

LIBER Webinar: A Data Citation Roadmap for Scholarly Data Repositories

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1. Importance

Data should be considered legitimate, citable products of research. Data citations should be accorded the same importance in the scholarly record as citations of other research objects, such as publications^[1].

2. Credit and Attribution

Data citations should facilitate giving scholarly credit and normative and legal attribution to all contributors to the data, recognizing that a single style or mechanism of attribution may not be applicable to all data^[2].

3. Evidence

In scholarly literature, whenever and wherever a claim relies upon data, the corresponding data should be cited^[3].

4. Unique Identification

A data citation
community

Joint Declaration of Data Citation Principles

5. Access

Data citations
are necessary

JDDCP endorsed by over 100 scholarly organizations

materials, as

6. Persistence

Unique identifiers, and metadata describing the data, and its disposition, should persist -- even beyond the lifespan of the data they describe^[6].

7. Specificity and Verifiability

Data citations should facilitate identification of, access to, and verification of the specific data that support a claim. Citations or citation metadata should include information about provenance and fixity sufficient to facilitate verifying that the specific timeslice, version and/or granular portion of data retrieved subsequently is the same as was originally cited^[7].

8. Interoperability and Flexibility

Data citation methods should be sufficiently flexible to accommodate the variant practices among communities, but should not differ so much that they compromise interoperability of data citation practices across communities^[8].

Achieving human and machine accessibility of cited data in scholarly publications

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Direct deposition and citation of primary research data

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Data Citation Implementation Pilot (DCIP)

The screenshot shows the bioCADDIE website homepage. At the top left is the bioCADDIE logo with the tagline "biomedical and healthCAre Data Discovery Index Ecosystem". To the right is a login form with fields for "E-mail or username *" and "Password *", a "Log in" button, and links for "Create new account" and "Request new password". Below the header is a navigation menu with items: HOME, ABOUT, GROUPS, PARTICIPATE, NEWS, EVENTS, RESOURCES, RELATED LINKS, and CONTACT. The main banner features a server room background with the bioCADDIE logo. Below the banner are three columns of content:

- ANNOUNCEMENTS:** Includes links for "The DataMed's DATS Model Annotated With Schema.org - Webinar", "BioCADDIE Repository Workshop June 23, 2016", "Sign Up For Access To DataMed (BioCADDIE Prototype)", and "Pilot Project On Harvester Announcement".
- ACCESS DATAMED:** Features a monitor displaying the "DataMed" logo with a mouse cursor pointing at it.
- METADATA STANDARDS:** Shows a diagram of a "DataMed" database cylinder with fields: ID, Org, Repo, PMID, ISSN, and Date.

At the bottom center is the FORCE11 logo with the tagline "The Future of Research Communications and e-Scholarship".

Led by Tim Clark, Maryann Martone, Jeffrey Grethe

Participants



SPRINGER NATURE

*And
you!*



Data Citation Generic Example

example of a data citation as it would appear *in a reference list**

Principle 2: Credit and Attribution (e.g. authors and data repositories).

*Note that the format is not intended to be defined with this example, as formats will vary across publishers and communities [Principle 8: Interoperability and flexibility].

Author(s), Publication Date, Title, Data Repository or Archive, [Dataset],
Persistent Identifier, Version

Principle 4: Unique Identifier (e.g. DOI, Handle).

Principle 5, 6 Access, Persistence: A persistent link to a landing page with metadata and access information.

Principle 7: Version and granularity (e.g. a version number or timestamp)
In addition, access to versions or subsets should be available from the landing page.

Roadmap for Scientific Publishers

GROUP
LEADER

Helena Cousijn

Elsevier



GROUP
LEADER

Amye Kenall

SpringerNature



- Participants: Elsevier, SpringerNature, eLife, PLOS, Frontiers, Wiley, and others
- In-person Workshop July 22, 2016 in London, hosted by SpringerNature, continuing work via Telcons.
- Roadmap as a set of actions for different steps of research article: pre-submission, submission, production, and publication.

Cousijn, H., Kenall, A., Ganley, E., Harrison, M., Kernohan, D., Murphy, F., ... Clark, T. (2017). A Data Citation Roadmap for Scientific Publishers, *BiorXiv*. <https://doi.org/10.1101/100784>

Publishers Roadmap

Specify how to format Data Citations

There are several ways data can be linked from (“cited” in) scholarly articles:

- reference lists,
- data availability statements and
- in-text mention of accession numbers.

While a globally unique, machine actionable persistent identifier is needed for all three scenarios, citation metadata (authors, title, publication date, etc.) are specifically recommended for reference lists.

From: <https://doi.org/10.1101/100784>

Leads: Martin Fenner (DataCite), Merce Crosas (Dataverse)



Roadmap for Data Repositories

Repositories Roadmap Approach & Status

Focus on how data repositories can provide metadata required for data citation to manuscript authors and publishers. Data repository landing page plays central role.

In-person workshop June 22, 2016 in San Diego.

Eleven recommendations published in December 2016. Now collecting feedback and endorsements for implementation.

Fenner, M., Crosas, M., Grethe, J., Kennedy, D., Hermjakob, H., Rocca-Serra, P., ... Clark, T. (2016). A Data Citation Roadmap for Scholarly Data Repositories, *BiorXiv*. <https://doi.org/10.1101/097196>

Repositories Roadmap Building Blocks

Persistent
Identifier

Landing
Page

Documentation
and Support

Metadata

schema.org

Recommendations: Required

1. All datasets intended for citation must have a **globally unique persistent identifier** that can be expressed as unambiguous URL.
2. Persistent identifiers for datasets must support **multiple levels of granularity**, where appropriate.
3. This persistent identifier expressed as URL must resolve to a **landing page** specific for that dataset.
4. The persistent identifier must be **embedded in the landing page** in machine-readable format.
5. The repository must provide **documentation and support** for data citation.

Globally Unique Persistent Identifier

- **Persistent method for identification:** Metadata must persist even beyond the data it describes
- **Machine actionable:** PID resolvable as an HTTP URI
- **Globally Unique:** Must use a prefix if ID only unique within a database
- **Widely used by a community:** For example, in life sciences accession numbers (not DOIs) are widely used.

Multiple Levels of Granularity

- Support citation of a specific version, as well as citation of unspecified version

Kaminer, Wendy; Moore, Elizabeth, 2008, "Women Volunteering, 1984", [hdl:1902.1/00897](https://doi.org/10.1902.1/00897), Harvard Dataverse, V3

 Cite Dataset ▾

 Learn about Data Citation Standards.

- In some cases, data is uniquely identified as a collection of many items (example in next slide)

Image collection 10.18116/C6H02X

UMass/CANDI Image Attribution Framework, 2016

DOI 10.18116/C6H02X

[DataCite XML](#)

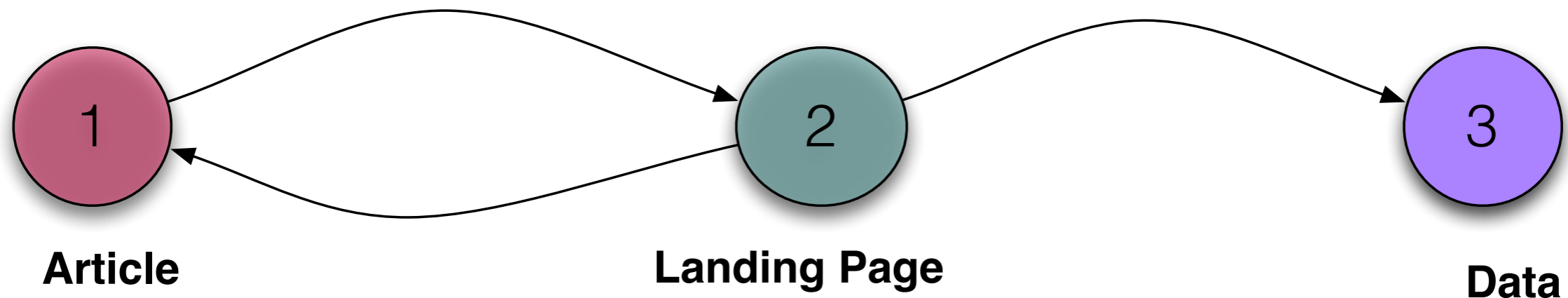
If you are citing this data because of one of the references below, please cite the reference of interest. If you are citing this data in its own right (independent of any of the references below), we suggest the following citation (APA): Breeze, JL, Caplan, D, Caviness, VS, Frazier, JA, Giuliano, AJ, Haselgrove, C, ... Zablotsky, B. (2016). Image collection 10.18116/C6H02X. UMass/CANDI Image Attribution Framework. <http://dx.doi.org/10.18116/C6H02X>.

[Refine/download](#)

Description	PubMed ID	Publication DOI	Funder	Authors
This collection contains all images (structural scans and segmentations) for female subjects age 10 and above from the Internet Brain Segmentation Repository and CANDI Share Schizophrenia Bulletin 2008 data sets. It was created as a demonstration collection.			NIMH	Honor, Leah Haselgrove, Christian Frazier, Jean A Kennedy, David N

Source projects	10.18116/C6WC71 10.18116/C6159Z
Source images	10.18116/C67P43 10.18116/C63W25 10.18116/C6059N 10.18116/C6VC7Q 10.18116/C66P4S 10.18116/C6301T 10.18116/C6759R

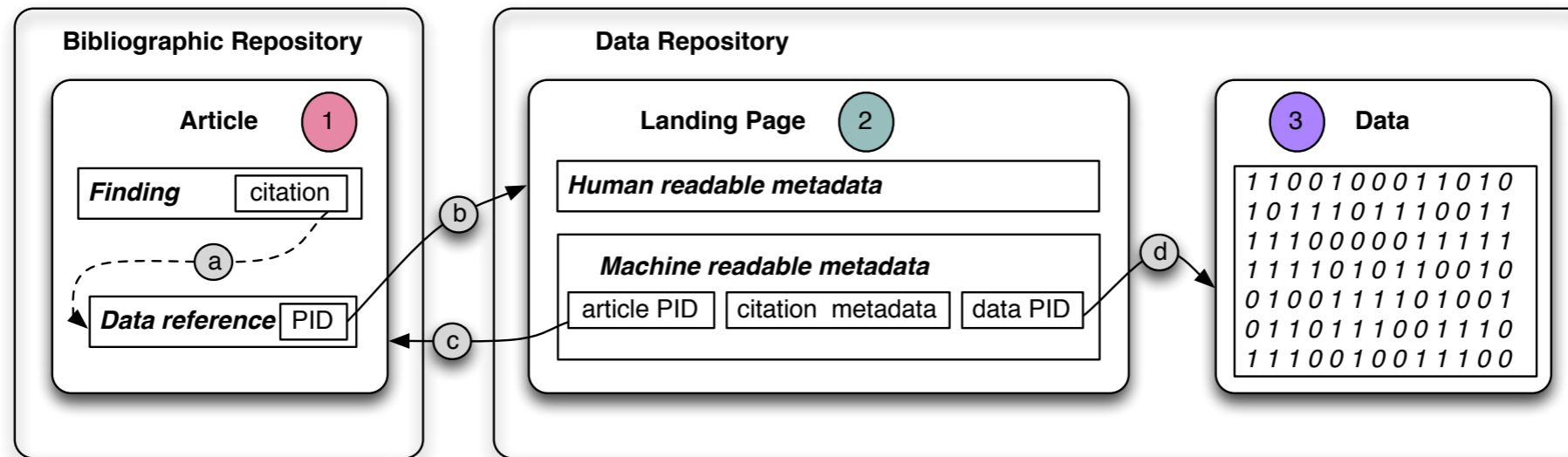
Persistent Identifier resolves to Landing Page



Expectation is that by default the persistent identifier as URL resolves to a human- and machine-readable page with more information.

Use content negotiation to resolve the persistent identifier as URL to machine-readable metadata, or to the content itself.

Persistent Identifier embedded in the Landing Page



Human Readable

Cite this Dataset

Bilokapic, S; Schwartz, TU. 2015. "X-Ray Diffraction data for: Nup37-Nup120 full-length complex from Schizosaccharomyces pombe. PDB Code 4FHN", SBGrid Data Bank, V1,

<http://dx.doi.org/10.15785/SBGRID/179>.

[Download Citation](#)

Machine Readable

```
<meta name="DC.identifier" content=  
"https://doi.org/10.15785/SBGRID/179" />
```

Documentation and Support

- The repository must provide documentation about how data should be cited, how metadata can be obtained, and who to contact for more information.
- The DCIP FAQ Expert Group has generated example documentation for data repositories, which will be provided on a dedicated website.

Recommendations: Recommended

6. The landing page should include **metadata required for citation** – and ideally also metadata helping with discovery – in human-readable and machine-readable format.
7. The machine-readable metadata should use **schema.org** markup in **JSON-LD** format.
8. Metadata should also be made available via **HTML meta** tags to facilitate use by reference managers.
9. *Metadata may be made available for download in Bibtex or other standard bibliographic format.*

Citation Metadata

Citation Metadata	Dublin Core^a	Schema.org^b	DataCite^c	DATS^d
Dataset Identifier	identifier	@id*	identifier	identifier
Title	title	name	title	title
Creator**	creator	author	creator	creator
Data repository or archive	publisher	publisher	publisher	publisher
Publication Date	date	datePublished	publicationYear	date
Version	<i>not available</i>	version	version	version
Type	type	type	resourceTypeGeneral	type


Metadata on Landing Pages: For Humans

[Files](#)


[Metadata](#)

[Terms](#)

[Versions](#)

 [Export Metadata](#) ▾

Citation Metadata

Dataset Persistent ID	hdl:1902.1/00341
Publication Date	2010-04-01
Title	Careers, Marriage, Identity, and Feminism: Women's Life-Choices in the Seventies, 1975
Other ID	00341
Author	Charlotte Weissberg (Deceased)
Contact	 Use email button above to contact.
Description	This study examined the personalities of a group of college women and their interactions with social institutions. The focus was on the relationship between the changes in values and ideas brought about by the women's movement and the personal development of young women.

Metadata on Landing Pages: Machine-Readable

The landing page should include metadata required for citation – and ideally also metadata helping with discovery.

Important for persistent identifiers that don't provide citation metadata in a central searchable index.

Less important if metadata also available elsewhere in standardized workflow, e.g. DOIs.

Use by reference managers to fetch citation metadata.

Used by publishers to validate data citations.

Used by indexers for discovery.

Metadata on Landing Pages: schema.org

Schema.org is community activity to promote structured data on the internet, started in 2011 by Google, Microsoft, Yahoo, and Yandex.

Schema.org can be displayed as microdata or RDFa embedded in HTML, or via JSON-LD. The expert group recommends JSON-LD as the preferred format.

Citation metadata are fully supported by schema.org (see earlier citation metadata table), several groups are extending support for more specialized metadata, including <http://bioschemas.org> in the life sciences.

DataCite provides citation metadata in schema.org/JSON-LD format via DOI content negotiation.

Schema.org Example

Available via DOI Content Negotiation

```
curl -LH "Accept: application/vnd.schemaorg.ld+json" https://doi.org/10.18116/c6h02x
```

```
{
  "@context": "http://schema.org",
  "@type": "Dataset",
  "@id": "https://doi.org/10.18116/c6h02x",
  "additionalType": "Imaging Data",
  "name": "Image collection 10.18116/C6H02X",
  "url": "http://iaf.virtualbrain.org/search/reconstitute/2ccda04d",
  "author": [{
    "@type": "Person",
    "givenName": "JL",
    "familyName": "Breeze"
  }, ...
```


Metadata on Landing Pages: HTML Meta Tags

```
<meta name="DC.identifier" content="doi:10.1594/PANGAEA.727206"  
scheme="DCTERMS.URI" />  
<meta name="DC.title" content="Landings of European lobster (Homarus  
gammarus) and edible crab (Cancer pagurus) from 1615 to 2009, Helgoland,  
North Sea" />  
<meta name="DC.creator" content="Schmalenbach, Isabel" />  
<meta name="DC.creator" content="Mehrtens, Folke" />  
<meta name="DC.creator" content="Janke, Michael" />  
<meta name="DC.creator" content="Buchholz, Friedrich" />  
<meta name="DC.publisher" content="PANGAEA" />  
<meta name="DC.date" content="2011-01-28" scheme="DCTERMS.W3CDTF" />  
<meta name="DC.type" content="Dataset" />
```

Recommendations: Optional

9. **Content negotiation** for `schema.org/JSON-LD` and other content types may be supported so that the persistent identifier expressed as URL resolves directly to machine-readable metadata.
10. **HTTP link headers** may be supported to advertise content negotiation options

Content Negotiation for Machine Readable Metadata

Example Image Attribution Framework (IAF)

```
curl -H "Accept: application/xml"  
http://iaf.virtualbrain.org/lp/10.18116/C6WC71
```

Examples DataCite

```
curl -LH "Accept: application/ld+json" http://doi.org/10.5061/DRYAD.8290N
```

```
curl -LH "Accept: application/vnd.citationstyles.csl+json"  
http://doi.org/10.5061/DRYAD.8290N
```

HTTP Link Headers

Example

```
curl -I https://search.datacite.org/works/10.5061/dryad.q447c/3
```

```
HTTP/1.1 200 OK
```

```
Content-Type: text/html;charset=utf-8
```

```
Status: 200 OK
```

```
Link: <https://doi.org/10.5061/dryad.q447c/3> ; rel="identifier",  
      <https://doi.org/10.5061/dryad.q447c/3> ; rel="describedby" ;  
      type="application/vnd.datacite.datacite+xml",  
  
      <https://doi.org/10.5061/dryad.q447c/3> ; rel="describedby" ;  
      type="application/ld+json",  
      <https://doi.org/10.5061/dryad.q447c/3> ; rel="describedby" ;  
      type="application/vnd.citationstyles.csl+json",  
      <https://doi.org/10.5061/dryad.q447c/3> ; rel="describedby" ;  
      type="application/x-bibtex"
```

Metadata in Standard Bibliographic Format

Example BibTex

```
@data{25240_2014,  
  author = {Figueiredo, Dalson and Rocha, Enivaldo and Paranhos, Ranulfo  
and Alexandre, José},  
  publisher = {Harvard Dataverse},  
  title = {How can soccer improve statistical learning?},  
  year = {2014},  
  doi = {10.7910/DVN/25240},  
  url = {https://doi.org/10.7910/DVN/25240}  
}
```

Example RIS

```
TY - DATAT1 - How can soccer improve statistical learning?  
A1 - Figueiredo, Dalson  
A1 - Rocha, Enivaldo  
A1 - Paranhos, Ranulfo  
A1 - Alexandre, José  
Y1 - 2014  
DO - 10.7910/DVN/25240  
UR - https://doi.org/10.7910/DVN/25240  
ER -
```

Tracking Data Citations

- The Research Data Alliance (RDA) Scholarly Link Exchange Working Group (Scholix) is working on a framework for standardizing the exchange of article/data links between scholarly infrastructure providers.
- The group has broad community participation from repositories, publishers and service providers.
- If you want to participate please contact one of the co-chairs Adrian Burton (ANDS), Wouter Haak (Elsevier), Paolo Manghi (OpenAIRE), or Martin Fenner (DataCite).

Next Steps

- We are in the process of collecting community feedback regarding the recommendations.
- We have started to work with data repositories on endorsement and implementation of the recommendations.
- We will publish an updated recommendations paper incorporating feedback, endorsements and sample implementations.

Thanks

Martin Fenner & Mercè Crosas

DCIP Executive Team

Tim Clark, Harvard Medical School & MGH (co-Chair), Maryann Martone, Hypothesis & UCSD (co-Chair), Carole Goble, University of Manchester & ELIXIR, Jeffrey Grethe, UCSD & bioCADDIE, Jo McEntyre, EMBL-EBI & ELIXIR, Joan Starr, California Digital Library, Martin Fenner, DataCite, Simon Hodson, CODATA, Chun-Nan Hsu, UCSD

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