standards, policies and communication in bioscience

Dawn Field\textsuperscript{1,2}
Susanna-Assunta Sansone\textsuperscript{1}
Philippe Rocca-Serra\textsuperscript{1}

\textit{also on behalf of our international partners and collaborators}

2. NERC Environmental Bioinformatics Data Centre, UK

COMBINE 2011, Heidelberg, Germany
DATA SHARING


Minimal requirements
mibbi
Terminological artefacts
OBO
Syntax, e.g.

Journals e.g.

biosharing

Technologies e.g.

Public repositories
Data sharing policies (funders)

Data management software, e.g.
isainfrastructure

Open society, industry initiatives e.g.

NEBC

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

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

<phenotype>
<environmental context>
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 innovation (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

Innovation through Collaboration
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

Specification projects

Checklists

Shared descriptors

Checklist specific descriptors

Applicable environmental packages (measurements and observations)

MIGS

MIMS

MIMARKS

New checklists

i.e. descriptors specific to sequencing methodology

i.e. details of organisms

i.e. details of sampling

i.e. details of PCR and genes

Air

Host-associated

Human-gut

Soil

Water

e.g. pan-genomes
Minimum information about a marker gene sequence (MIMARKS) and minimum information about any (x) sequence (M1xS) specifications

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.:
Growing number of standards and interest in their use....

Data preservation, management submission and sharing policies

Source: MIBBI, EQUATOR

Source: BioPortal

Source: MIBBI, EQUATOR

Databases, annotation, curation tools


FUNDING BODY
Economic and Social Research Council (ESRC)
Natural Environment Research Council (NERC)
National Science Foundation (NSF)
National Institute of Health (NIH)
Gordon and Betty Moore Foundation (GBMF)
Genome Canada

FDA

Data formats

+ 50

Estimated

+ 250

Source: BioPortal

+ 150

Source: MIBBI, EQUATOR

terminologies

guidelines

Nature Research Notes

A call for BMC Research Notes contributions promoting best practice in data standardization, sharing and publication

Call for Papers
Special Issue on Standards in Practice

Read more here!
But how much do we know about these standards?

- Which tools and databases implement which standard?
- I use high throughput sequencing technologies, which one are applicable to me?
- What are the criteria to evaluate status and value?
- Which ones are mature enough for me to use or recommend?
- What are the criteria to evaluate status and value?
- I work on plants, are these just for biomedical applications?
- How can I get involved to propose extensions or modifications?
Promoting coherent minimum reporting guidelines for biological and biomedical investigations: the MIBBI project

Chris F Taylor1,2, Dawn Field2,3, Susanna-Assunta Sansone1,2, Jan Aerts4, Rolf Apweiler1, Michael Ashburner5, Catherine A Ball6, Pierre-Alain Binz7,8, Molly Bogue9, Tim Booth2, Alvis Brazma1, Ryan R Brinkman10, Adam Michael Clark11, Eric W Deutsch12, Oliver Fiehn13, Jennifer Fostel14, Peter Ghazal15, Frank Gibson16, Tanya Gray2,3, Graeme Grimes15, John M Hancock17, Nigel W Hardy18, Henning Hermjakob1, Randall K Julian Jr19, Matthew Kane20, Carsten Kettner21, Christopher Kinsinger22, Eugene Kolker23,24, Martin Kuiper25, Nicolas Le Novère1, Jim Leebens-Mack26, Suzanna E Lewis27, Phillip Lord16, Ann-Marie Mallon17, Nishanth Marthandan28, Hiroshi Masuya29, Ruth McNally30, Alexander Mehrle31, Norman Morrison2,32, Sandra Orchard1, John Quackenbush33, James M Reecy34, Donald G Robertson35, Philippe Rocca-Serra1,36, Henry Rodriguez22, Heiko Rosenfelder31, Javier Santoyo-Lopez15, Richard H Scheuermann28, Daniel Schober1, Barry Smith37, Jason Snape38, Christian J Stoeckert Jr39, Keith Tipton40, Peter Sterk1, Andreas Untergasser41, J. Vandesompele42 & Stefan Wiemann31
'Omics Data Sharing

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

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/5ErqOPG
12 days ago

BioSharing: Report of the BMC-led Publishing Open Data Working Group meeting - now available:
http://t.co/spLpGh5
24 days ago

Read more on our blog...
### Standards, Policies and Communication

#### POLICIES

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

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<thead>
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#### 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 when...

*Received 19 May 2011 15:28 UTC; Posted 19 May 2011*

*Posted to: Genetics & Genomics*

#### 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*

#### EPSRC Policy Framework on Research Data

UK | 2011

#### Communication calling for uniform policies across Member Nations

EU | n/a

#### 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 Data Release and Resource Sharing Policy

US | 2008 (since 2005)

#### GBMF Data Sharing Philosophy and Plan

US | 2008 (since 2005)

#### MRC Data Sharing and Preservation Policy

UK | 2006

#### Sharing research data to improve public health: joint statement of purpose

UK; US; DE; NZ; FR; AU; global | 2011

#### NIH Data Sharing Policy

US | 2003

#### NSF Data Sharing Policy and Data Management Plan Requirements

US | 2001

#### NERC Data Policy

UK | 2008 (since 1996)

#### WT Policy on Data Management and Sharing

UK | 2010 (since 2007)

#### Data Sharing Policy and Guidelines

UK | 2009 (since 1998)
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.

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## A Catalogue of Standards

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### SBML

**System Biology Markup Language**

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**PUBLICATION(S)**

- Hucka et al; Bioinformatics; 2003

**ORGANIZATION**

- SMBL community

**MAIN CONTACT(S)**

- GEO

» Login or register to post comments
Classify the domain(s) the standards cover *(in progress)*

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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:
User accounts for editing and updates (soon active)
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
Acknowledgements

GSC Funding

Coordination, workshops, working groups, infrastructure and exchange visits

Additional workshop funds

Local Hosts of GSC workshops

Sponsors of GSC 9 and GSC 10
THE TEAM

Website:  
Eamonn Maguire (University of Oxford, UK)  
Philippe Rocca-Serra (University of Oxford, UK)  
Annapaola Santarsiero (University of Oxford, UK)

Content:  
Susanna Sansone (University of Oxford, UK)  
Dawn Field (NERC-NEBC, UK)  
Philippe Rocca-Serra (University of Oxford, UK)  
Chris Taylor (EMBL-EBI, UK)

with contributions from members of our communities and individuals.