FUNDED BY

biosharing

standards, policies and communication in bioscience

Dawn Field[1,2]

Susanna-Assunta Sansone[1]

Philippe Rocca-Serra[1]

also on behalf of our international partners and collaborators

1. University of Oxford, Oxford e-Research Centre, Oxford, UK
2. NERC Environmental Bioinformatics Data Centre, UK

COMBINE 2011, Heidelberg, Germany

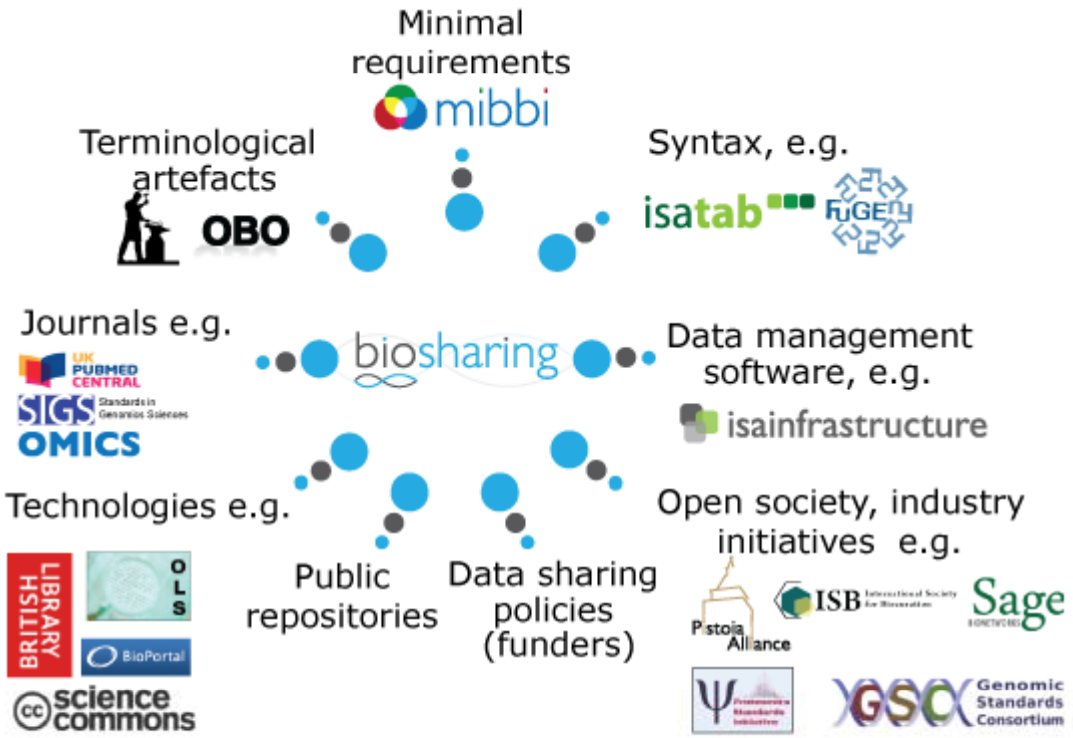
POLICYFORUM

http://biosharing.org

MEGASCIENCE

'Omics Data Sharing

Dawn Field,[1*†‡] Susanna-Assunta Sansone,[1,2†] Amanda Collis,[3†] Tim Booth,[1] Peter Dukes,[4] Susan K. Gregurick,[5] Karen Kennedy,[6] Patrik Kolar,[7] Eugene Kolker,[8] Mary Maxon,[9] Siân Millard,[10] Alexis-Michel Mugabushaka,[11] Nicola Perrin,[12] Jacques E. Remacle,[7] Karin Remington,[13] Philippe Rocca-Serra,[12] Chris F. Taylor,[12] Mark Thorley,[14] Bela Tiwari,[1] John Wilbanks[15]



Data sharing, and the good annotation practices it depends on, must become part of the fabric of daily research for researchers and funders.

[1]U.K. Natural Environment Research Council (NERC), Environmental Bioinformatics Centre. [2]European Molecular Biology Laboratory (EMBL) Outstation, The European Bioinformatics Institute (EBI). [3]U.K. Biotechnology and Biological Sciences Research Council. [4]U.K. Medical Research Council. [5]U.S. Department of Energy. [6]Genome Canada. [7]Unit for Genomics and Systems Biology, European Commission. [8]Seattle Childrens Hospital. [9]Marine Microbiology Initiative, Gordon and Betty Moore Foundation. [10]U.K. Economic and Social Research Council. [11]European Science Foundation. [12]The Wellcome Trust. [13]U.S. National Institute of General Medical Sciences, NIH. [14]NERC. [15]Science Commons.
* **The first three authors contributed equally to this article.**

Field, et al 2009. ***Science***. 326:234-236.

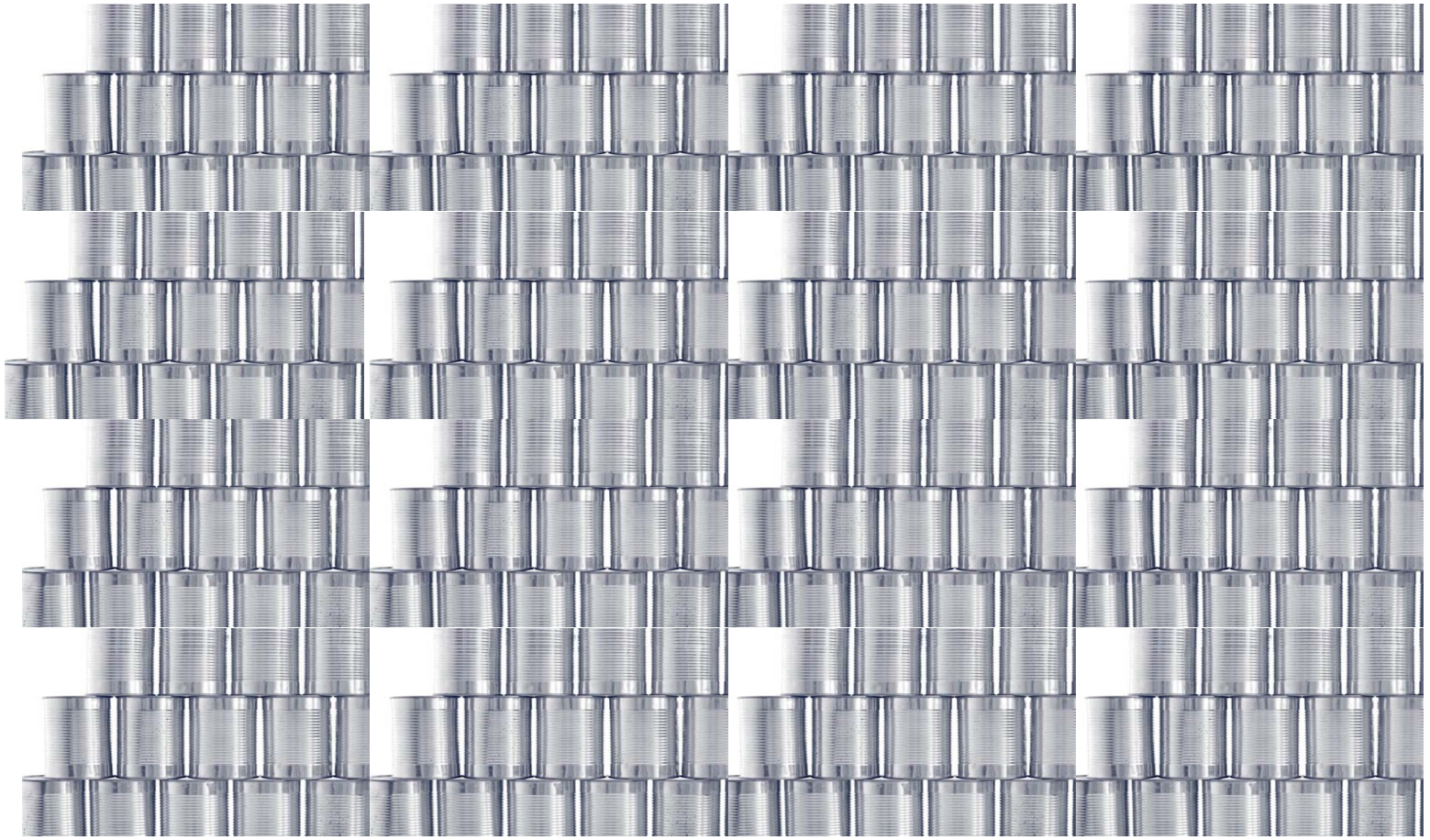
To exploit fully the promise of scientific data we need both innovation and community agreement on how to provide appropriate stewardship of these resources for the benefit of all.

Requires the evolution of our scientific, technological and sociological thinking....

The Data SuperMarket

DataMarket

Norman Morrison



Packaging data

Labels for data

standards

Principles:

Not everything should be ‘standardized’

Aggregation of data, information, and knowledge requires standard ways of doing things

Standards provide foundations; Standards should drive innovati (think of electrical plugs or the internet)

Pick the right concepts to standardize – at the right time, with the right people

Requires good ‘group think’ – or ‘systems thinking’

Community-driven solutions:

The Common Path:

- Identify the problem
- Define a community to address it
- Define scope of the solution
- Implement solution
- Gain adoption of solution

The Genomic Standards Consortium

genomic gsc STANDARDS consortium

Innovation through Collaboration

GSC 10
Argonne, 2010

GSC 11,
Hinxton, 2010

wellcome trust

GSC 12
Bremen, 2011

GSC 13
BGI 2012

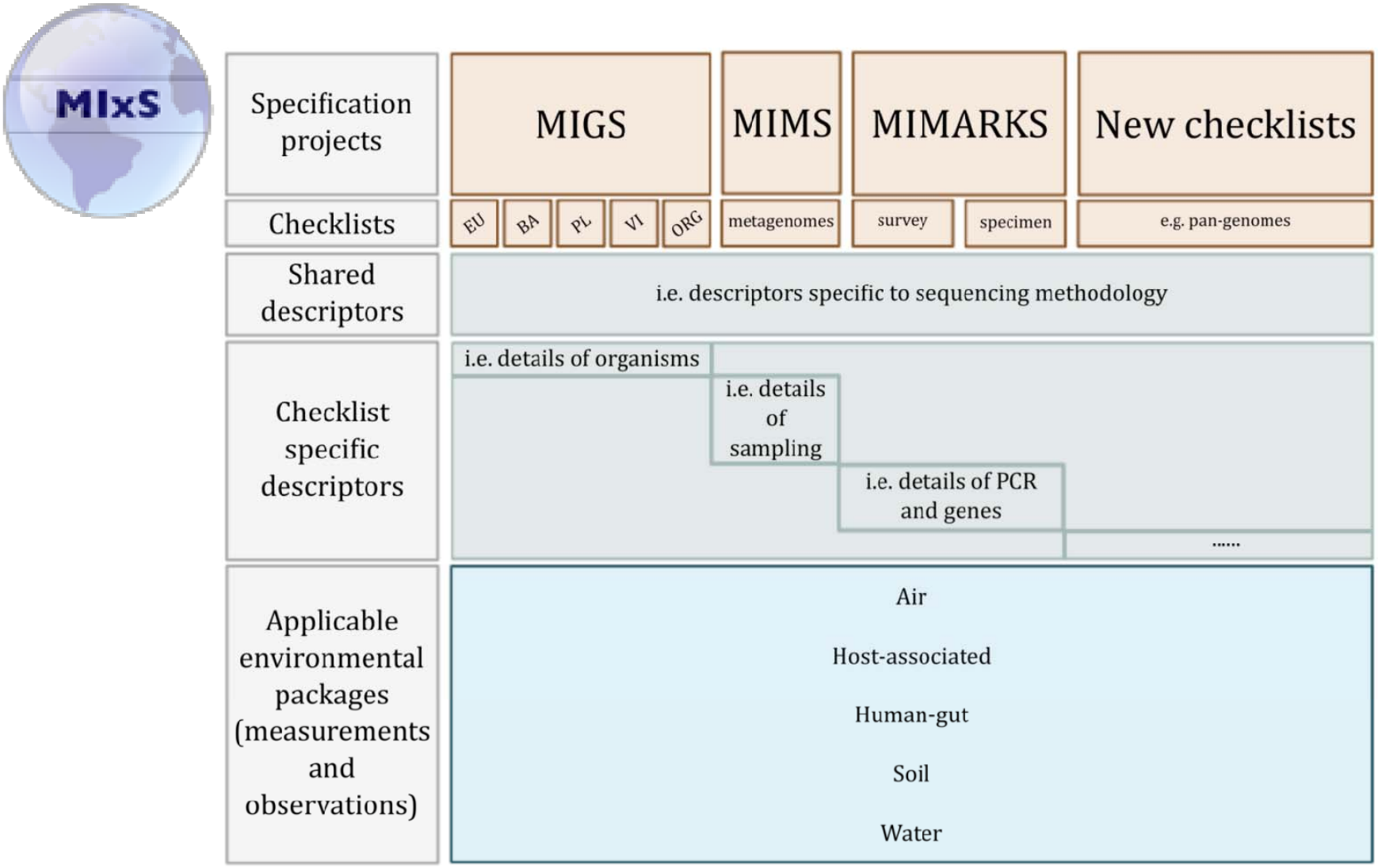
The GSC's Mission

- the implementation of new genomic standards
- methods of capturing and exchanging metadata
- harmonization of metadata collection and analysis efforts across the wider genomics community

The GSC fulfills its mission by

- Organizing meetings
- Forming working groups
- Creating Consensus Products

Pelin Yilmaz et al 2011



nature biotechnology

PERSPECTIVE

PERSPECTIVE

nature biotechnology

The minimu
(MIGS) spec

Dawn Field*[1], George Gar
Nicholas Thomson[8], Mich
Sandra Baldauf[12], Stuart B
Claude dePamphilis[18], Rol
Frank Oliver Glöckner[23], F
Henning Hermjakob[6], Chr
Jessie Kennedy[27], George F
Jim Leebens-Mack[33], Suza
Victor Markowitz[37], Jenni
Julian Parkhill[8], Lita Proct
Paul Swift[1], Chris Taylor[6],
Naomi Ward[45], Trish Whe

Minimum information about a marker gene sequence (MIMARKS) and minimum information about any (x) sequence (MIxS) specifications

Pelin Yilmaz[1,2]*, Renzo Kottmann[1], Dawn Field[3], Rob Knight[4,5], James R Cole[6,7], Linda Amaral-Zettler[8], Jack A Gilbert[9–11], Ilene Karsch-Mizrachi[12], Anjanette Johnston[12], Guy Cochrane[13], Robert Vaughan[13], Christopher Hunter[13], Joonhong Park[14], Norman Morrison[3,15], Philippe Rocca-Serra[16], Peter Sterk[3], Manimozhiyan Arumugam[17], Mark Bailey[3], Laura Baumgartner[18], Bruce W Birren[19], Martin J Blaser[20], Vivien Bonazzi[21], Tim Booth[3], Peer Bork[17], Frederic D Bushman[22], Pier Luigi Buttigieg[1,2], Patrick S G Chain[7,23,24], Emily Charlson[22], Elizabeth K Costello[4], Heather Huot-Creasy[25], Peter Dawyndt[26], Todd DeSantis[27], Noah Fierer[28], Jed A Fuhrman[29], Rachel E Gallery[30], Dirk Gevers[19], Richard A Gibbs[31,32], Inigo San Gil[33], Antonio Gonzalez[34], Jeffrey I Gordon[35], Robert Guralnick[28,36], Wolfgang Hankeln[1,2], Sarah Highlander[31,37], Philip Hugenholtz[38], Janet Jansson[23,39], Andrew L Kau[35], Scott T Kelley[40], Jerry Kennedy[4], Dan Knights[34], Omry Koren[41], Justin Kuczynski[18], Nikos Kyrpides[23], Robert Larsen[4], Christian L Lauber[42], Teresa Legg[28], Ruth E Ley[41], Catherine A Lozupone[4], Wolfgang Ludwig[43], Donna Lyons[42], Eamonn Maguire[16], Barbara A Methé[44], Folker Meyer[10], Brian Muegge[35], Sara Nakielny[4], Karen E Nelson[44], Diana Nemergut[45], Josh D Neufeld[46], Lindsay K Newbold[3], Anna E Oliver[3], Norman R Pace[18], Giriprakash Palanisamy[47], Jörg Peplies[48], Joseph Petrosino[31,37], Lita Proctor[21], Elmar Pruesse[1,2], Christian Quast[1], Jeroen Raes[49], Sujeevan Ratnasingham[50], Jacques Ravel[25], David A Relman[51,52], Susanna Assunta-Sansone[16], Patrick D Schloss[53], Lynn Schriml[25], Rohini Sinha[22], Michelle I Smith[35], Erica Sodergren[54], Aymé Spor[41], Jesse Stombaugh[4], James M Tiedje[7], Doyle V Ward[19], George M Weinstock[54], Doug Wendel[4], Owen White[25], Andrew Whiteley[3], Andreas Wilke[10]

Use of MIxS

Please provide this minimum information when you publish

- a genome
- a metagenome
- a gene marker study (i.e. ribosomal genes)

Genbank, EMBL and DDBJ now accept this information and encourage its submission to their public DNA databases

Labels for data

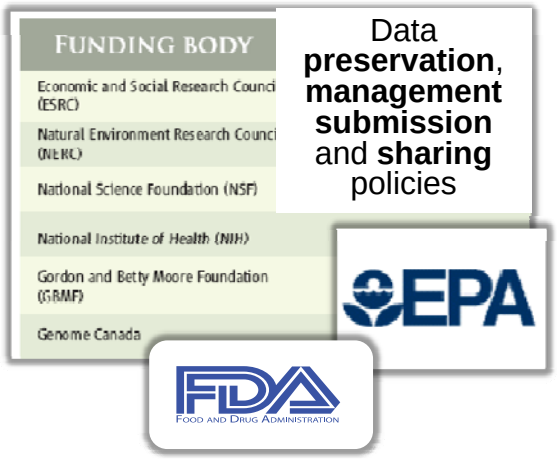
Escalating number of standardization efforts in bioscience, *e.g.:*

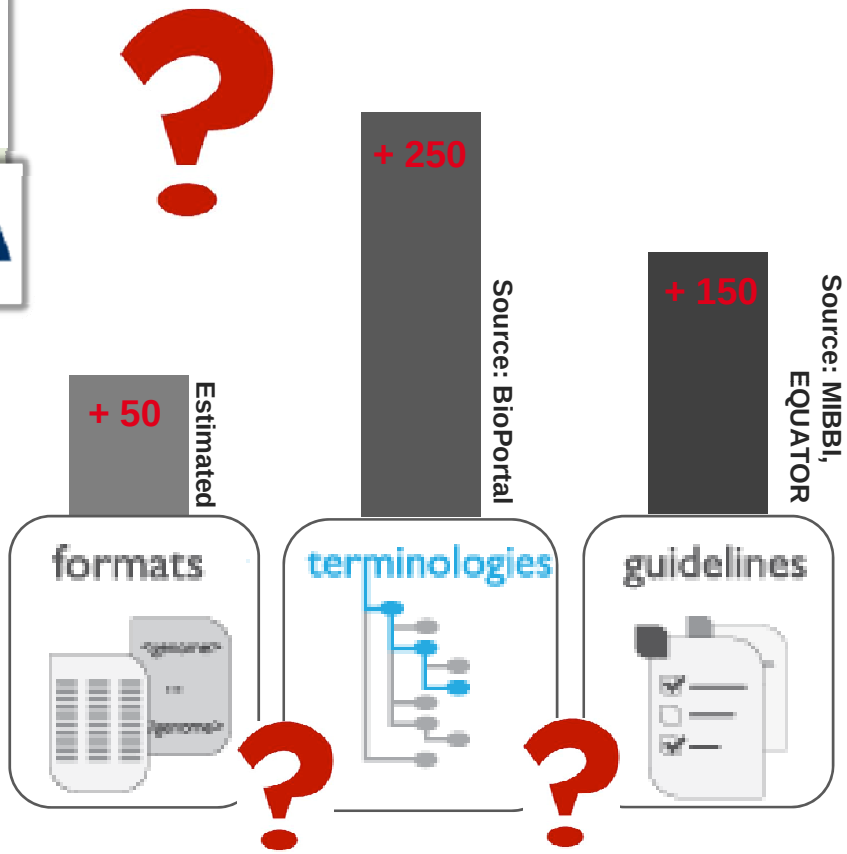
formats

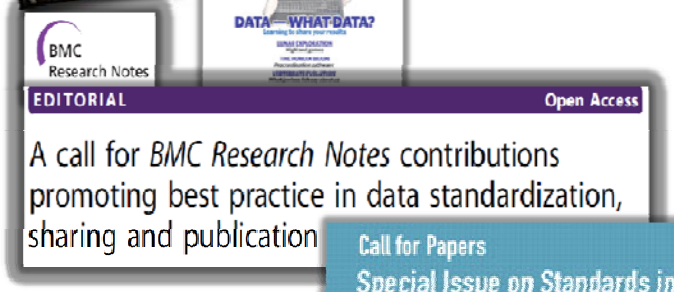
terminologies

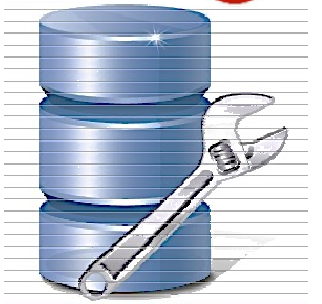
guidelines

Growing number of standards and interest in their use….



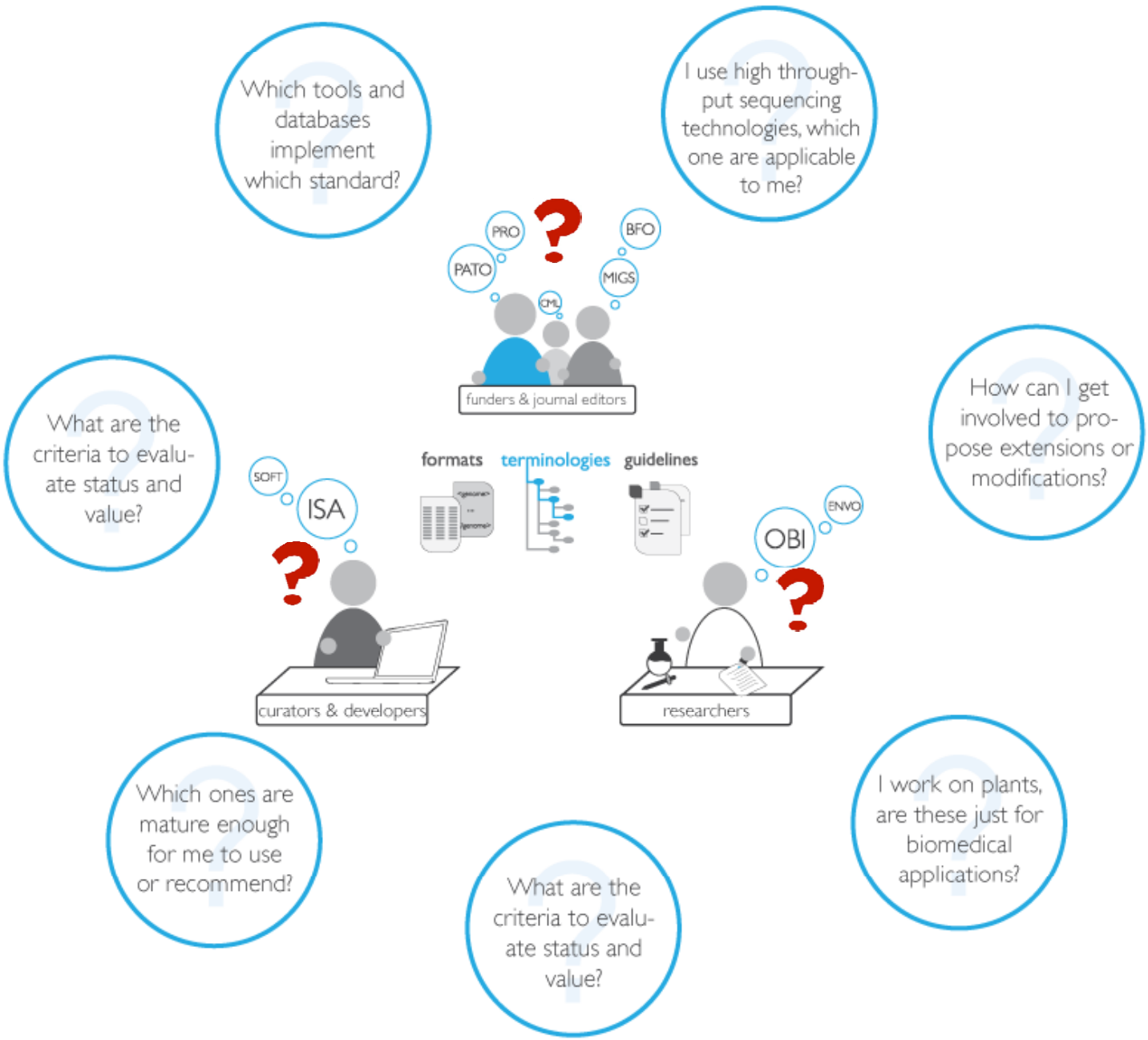






Databases, annotation, curation tools

But how much do we know about these standards?



_computational BIOLOGY

nature biotechnology (2008) Vol 26 No 8

COMMENTARY

Promoting coherent minimum reporting guidelines for biological and biomedical investigations: the MIBBI project

Chris F Taylor[*1,2], Dawn Field[2,3], Susanna-Assunta Sansone[1,2], Jan Aerts[4], Rolf Apweiler[1], Michael Ashburner[5], Catherine A Ball[6], Pierre-Alain Binz[7,8], Molly Bogue[9], Tim Booth[2], Alvis Brazma[1], Ryan R Brinkman[10], Adam Michael Clark[11], Eric W Deutsch[12], Oliver Fiehn[13], Jennifer Fostel[14], Peter Ghazal[15], Frank Gibson[16], Tanya Gray[2,3], Graeme Grimes[15], John M Hancock[17], Nigel W Hardy[18], Henning Hermjakob[1], Randall K Julian Jr[19], Matthew Kane[20], Carsten Kettner[21], Christopher Kinsinger[22], Eugene Kolker[23,24], Martin Kuiper[25], Nicolas Le Novère[1], Jim Leebens-Mack[26], Suzanna E Lewis[27], Phillip Lord[16], Ann-Marie Mallon[17], Nishanth Marthandan[28], Hiroshi Masuya[29], Ruth McNally[30], Alexander Mehrle[31], Norman Morrison[2,32], Sandra Orchard[1], John Quackenbush[33], James M Reecy[34], Donald G Robertson[35], Philippe Rocca-Serra[1,36], Henry Rodriguez[22], Heiko Rosenfelder[31], Javier Santoyo-Lopez[15], Richard H Scheuermann[28], Daniel Schober[1], Barry Smith[37], Jason Snape[38], Christian J Stoeckert Jr[39], Keith Tipton[40], Peter Sterk[1], Andreas Untergasser[41], Jo Vandesompele[42] & Stefan Wiemann[31]

BBSRC bioscience for the future

NATURAL ENVIRONMENT RESEARCH COUNCIL

POLICYFORUM

Science
(2009), Vol 326, 234-236

MEGASCIENCE

'Omics Data Sharing

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biosharing
www.biosharing.org

biosharing.org

Standards, Policies and Communication

www.biosharing.org

BioSharing works at the global level to **build stable linkages** between **journals**, **funders**, implementing data sharing policies, and well-constituted **standardization efforts** in the biosciences domain, to expedite the communication and the production of an integrated standards-based framework for the **capture and sharing of high-throughput genomics and functional genomic bioscience data.**

We work with other organisations to

1. develop **catalogues** to centralize **bioscience data policies** and **reporting standards**
   - enrich these progressively by linking to other related portals and resources to serve those seeking information on systems serving or implementing the standards;
2. moderate a **communication forum** for **funders** and **stakeholders**
   - promote mutual support and cross-project activities to ensure the difference among the policies and standards do not impede seamless interoperability of the data.

POLICIES

A catalogue of data preservation, management and sharing policies from international funding agencies and regulators.

STANDARDS

A catalogue of reporting standards (minimum reporting guidelines, exchange formats and terminologies) and organizations that develop these.

RECENT NEWS

BioSharing attends the BioHackathon 2011 - Focus on Linked Data in life science: http://t.co/5Erq0PG
12 days ago

BioSharing: Report of the BMC-led Publishing Open Data Working Group meeting - now available: http://t.co/spUpGh5
24 days ago

Read more on our blog...

in partnership with

BioMed Central The Open Access Publisher

BioMed Central and the journal **BMC Research Notes** proudly support BioSharing and its catalogue of domain-specific data standards.

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Standards, Policies and Communication

POLICIES

A prototype catalogue that centralizes bioscience data policies and plans. The ent
the relevant submission form.

ORGANISATION	ROLE	P		
Biotechnology and Biological Sciences Research Council	funding body			
Cancer Research UK	funding body			
Center for Drug Evaluation and Research	regulator			
Department of Energy	funding body			
Economic and Social Research Council	funding body			
Engineering and Physical Sciences Research Council	funding body	EPSRC Policy Framework on Research Data	UK	2011
European Commission	funding body	Communication calling for uniform policies across Member Nations	EU	n/a
European Science Foundation	funding body	ESF mainly provides ""network"" funding, therefore researchers are expected to follow the policies of the national agencies that directly provide research funding.	EU	n/a
Genome Canada	funding body	Genome Canada Data Release and Resource Sharing Policy	US	2008 (since 2005)
Gordon and Betty Moore Foundation	funding body	GBMF Data Sharing Philosophy and Plan	US	2008 (since 2005)
Medical Research Council	funding body	MRC Data Sharing and Preservation Policy	UK	2006
multiple organizations	funding bodies; research institutes; charitable foundations; international organisations	Sharing research data to improve public health: joint statement of purpose	UK; US; DE; NZ; FR; AU; global	2011
National Institute of Health	funding body	NIH Data Sharing Policy	US	2003
National Science Foundation	funding body	NSF Data Sharing Policy and Data Management Plan Requirements	US	2001
Natural Environmental Research Council	funding body	NERC Data Policy	UK	2008 (since 1996)
Wellcome Trust	funding body	WT Policy on Data Management and Sharing	UK	2010 (since 2007)
Wellcome Trust Sanger Institute	research institute	Data Sharing Policy and Guidelines	UK	2009 (since 1998)

nature precedings
Pre-publication research and preliminary findings

0 votes

Wellcome Trust Policy on Data Management and Sharing

David Carr

The Wellcome Trust's policy statement on data management and sharing, which was originally published in January 2007 and revised in August 2010.
Received 07 June 2011 15:06 UTC; Posted 07 June 2011

Posted to: Genetics & Genomics, Bioinformatics

0 votes

Information and Data Sharing Policy, Genomic Science Program, DOE

Susan Gregurick

The Office of Biological and Environmental Research (OBER) will require that all publishable information resulting from GTL funded research must conform to community recognized standard formats whe...
Received 19 May 2011 15:28 UTC; Posted 19 May 2011

Posted to: Genetics & Genomics

biosharing.org

Standards, Policies and Communication

A catalogue of data sharing resources that (collaboratively) works to:

2. **Centralizes** community-developed **bioscience standards**, linking to:
   - data sharing, preservation and management policies;
   - other portals *e.g.* NCBO's BioPortal, OBOfoundry;
   - related open access, published material *e.g.* BioMedCentral, Nature Precedings, F1000;
   - lists of tools and databases implementing the standards *e.g.* NIF, Links Directory, Biositemaps

2. **Identifies** and maintain a set of (implicit) **criteria for assessing *usability* and *popularity*** of the standards, including:
   - implementations by tools and databases
   - availability of standards-compliant, public datasets
   - relations among standards;

3. **Fosters** **communication** among groups, in particular to:
   - address overlaps and duplication of efforts and enhance interoperability of standards;
   - produce 'best practice' guidelines starting new, or contributing to existing efforts.

A CATALOGUE OF STANDARDS

You can **sort** columns and **browse** the reporting guidelines content, or you can view ***all the standards***, or terminological artifacts or exchange formats only; or go back to the **catalogue main page**.

ACRONYM	FULL NAME	TYPE	DOMAIN	VERSION	PUBLICATION	CONTACT
BioPAX	Biological Pathway Exchange	exchange format	biological pathway	Level 3	Demir et al; Nat Biotech; 2010	BioPAX community
CellML	Cell Markup Language	exchange format	cell modelling	v 1.1	Cuellar et al; Simulation; 2003	CellML community
SBML	System Biology Markup Language	exchange format	computational modelling (biochemical reaction networks)	level 3, v 1 core	Hucka et al; Bioinformatics; 2003	SMBL community
FuGE	Functional Genomics Experiment Markup Language	exchange format	experimental description	v 1.0	Jones et al; Nature Biotech; 2007	FuGE working group
ISA-Tab	Investigation/Study/Assay Tabular	exchange format	experimental description	v 1.0	Rocca-Serra et al; Bionformatics; 2010	ISA working group
MINiML	MIAME Notation in Markup Language	exchange format	experimental description (functional genomics)	v 1.0		GEO
SOFT	Simple Omnibus Format in Text	exchange format	experimental description (functional genomics)	not versioned		GEO
GCDML	Genomic Contextual Data Markup Language	exchange format	experimental description (genomics)	v 2.0.0 beta	Kottmann et al; OMICS; 2008	GSC
MAGE-Tab	MicroArray Gene Expression Tabular	exchange format	experimental description (transcriptomics)	v 1.0	Rayner et al; BMC Bioinformatics; 2006	FGED Society
GelML	Gel Electrophoresis Markup Language	exchange format	gel electrophoresis	v 1.0	Gibson et al; Proteomics; 2010	HUPO PSI Protein Separation working group
mzML	mz Markup Language	exchange format	mass spectrometry (proteomics)	v 1.1.0	Martens et al; Mol Cell Proteomics; 2011	HUPO PSI
MIABE	Minimum Information About a Bioative Entity	reporting guideline	bioactive entities	0.4		MIABE Working Group
MIPFE	Minimal Information for Protein Functional Evaluation	reporting guideline	biochemistry	v 01	de Marco; Microbial Cell Factories; 2008	MIPFE working group
BioCoreDB	Core Attributes of Biological Databases	reporting guideline	biological databases	not specified	Gaudet et al; NAR; 2010	Biocuration Society
GIATE	Guidelines for Information About Therapy Experiments	reporting guideline	cancer therapy experiments	not specified	Yong et al; Protein Eng Des Sel; 2009	Antibody Society
MIRIAM	Minimal Information Required In the Annotation of biochemical Models	reporting guideline	computational modeling	not specified	Le Novère et al; Nature Biotech; 2005	BioModels.net

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GCDML						
MAGE-Tab						
GelML						
mzML						
MIABE						
MIPFE						
BioCoreDB						
GIATE	About Therapy Experiments	guideline	experiments	not specified	Eng Des Sel; 2009	Antibody Society
MIRIAM	Minimal Information Required In the Annotation of biochemical Models	reporting guideline	computational modeling	not specified	Le Novère et al; Nature Biotech; 2005	BioModels.net

SBML

System Biology Markup Language

ID
bsg-000052

TYPE
exchange format

DOMAIN(S) COVERED
computational modelling (biochemical reaction networks)

PUBLICATION(S)
Hucka et al; Bioinformatics; 2003

ORGANIZATION
SMBL community

MAIN CONTACT(S)

Like

Tweet 0

» Login or register to post comments

Classify the domain(s) the standards cover (*in progress*)

ACRONYM	FULL NAME	TYPE	DOMAIN	VERSION	PUBLICATION	CONTACT
BioPAX	Biological Pathway Exchange	exchange format	biological pathway			BioPAX community
CellML	Cell Markup Language	exchange format	cell modelling			CellML community
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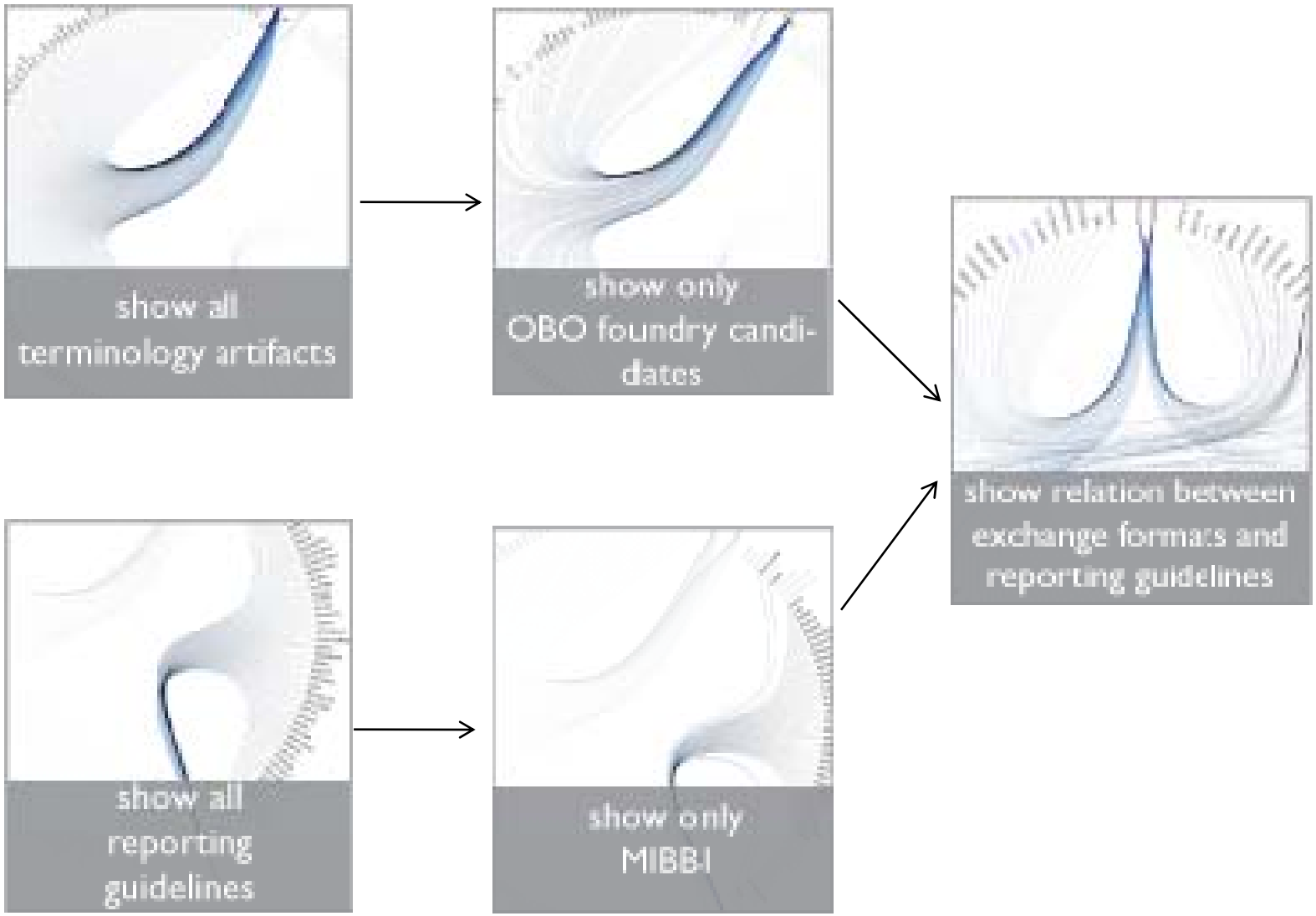
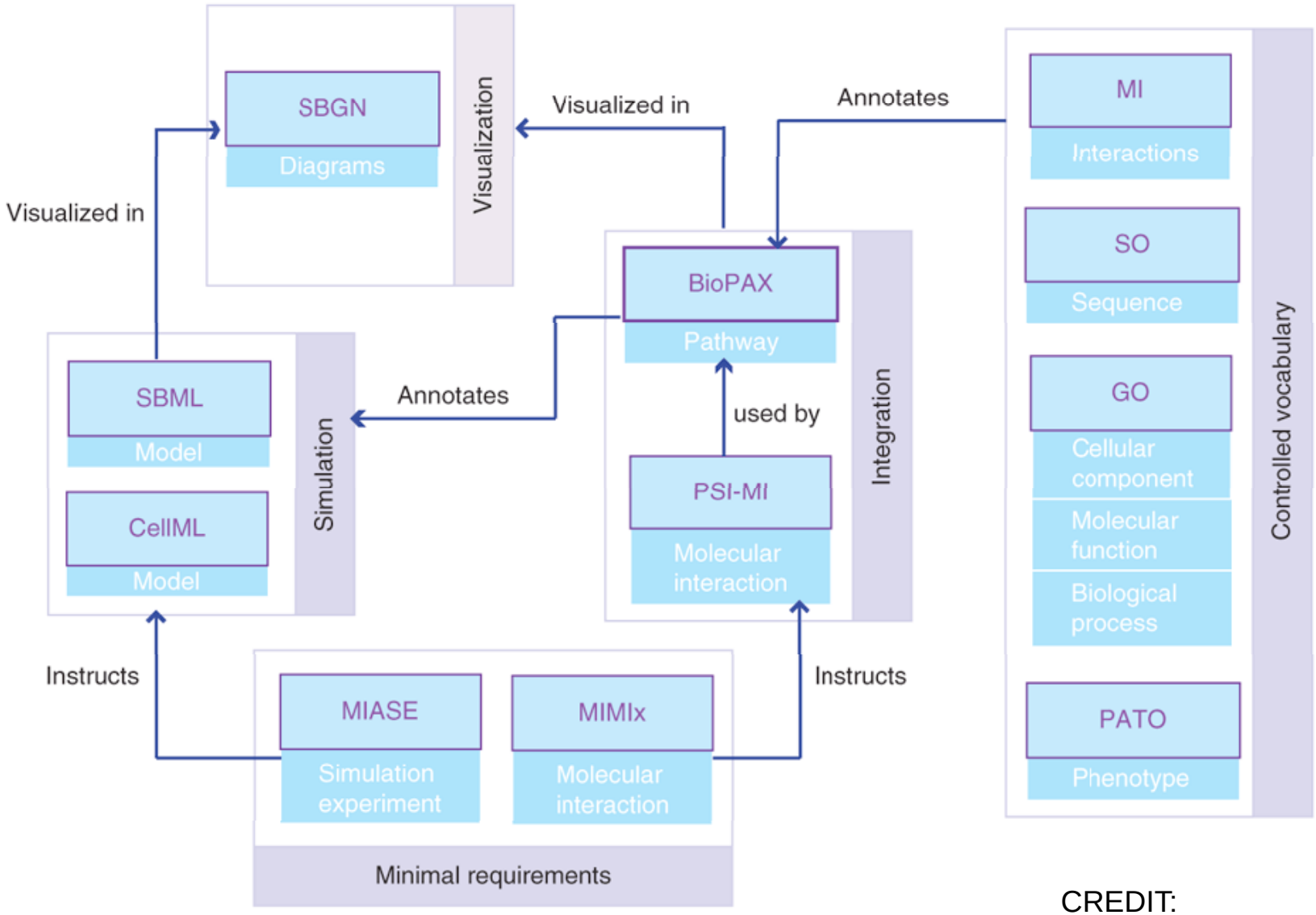
Define groups and relations among standards (*in progress*)

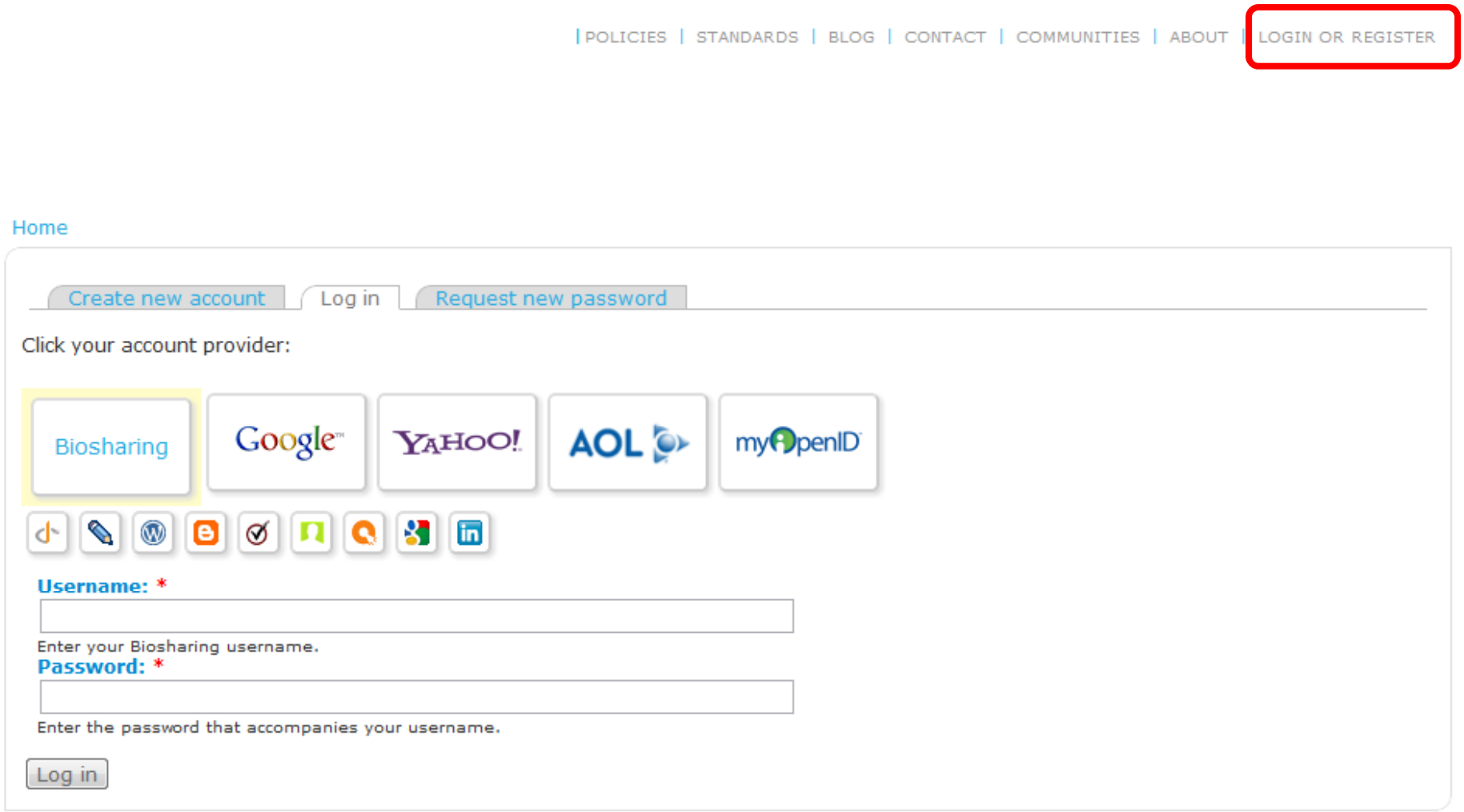




The relationship among popular standard formats for pathway information BioPAX and PSI-MI are designed for data exchange to and from databases and pathway and network data integration. SBML and CellML are designed to support mathematical simulations of biological systems and SBGN represents pathway diagrams.

CREDIT:
"The BioPAX community standard for pathway data sharing." **Nature Biotechnology** 28, 2010.

User accounts for editing and updates (*soon active*)



biosharing.org

Standards, Policies and Communication

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The Open Access Publisher

BioMed Central and the journal **BMC Research Notes** proudly support BioSharing and its catalogue of domain-specific data standards.

EDITORIAL

nature genetics

NATURE GENETICS | VOLUME 43 | NUMBER 6 | JUNE 2011

Standard cooperating procedures

Community review of proposed standards is a good strategy to broaden consensus on ways to conduct principled, ethical and efficient research. We are pleased to welcome new partners for our *Nature Precedings* Data Standards initiative and suggest other standards that could be usefully presented as citable preprints.

Our community approach extends not only to our own site but to those of other publishers, funders, informaticians and research consortia. In this respect, we are pleased to work with the Biosharing project

Conclusions

- The era of real data sharing is just beginning…
- Self-organization by the scientific community can pay dividends (i.e. consensus building, large-scale co-ordination)
  - Standards are keys to unlocking data
  - Group thinking overcomes the tragedy of the commons
- Many communities and ‘solutions’
  - Should be interlocking
  - BioSharing – aims to drive cross-community collaborations

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Standards, Policies and Communication

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