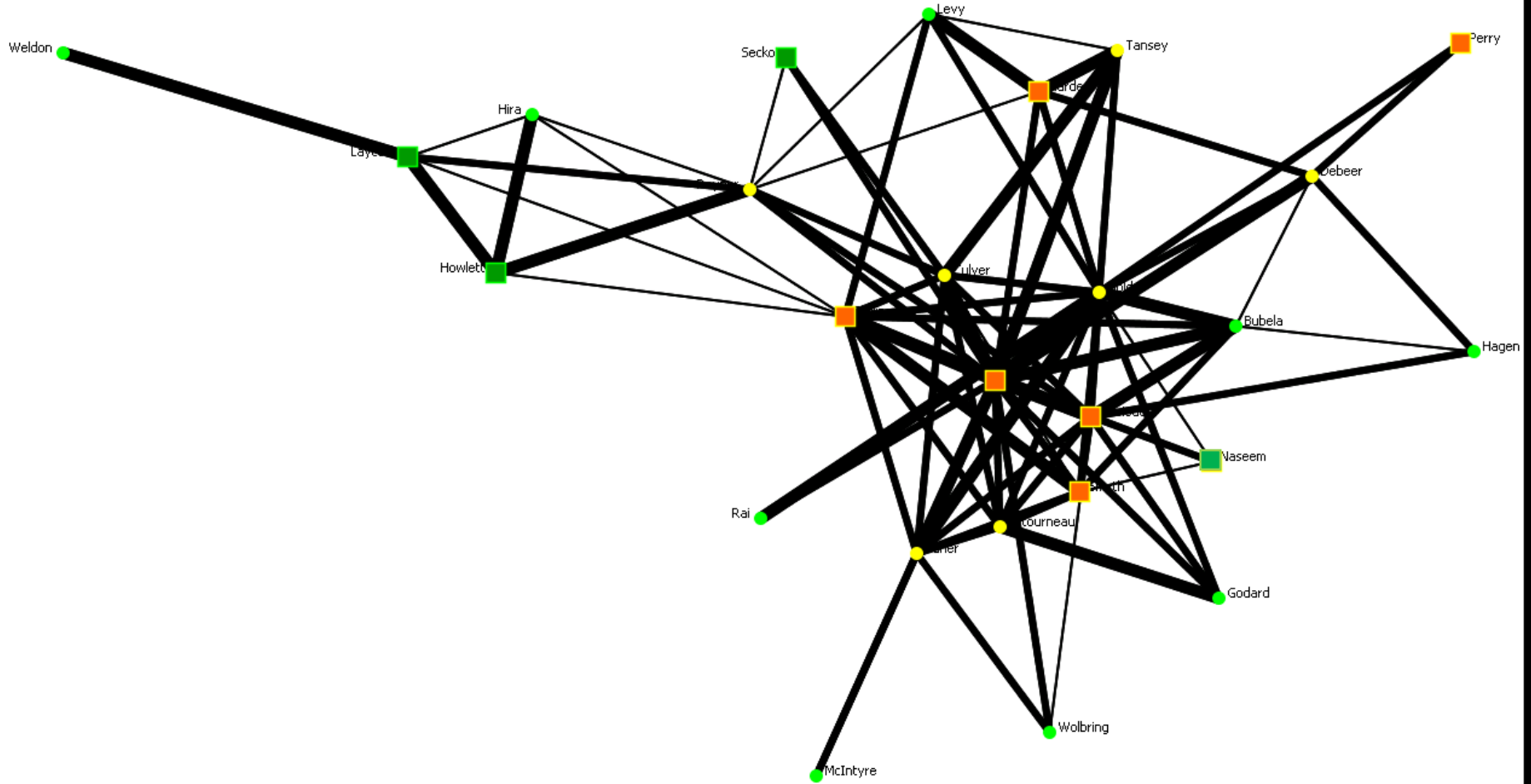


● GE3LS

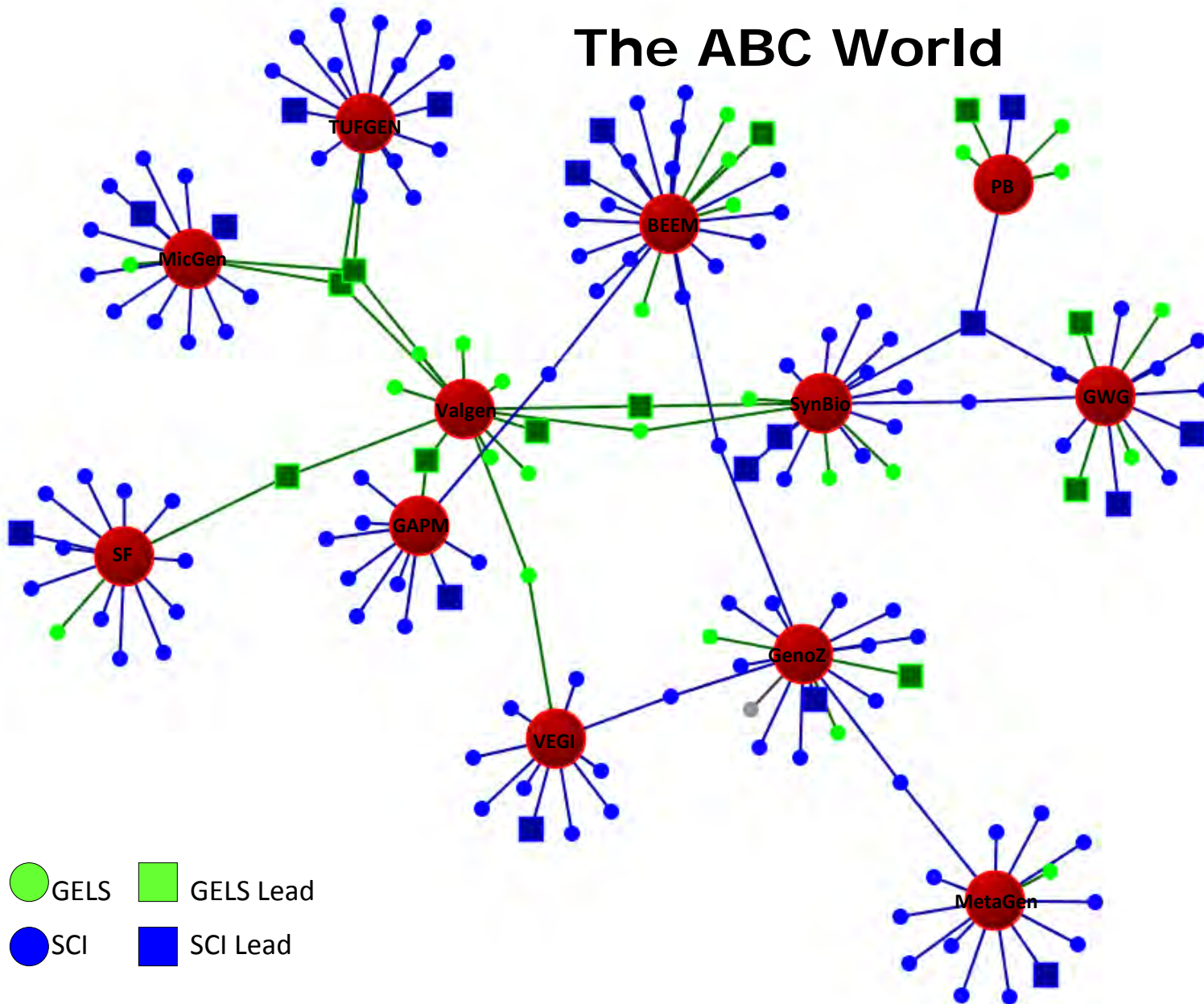
■ GE3LS Lead

n = 37

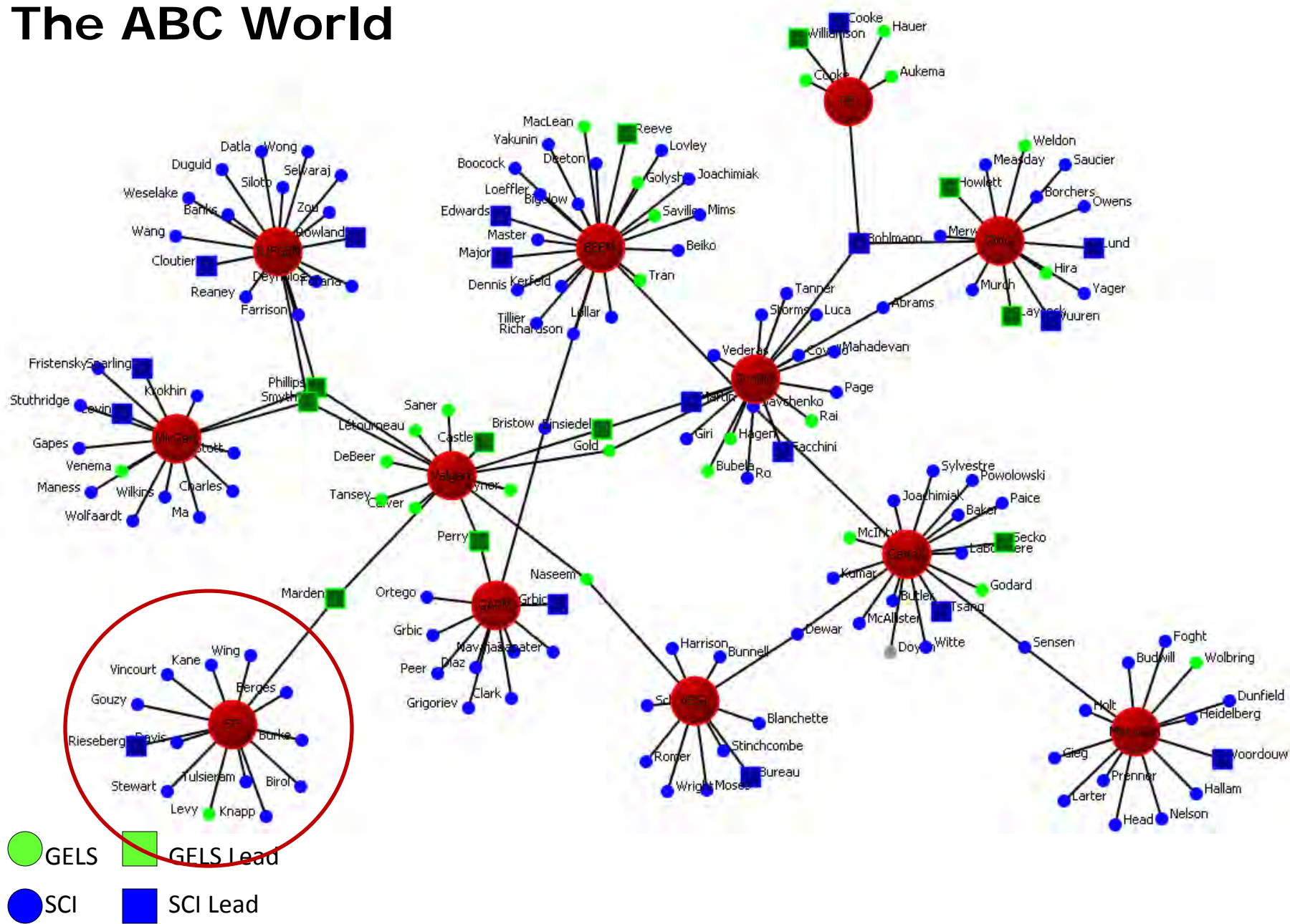
ABC GE3LS Actor Network – Main Component



The ABC World



The ABC World





THE DELPHI SURVEY : An Overview

Alex Mogyoros

What is Delphi Survey?

- ❖ A structured group communication method
- ❖ Used to solicit opinions and ideas from a knowledgeable group of participants
- ❖ Done through a combination of a series of questionnaires and controlled feedback

When is a Delphi used?

- ❖ When face-to-face communication is not feasible or desirable due to political, social, or logistical factors
 - ❖ For example: When power dynamics or hierarchical structure may impact the discussion
- ❖ When personal opinions/judgements are indispensable
- ❖ When working with an issue or problem that would be best dealt with by a group of people

Applications of Delphis

- ❖ Primarily used for...
 - ❖ Generating a consensus
 - ❖ Conducting a foresight exercise
 - ❖ **Generating new ideas**
 - ❖ **Identifying issues**
 - ❖ **Prioritizing issues**
 - ❖ Developing a framework
 - ❖ Developing a strategic approach

Objectives of Policy Delphis

“to ensure that **all possible options have been put on the table** for consideration, to estimate impact and consequences of any particular option, and to examine and estimate the acceptability of any particular option”

Linstone, Harold A., and Murray Turoff, eds. *The Delphi Method: Techniques and Applications*. 2002. *The Delphi Method: Techniques and Applications*. New Jersey's Science and Technology University, 2002. Web. 14 Nov. 2009.

Essential Characteristics of a Delphi

- ❖ Iterative round
 - ❖ Successive rounds over a determined time span
- ❖ Controlled feedback between rounds
 - ❖ Participants receive summaries before completing the next round
- ❖ Anonymity
 - ❖ Between participants, not between participants and Delphi administrators

Goals of our Policy Delphi

- ❖ Gain an understanding of how GE³LS research is perceived by the ABC genomics research community
- ❖ Identify barriers and obstacles to GE³LS research
- ❖ Learn about the factors that impact successful GE³LS research and integration
- ❖ Identify drivers of change that will impact GE³LS issues and how GE³LS research is done

Results of Survey

What do you think are the main barriers to research and development in applied genomics in bioproducts and crops?

Answer Options	Response Percent
Funding	58%
Public Perceptions	47%
Regulation/Governance/Policy	41%
HQP	17%
Scientific barriers	16%
Industrial structure	13%
IPRs	11%
Economics	5%
Environment	3%
Ethics	3%

Results of Survey

What are the most important barriers to resolving the most important GE3LS issues related to applied genomics in bioproducts and crops (ABC)?

Regulation/Governance/Policy	38%
Public Perceptions	29%
IPRs	23%
Environment	20%
Economics	13%
Money	6%
Ethics	4%
Industrial structure	4%

5 Workshop Objectives

1. Bring the ABC community together for the first time
2. Share cross-project information
3. Identify opportunities for, and barriers to, ABC genomics research
4. Share best practices regarding GE³LS integration
5. Structure relationship between VALGEN and S&T projects

1. Bring the ABC community together
for the first time

Major barriers to research and development in
applied genomics in bioproducts and crops

“synergy opportunities between funded groups”

“Lack of coordination of research efforts and
networking among all interested parties.”

2. Share cross-project information

“[There is a] Lack of coordination of research efforts and networking among all interested parties”

“Insufficient integration and collaboration between researchers”

“[An important GE³LS issue is the presence of] innovation networks and support structures within related industries”

3. Identify opportunities for, and barriers to, ABC genomics research

Q. 6 What do you think are the main barriers to research and development in applied genomics in bioproducts and crops (please cite up to three barriers)?

Funding = 58%

“The major barrier to research is always, to some extent, funding”

“A lack of research funding”

Public Perceptions = 47%

“public perceptions (hostility to "genetic" research)”

“Effective communication into public perception and the deeper inclusion of various publics in the research and development process.”

Regulation/Governance/Policy = 41%

“Limited interaction between regulatory agencies (Federal) and funded projects”

“Regulatory bottlenecks for approvals”

4. Share best practices regarding GE³LS integration

Question 11. What are the most influential factors that contribute to successful GE³LS integration, and what are the most relevant obstacles to successful GE³LS integration? Please provide reasons for your answer.

Communication = 48%

“GE³LS folk need to understand the science sufficiently to be of use to the scientists, and likewise the scientist needs to be able to learn at least some of the GE³LS vocabulary. Only when we can effectively talk to one another will we be able to articulate the issues to the politicians, policy makers and general population.”

5. Structure relationship between VALGEN and S&T projects

By what measures would you evaluate successful collaboration between science and technology and GE3LS research?

Joint science and GE3LS publications	28%
Idea exchange	26%
Research Design	17%
Stakeholder relationships	15%
Policy impact	15%
Joint HQP development	4%

Concluding remarks

- ❖ Identified a need in the ABC community for opportunities for networking and collaboration that VALGEN could work on
- ❖ Further unpack and develop arguments for the issues brought up in the Delphi
- ❖ Round two of the Delphi
 - ❖ Respondents will have opportunity to review responses from the first round
 - ❖ A second round of Delphi will be developed and circulated

VALGEN

A Genome Canada Project Managed by Genome Prairie:



Workshop supported by:

