



Publisher Implementation Guide

v2.2.1 – June 2019

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Document Updates

Version 2.2.1 Updates:

- Terminology has been updated to “Open/Public”; not a requirement change, just a wording change.
- JATS 1.2 has been approved by NISO and ANSI in March 2019.

Version 2.2 Document Text & Structure Updates:

- The URLs in this doc have been verified and updated. Many have changed to https: from http: and the Crossref website has been significantly restructured so lots of URL updates and additions.
- This document has been restructured slightly to improve readability.
- A new section added to document current future topics and tasks related to NISO JATS XML and Crossref and CHORUS. So just possible future XML information.

Version 2.2 Funder Updates:

- URL for information about international funders that require open access added.

Version 2.2 CHORUS Updates:

- Information about the CHORUS Accessibility Audit has been added.
- The URL for CHORUS funder participant information has been added:
<https://www.chorusaccess.org/resources/chorus-funder-participants/>
- New URLs from the CHORUS website have been added to this document.
- New section added about CHORUS APAA and Publisher website markers.
- Website HTML metadata (Google Scholar) is a publisher problem so not CHORUS relevant yet; information added.
- The Funder-Specific Task of DOE prompt samples has been updated; not new functionality just updated documentation.

Version 2.2 Crossref Updates:

- Crossref Metadata deposit schema is now version 4.4.1: additions but not changes to metadata related to CHORUS. The funder metadata subschema (fundref.xsd) has not changed since 2013.
- Crossref recommended in 2017 that DOI URLs be changed from “http://dx.doi.org/” to “https://doi.org/” --- examples in this document updated.
- Crossref Open Funder Registry is now being updated monthly --- October 2018 statistics added to this document.
- Crossref Metadata examples were enhanced to show the syntax for multiple funding sources; not a new Crossref or CHORUS requirement, just info added to this doc.
- Crossref confirmed that metadata rejection due to possible errors has continued so no changes to that in this doc.
- Crossref Submission Log: example from Crossref of Publisher Submission Log notification of Crossref adding Funder ID by name identification.

Version 2.2 NISO JATS Updates:

- JATS 1.2 includes new vocabulary attributes. Does not include any plan for Intramural Funding. JATS 1.1 XML for Crossref Funding Metadata examples were updated.

INTRODUCTION

This document is designed to help publishers new to CHORUS plan and execute their implementation by providing background information, links to resources, commentary, and advice based on the CHORUS publishers' experience. From the CHORUS website, here is a summary of publisher implementation to support open/public access for research funded by CHORUS Funder participants:

Simple Guide to Participating in CHORUS: What Publishers Need To Do

1. Collect funder information (via your manuscript tracking system or by extracting from your articles) and map it to entries in the Crossref Open Funder Registry
2. Include funder information in deposits to Crossref
3. Make at least one version of your articles reporting on funded research openly/publicly accessible on your website, either Version of Record (VOR) or Accepted Manuscript (AM), with an appropriate embargo period
4. Choose a license for content reuse for each article reporting on funded research, either a common public license such as Creative Commons (CC) or a publisher proprietary license and register the license with CHORUS
5. Include license metadata in deposits to Crossref that identifies the openly/publicly accessible version, the reuse license, and the start date for open/public access commensurate with the selected embargo period
6. Include a URL for a full text version in deposits to Crossref and make it available to be harvested for indexing by funders from date of publication (funders will link back to you by the DOI and only harvest articles reporting on research that they funded)
7. Archive the AM or VOR at a recognized archive service (CLOCKSS or Portico)

And here are links to the CHORUS website for funder information:

<https://www.chorusaccess.org/resources/chorus-funder-participants/>

<https://www.chorusaccess.org/resource/us-agency-public-access-plans-details/>

<http://search.chorusaccess.org/funders>

CHORUS Website Publisher Admin Page

The CHORUS web site includes a Publisher Admin Page for each CHORUS member. Login information and Publisher Admin Page user documentation will be sent to each member by the CHORUS system administrator. If there are questions, contact support@chorusaccess.org.

The Publisher Admin Page includes the organization's contact details and important information for the CHORUS implementation:

- Public Access Reuse License URL
- APAA Markers
- Prompt Samples

These are discussed in this document.

IMPLEMENTATION CHOICE: AM or VOR for Open/Public Access

CHORUS Policy: *Publisher member must make at least one version of their articles reporting on U.S. federally funded research publicly accessible through their website (either Version of Record [VOR] or Accepted Manuscript [AM]) with a stated embargo period if applicable.*

The decision as to whether to make the VOR or the AM available after embargo is an important decision that impacts many of the CHORUS implementation components discussed in this document. It is primarily a business policy decision, but there may be technical issues depending on the publisher's current production process and systems.

For most hosting platforms, using the VOR to meet the mandate is likely to be the easier implementation: articles would just change from subscription access to public access at the end of the applicable embargo period. The article would then be free to read in the same way that a Gold Open Access article would have been from date of publication. The implementation logistics depend on the mechanics of the access control system in the hosting platform.

Using the AM to meet the mandate may require system changes, depending on the current production process and hosting system. Implementation tasks could include adding the AM into the content on the hosting platform, adding a link to the AM from the article landing page, and any necessary changes to access control system so that the AM would be public access while the VOR is still subscription access. Some CHORUS participants using the AM as a PDF for public access are adding watermarks and/or cover pages to the AM PDF so as to document for the reader that the PDF is the AM not the VOR and to point the reader back to the VOR on their website via DOI links.

Using the AM as the public access version also raises a workflow issue: when to load the AM into the hosting system? If it is loaded at the time of publication, a publisher might want to hide it from public view until the end of the applicable embargo period (the access start date) or the publisher might choose to wait and load the AM once the embargo period for the article ends. The timing of the loading of the AM has implications for the URL registration and funder harvesting requirements which are discussed below in sections [5](#) and [6](#). Another optional consideration is whether a publisher wants to suppress the visibility of the AM from any authenticated subscribers who are entitled to the VOR so users access the best version available to them as well as whether to prevent Google from indexing accepted manuscripts.

IMPLEMENTATION COMPONENTS

In addition to the standard CHORUS implementation components documented in this section, there are also funder-specific implementation tasks that arise from CHORUS funder participation agreements.

1. Funding Metadata

The management of funding metadata is executed using the Crossref funding data, a component of the Crossref metadata that provides a standard way to report funding sources for published scholarly research. Publishers deposit funding information from articles and other content using the Crossref Open Funder Registry, a taxonomy of international funders. A registry entry consists of funder name, funder ID, abbreviations, alternate names, and country. The registry is hierarchic and can thus represent parent-child relationships between funders and the funder's sub-organizations. The initial registry was created by and is still maintained by Elsevier and is freely available from Crossref. As of release v1.22 (October 3, 2018) the registry has 19,129 records: 18,808 active and 321 replaced or defunct.

CHORUS Policy: *Participating publishers must collect and deposit funding metadata with Crossref for articles that acknowledge funding from a signed CHORUS Funder participant. This must include all content published since the funder's awards on/after date.*

CHORUS Recommendation: *Publishers may wish to make their existing open access content visible in CHORUS by depositing retroactive funding metadata with Crossref. Retroactive deposits are not a requirement of CHORUS membership but would be a valuable contribution to the scholarly community.*

For more information about Crossref Funding data, see the Crossref website:

<https://www.crossref.org/services/content-registration/funding-data/>
<https://www.crossref.org/services/funder-registry>
<https://support.crossref.org/hc/en-us/articles/214360746-Funding-data-overview>
<https://www.crossref.org/blog/best-practices-for-depositing-funding-data/>

The funding metadata for a given article consists of sets of funder name, funder identifier (omitted if the funder name is not in the registry), and award/grant/contract numbers (optional and repeatable). From the Crossref support article Funding-data-overview:

Funding metadata must include the name of the funding organization AND the funder identifier, where the funding organization is listed in the Registry, and should include an award/grant number. Funder names should only be deposited without the accompanying ID when the funder is not found in the Registry. These deposits will not be considered valid records until such a time as the funder is added to the database and they are re-deposited with an ID. To this goal it is critical that publishers do their utmost to match submitted or extracted funding data to the Registry, which covers all major international funders and a growing number of lesser-known organizations.

Funder names with no funder ID will not be visible in the CHORUS dashboard and searches until a funder ID is assigned and the article metadata updated accordingly.

If a funder name is submitted without a funder ID, Crossref will attempt to match the name to funder IDs but cautiously so an ambiguous abbreviation (like NSF) would not be matched. If Crossref can robustly match the name against the Open Funder Registry, they will add the Funder ID into the deposited funding metadata with an attribute that indicates that the provider is Crossref rather than the publisher: in XML `provider="crossref"` in JSON `"doi-asserted-by": "crossref"`.

The Crossref submission log sent back to the depositor that reports on the DOI deposit transaction would include notification that an identifier has been added so a publisher should consider updating their records accordingly. Example from Crossref:

```
<record_diagnostic status="Success">
  <doi>10.1016/j.apcatb.2018.04.081</doi>
  <msg>Inserted identifier: 501100001809 for name:
    "the National Natural Science Foundation of China"
  </msg>
</record_diagnostic>
```

As noted in the best practices blog post cited above, the Crossref deposit system will reject funding metadata that appears to have errors:

- The `funder_name` field contains a numeric string longer than 4 digits
- The `funder_id` field contains a number that is not an ID from the Funder Registry
- The `funder_name` contains text that exceeds 200 characters

The Crossref Open Funder Registry continues to be updated and Crossref is issuing new versions almost every month. One can sign up for notifications from Crossref when updates are released: sign up at <https://outreach.crossref.org/acton/media/16781/funder-registry>. Publisher implementation plans should include provision for keeping in sync with future updates to the registry and updating their deposited information based on future additions to the registry.

As Funders become CHORUS participants they review their information in the Crossref Open Funder Registry and sometimes submit corrections and updates.

Scope of Funder Metadata Collection: All or Part? The Open Funder Registry is very large and collecting high-quality metadata for more than 19K funders can be a challenge. Some publishers have chosen to focus on a subset of the registry and only collect metadata for that subset.

CHORUS Recommendation: *Publishers should capture as much funder metadata as possible so that they don't have to go back and do it later. But if data collection for a subset is a practical solution, priority should be in this order:*

- Signed CHORUS Funder participants
- All US Government Funding Agencies
- All non-government US Funders (Bill and Melinda Gates Foundation, World

Bank, Sloan, etc.)

- *All international Funders with OA Policies*
- *All US State-level Funding Agencies*
- *All Funders (the full Open Funder Registry)*

The list of CHORUS funder participants are on these CHORUS website pages:

<https://www.chorusaccess.org/resources/chorus-funder-participants/>

<http://search.chorusaccess.org/funders>

As the Crossref Open Funder registry includes information about the funder organizations it can be searched to find categories of funders:

- **country** — geonames country IDs
- **state** — geonames state IDs
- **fundingBodyType** — “gov” or “pri”
- **fundingBodySubType** — “federal/national government”, “government non-federal”, “corporate”, “foundation”, “international”, “professional associations and societies”, “other non-profit”.

Information about International Funders with Open/Public Policies on SHERPA/RoMEO website:

<http://www.sherpa.ac.uk/romeo/search.php?la=en&flDnum=|&version=&mode=advanced>

Funding Metadata Collection Processes. There are two different approaches that publishers are using for collecting funding metadata for new articles: selected by the author in the peer review/manuscript tracking system UI (typically during manuscript submission) or extracted from acknowledgments during the production phase.

Most of the peer-review system vendors have added support for funding metadata collection into the user interface of their products. If you need to add an interface to your own software system, Crossref has made available a reference UI widget:

<https://www.crossref.org/labs/fundref-widget/>

If you need real-time software access to the registry, Crossref has an API that can be used to look up funder names: <https://github.com/CrossRef/rest-api-doc> Using this API ensures that your system is accessing the most up-to-date version of the Open Funder Registry.

There are a number of operational challenges for publishers in getting funding information from authors:

- Authors don't always cite funders in their acknowledgement text using the canonical registry funder names; e.g. cited as acronyms versus full names or funding program names rather than funding organization names
- As the same organization name may occur in multiple countries, it is possible to accidentally select the wrong funder
- Authors may not understand the hierarchy of the registry if they are asked to interact with it and/or may go for the parent funder rather than the sub-organization
- Authors may input a variant of an existing funder name as a “new” funder name

- Authors may not include all funders mentioned in acknowledgments section of their article in the funding metadata (or vice versa)

As a result of these challenges, some CHORUS member publishers that are relying on author input have built a formal review step into their process where the funding metadata entered by the author is compared with the acknowledgments text in the submitted manuscript, any problems or inconsistencies identified, corrected, and then verified with the author. That can be done during the submission process or later during production. Some publishers are including the funding metadata verification as author queries on the article proofs. Studies by already implemented member publishers have found significant error rates in author metadata collected via peer review system UI, primarily omissions. Those error rates were reduced by improving the author instructions to emphasize that the funding information should match the acknowledgments text.

The other workflow solution is to make this a production operation rather than an author task: have the funding information extracted from the acknowledgments text and mapped to the Open Funder Registry, verified during copy editing, and then the proposed funding metadata submitted to the author for confirmation at the proof stage. Crossref Labs made available a tool for looking up funder names: <https://www.crossref.org/labs/fundref-reconciliation-service/>.

Funding Metadata Special Cases. In addition to author grant funding, there are other kinds of funding relationships that appear in acknowledgments and may or may not be part of the Crossref funding metadata. Some examples currently being discussed:

- **Facility Acknowledgements versus Facility Funding.** Author acknowledgements may include mentioning the use of a government-funded facility (e.g. a laboratory) in the research that was the basis of the article. However, using a government facility is not necessarily the same as a funding grant and therefore may not have an open/public access mandate and should not be captured as funding metadata. But there is also laboratory-funded research which could be captured as funding metadata. The US Department of Energy had adjusted its Open Funder Registry hierarchy: deprecated laboratory names and redirected them to a new entry named “Laboratory Directed Research and Development (LDRD)”. Non-funded research support is an upcoming enhancement in NISO JATS 1.2 XML; described in this document.
- **Intramural Funding.** Crossref has been having discussions about how to capture intramural funding information in their funding metadata. Intramural funding is defined as when authors of an article are employees of a funder. So they are not grant funded but their research is subject to government open/public access mandates. This is still a future functionality; Crossref has not yet coordinated this with the NISO JATS committee and it is not in the upcoming JATS v1.2.

Storing Funding Metadata. In designing a production process, a key decision will be where the funding metadata resides long-term. The most common process is to embed it into the article XML full text; examples of how to encode funding metadata in JATS or NLM XML are included in this document. Publishers who use hosting vendors to deposit Crossref metadata will have to conform to the vendors procedure...which may require JATS XML. Another choice is to store the information externally (e.g., as metadata in a content management system, in a database, or in

an external file) rather than in the full text.

CHORUS Policy: *NISO JATS XML is not a specific CHORUS requirement or recommendation; only submission of funding metadata to Crossref is a requirement.*

Depositing Funding Metadata with Crossref. In production mode (publishing new content), funding metadata would normally be part of the normal DOI registration process with Crossref. So implementation would depend on a publisher's current arrangements with Crossref. For example, some publishers use their hosting platform vendors for DOI registration and thus implementation would depend on their vendor's procedures. Funding metadata can be deposited with Crossref either as part of article level metadata or as part of Crossmark metadata.

CHORUS POLICY: *Crossmark is not a specific CHORUS requirement or recommendation; only submission of funding metadata to Crossref is a requirement.*

If the publisher is participating in Crossmark, it is best practice to deposit the funding metadata within Crossmark so that it is visible in the displays of Crossmark data. According to Crossref, publishers can start depositing funding metadata in the Crossmark section of the deposit even before Crossmark has been enabled in publisher PDFs and web pages.

For current documentation on depositing funding metadata see the Crossref website pages:

- <https://support.crossref.org/hc/en-us/articles/214360886-The-Open-Funder-Registry>
- <https://support.crossref.org/hc/en-us/articles/215788143-Funder-data-via-the-API>
- <https://support.crossref.org/hc/en-us/articles/214360746-Funding-data-overview>
- <https://support.crossref.org/hc/en-us/articles/215788123-Funding-data-deposits>
- <https://support.crossref.org/hc/en-us/articles/215788243-Updating-funding-deposits-with-new-Registry-info>

Depositing Retroactive or Updated Funding Metadata. Crossref supports adding or updating funding metadata to existing article DOI metadata records by full metadata redeposit or “stand-alone deposit” of funding metadata only. Details are on the deposit information pages listed above. Crossref also has a non-XML deposit process that uses CSV format that can be used to facilitate retroactive metadata deposit: <https://support.crossref.org/hc/en-us/articles/215871703-Depositing-funding-and-license-metadata-using-a-csv-file>

Funding Metadata Corrections. In discussion with funders, it has been clear that they understand that the accuracy of publisher collected funding data depends on the actions of the authors and that if the funder spots an error or omission for a specific article, they should contact the author to pass the correction along to the publisher. The publisher would then update the funding metadata using the Crossref procedures. An implementation plan should include provisions for making these types of corrections, as the accuracy of the funding metadata is critical to support the implementation of the funder's open/public access requirements.

Funding Metadata Display on Site. The Crossref Funding data FAQ page <http://www.crossref.org/fundingdata/faqs.html> suggests that publishers should display funding data on the DOI response pages, ideally via Crossmark.

CHORUS Policy: *Crossmark or its display is not a specific CHORUS requirement or recommendation; only submission of funding metadata to Crossref is a requirement.*

However, using Crossmark could be beneficial because the funding metadata as submitted by the publisher can be revised by Crossref (e.g. a funder name without funder id mapped to a funder id). The Crossmark widget fetches the current data from Crossref so it is always up to date. To display the metadata directly in the DOI response page HTML, the publisher would need to be sure that its version of the data is current and reflects the latest changes to the registry by Crossref. Another possible change is that the name in the registry might be corrected in response to input from the funder so the same funder ID might now point to an updated funder name.

Funding Metadata in Articles. The funder information is often part of the acknowledgements in an article, but it could be included as in a separate section. Journals that have already had separate funding and acknowledgements sections have found that they have less difficulty in implementing funding metadata because their authors already make the logical separation of funding information from other acknowledgements.

CHORUS POLICY: *This is a publisher decision, not a CHORUS requirement.*

2. Calculating Open/Public Access Start Dates

If an article is identified as having funding metadata, the next step is to assign an open/public access start date and include that in the Crossref license metadata for the open/public access license.

CHORUS Recommendation: *Member publishers should be aware of the funder open/public access mandates when establishing their own embargo periods per article.*

For information about CHORUS funder participants and their access requirements:

<https://www.chorusaccess.org/resources/chorus-funder-participants/>

The funders awards on/after dates are the start of the funding requirement for open/public access and so articles published on or after those dates that were funded by that funder should be scheduled for open/public access start dates. Some scenarios for calculating the access start date:

- If the article is openly/publicly accessible as of date of publication (e.g., Gold Open Access or made permanently open due to publisher policy such as free errata or free editorials), use the date of publication as the access start date.
- If the article is to become openly/publicly accessible after the date of publication calculate the open/public access start date from the date of publication based on the publisher's own embargo period policy and/or funder access mandates.

Then populate the license metadata (described in next section). Depending on the nature of your hosting platform, you may also need to update the access control system.

3. License Information

CHORUS Policy: *A publisher must identify a license for content reuse of all articles that acknowledge funding, register that information with Crossref, and link to it on their content website. The registered metadata must include the AM and/or VOR indicator flag and license start date.*

For current documentation on depositing license metadata see the Crossref article:

<https://support.crossref.org/hc/en-us/articles/214572423-License-metadata-Access-Indicators>

Crossref supports associating one or more licenses with an article DOI. License metadata can be included with the initial DOI registration or added later. The metadata properties for each license consists of a license URL, an optional start date, and an optional indicator as to what version the license applies to (AM, VOR, or TDM). TDM (text and data mining) is not relevant to CHORUS; license metadata marked as “TDM” will be ignored by CHORUS Services.

CHORUS Recommendation: *License metadata for open/public access licenses deposited with Crossref should include a start date; that date should be a full date (YYYY-MM-DD).*

The Crossref deposit schema does not require the start date for license metadata; it is optional. But it is important metadata for CHORUS. Including a start date for open/public access licenses supports the CHORUS dashboard and search functionality and also helps funders in their tracking and indexing of funded articles so it is a contribution to the community.

The choice of license is up to the publisher: it can be either a standard open license such as one of the Creative Commons licenses or a proprietary publisher-specific license. Best practice information and sample publisher licenses are available from STM at <https://www.stm-assoc.org/copyright-legal-affairs/licensing/open-access-licensing/>

For standard open licenses, the URL should point to the appropriate open web page and not to a page on the publisher’s website; e.g., to <https://creativecommons.org/licenses/by/4.0/>

For publisher-specific licenses, a public web page must exist that documents the license; that URL would then be part of the Crossref metadata deposit. It is important that those URLs be persistent. As licenses can potentially change over time, it is important that publisher proprietary licenses include version information. That can be as easy as building a version number into the URL, as in the example Creative Commons license cited above. Publishers should try to use stable URLs that are unlikely to change to avoid having to do large updates of metadata deposited with Crossref.

Some CHORUS members are using a single web page for all their licenses and then distinguishing which portion of the web page is which license by dividing the page using an anchor and hash to point to components of the page so that the URLs registered with Crossref are appropriate. For example:

www.publisher.org/licenses#OpenAccessLicense
www.publisher.org/licenses#SubscriptionLicense

Whether to use one page for all or separate pages for each license is a publisher decision. The only requirement is that the registered URLs deposited with Crossref are distinctive and indicate correctly which license is being referenced.

Registering Open/Public Access License URLs with CHORUS. On the CHORUS Publisher Admin Page there is functionality for publishers to document the URLs of all the various open/public access licenses that they are using. This is important information that tells CHORUS which of the licenses that a publisher deposits with Crossref are to be considered as compliant with open/public access mandates. That information is then used by the CHORUS auditing system. If a publisher is using public licenses (e.g. CC-BY license URLs), those license URLs should be included in this list, not just publisher proprietary licenses (URLs on publisher site). If a publisher is including non-open access licenses in their Crossref metadata deposits (e.g. subscription license), those license URLs should not be registered on the CHORUS Publisher Admin Page, only the open/public access license URLs.

CHORUS Recommendation: *Participating publishers are strongly urged to document for CHORUS what open/public access licenses they use by recording this on their CHORUS Publisher Admin Page (the "Public Access Reuse Licenses URL" list).*

Crossref License Metadata. The Crossref license metadata (called "access indicators") supports multiple licenses for the same article. Here are some scenarios:

- One license for during the embargo (subscription access) period, another starting afterwards for public access
- A different license for each version (AM or VOR)
- A separate license for TDM privileges (Not related to CHORUS)
- Or any combination of the above

CHORUS Policy: *Submitting license metadata for the non-open access period is not required by CHORUS.*

However, a publisher might choose to do that for completeness or to document TDM licensing for subscribers. For technical information on license information deposit:

<https://support.crossref.org/hc/en-us/articles/214572423-License-metadata-Access-Indicators>

EXAMPLE. License metadata in Crossref format

```
<ai:program name="AccessIndicators">
  <ai:license_ref applies_to="am" start_date="2015-07-01">
    http://creativecommons.org/licenses/by/4.0/
  </ai:license_ref>
</ai:program>
```

As with funding metadata, publishers systems may store license metadata in the full text XML or store it externally in content management systems or database. Examples of encoding license metadata in full text XML are in this document. Because access to an article can change over time due to business considerations (e.g., an author going for gold open access post-publication

rather than pre-publication), some CHORUS participants choose to store changes and updates to license information outside the full text XML.

4. Content Accessibility

CHORUS Policy: *Publisher member must make at least one version of their articles reporting on U.S. federally funded research publicly accessible through their website (either Version of Record [VOR] or Accepted Manuscript [AM]) with a stated embargo period if applicable.*

CHORUS Recommendation: *Display of a CHORUS Member logo on publisher sites is encouraged but not required.*

Content declared to be public access as of a start date documented in the license metadata deposited with Crossref must actually be publicly accessible on the public platform as of that date. Coordination of the license metadata with the hosting platform access control system is critical to the success of CHORUS. Errors in this area would seriously damage the reputation of CHORUS so publishers are urged to implement this robustly.

Public Access means unimpeded (unfettered) access. Requiring users to register an account to get to public access content is not considered to be unfettered access. For US funders, requiring registration does not meet OSTP requirements.

CHORUS Policy: *Only content available with unfettered access will be recorded as publicly accessible in the CHORUS audit.*

5. URLs to Allow Funder Harvesting for Indexing

CHORUS Policy: *Publishers must send to Crossref a URL for either the publicly accessible version or VOR version for Funder harvesting and indexing using the Crossref Collection and Resource metadata syntax.*

CHORUS participating funders want to harvest funded content for indexing from the date of publication, which would often be well before the public access start date. So publisher implementation must include funder access to some full text version during the embargo period. Possible scenarios:

1. Funder access to AM from day 1 for indexing; public access to AM post-embargo
2. Funder access to VOR from day 1 for indexing; public access to AM post-embargo
3. Funder access to VOR from day 1 for indexing; public access to VOR post-embargo

Some publishers using AM for public access have chosen scenario 2 because they do not post the AM on their platform until the end of the embargo period. Each of these solutions has a different set of metadata values to be deposited with Crossref, see examples below.

The core of Crossref metadata is a DOI and the URL that the DOI resolves to, usually the landing page for the article on the publisher hosting site. Crossref has expanded its metadata to now support defining additional URLs in groups known as collections of resources so as to point

directly to specific content resources and not just the landing page. Each resource entry can include metadata for mime-type and content version. This Crossref collection and resource metadata supports many different functionalities such as multiple resolutions, text mining, crawling, etc. Only a subset of this metadata is relevant to and used by CHORUS.

To support funder harvesting, a URL for the full text must be provided using the collection metadata element in the “syndication” collection. If a different version is intended for funder harvesting and for public access, the harvesting version should be in the “syndication” collection and the public access version in “unspecified” collection. If there is only one version URL, it must be in the “syndication” collection. There are other collection property values in the Crossref metadata that are not relevant to CHORUS and will be ignored by CHORUS and funders: “list-based” (for multiple DOI resolution), “country-based”, “crawler-based”, and “text-mining”. The three examples below show the three scenarios listed above (AM/AM, VOR/AM, VOR/VOR). In scenario 1 (AM/AM), the publisher would also have the VOR available to subscribers, but is not required to deposit resource and license metadata for the non-publicly accessible versions, only that which fulfills the public access mandate. In Scenario 2, because the VOR is for harvesting and the AM for public access, the license_ref for the VOR is optional because it isn’t the public access copy and the resource metadata for the AM is optional because it isn’t the harvesting copy. Optional means not required by CHORUS; it is compatible with Crossref practices to supply this metadata.

EXAMPLES: Three versions of Funder harvesting (Crossref schema)

Scenario 1. Funder harvesting AM and public access AM

```
<ai:program name="AccessIndicators">
  <ai:license_ref applies_to="am" start_date="2016-07-01">
    http://creativecommons.org/licenses/by/4.0/
  </ai:license_ref>
</ai:program>
<doi_data>
  <doi>10.5555/12345678</doi>
  <timestamp>201505151609</timestamp>
  <resource>http://publisher.com/content/12345678.html</resource>
  <collection property="syndication">
    <item>
      <resource content_version="am" mime_type="application/pdf">
        http://publisher.com/content/12345678-AM.pdf
      </resource>
    </item>
  </collection>
</doi_data>
```

Scenario 2. Funder harvesting VOR and public access AM

```
<ai:program name="AccessIndicators">
  <ai:license_ref applies_to="am" start_date="2016-07-01">
    http://creativecommons.org/licenses/by/4.0/
  </ai:license_ref>
  <ai:license_ref applies_to="vor" start_date="2015-07-01">
    http://publisher.com/licenses/1.0/
```

```

    </ai:license_ref>
</ai:program>
<doi_data>
  <doi>10.5555/12345678</doi>
  <timestamp>201505151609</timestamp>
  <resource>http://publisher.com/content/12345678.html</resource>
  <collection property="syndication">
    <item>
      <resource content_version="vor" mime_type="application/pdf">
        http://publisher.com/content/12345678.pdf
      </resource>
    </item>
  </collection>
  <collection property="unspecified">
    <item>
      <resource content_version="am" mime_type="application/pdf">
        http://publisher.com/content/12345678-AM.pdf
      </resource>
    </item>
  </collection>
</doi_data>

```

Scenario 3. Funder harvesting VOR and public access VOR

```

<ai:program name="AccessIndicators">
  <ai:license_ref applies_to="vor" start_date="2016-07-01">
    https://creativecommons.org/licenses/by/4.0/
  </ai:license_ref>
</ai:program>
<doi_data>
  <doi>10.5555/12345678</doi>
  <timestamp>201505151609</timestamp>
  <resource>http://publisher.com/content/12345678.html</resource>
  <collection property="syndication">
    <item>
      <resource content_version="vor" mime_type="application/pdf">
        http://publisher.com/content/12345678.pdf
      </resource>
    </item>
  </collection>
</doi_data>

```

Including these resource URLs in Crossref is completely separate from access control; that remains a function and responsibility of the publisher's hosting system.

6. Funder Harvesting Access

CHORUS Policy: *Members must permit the publicly accessible AM or VOR, or a VOR behind a paywall, to be available for indexing from the date of publication by Participating Funders.*

CHORUS Policy: *Participating funders agree to harvest only articles they funded and for which that funding metadata has been deposited with Crossref, not to try to crawl a publisher's entire site unless the funder has a separate agreement with the publisher.*

Because CHORUS participating funders will want to harvest articles for indexing soon after publication which often will be prior to public access mandate start date, there is an access control implementation requirement for CHORUS publishers. Publishers are only required to grant funder access to the articles based on research that they funded, not the entire journal. As discussed in the previous section, the harvesting can be of the AM or VOR (publisher decision). CHORUS is supporting two different solutions for funder access: IP-based access and token-based authentication.

IP Access. Funders that conduct harvesting will register the IP address of their crawler with CHORUS. Publishers can sign up for notifications of any changes to funder crawler IP addresses on their CHORUS Publisher Admin page. IP-based access can be implemented on the hosting platform in various ways. Some solutions: by registering the IP address on the hosting server as a crawler, by giving the funder IP-based subscription access to the journals, or by constructing a separate product that consists of the funded articles and giving the funder a subscription to that product. Given that the funder agrees to harvest only funded articles, giving the funder access to the entire journals might be a technically easier solution. The best solution will be based on the hosting platform requirements.

Token Authentication. CHORUS has implemented a token-based authentication scheme based on the Crossref TDM implementation. For a copy of the Token Authentication API documentation, CHORUS participants should contact support@chorusaccess.org. The token authentication system issues a token to the funder that is then included in the content request to the publisher's site; the publisher's system can then check the token via a CHORUS API to authenticate the content request.

7. Content Archiving

CHORUS Policy: *Publishers must archive the AM or VOR in at least one CHORUS recognized archive (CLOCKSS or Portico)*

To implement this policy publishers must have a contractual arrangement and their content must be actively being deposited with or collected by one of the approved archiving services. Publishers who do not currently participate in an archiving arrangement should contact the archiving services directly for information about the agreement and the data transfer process (crawling or feeding). For publishers using hosting platform vendors, some of those service providers support archiving arrangements so they may be able to facilitate the implementation.

Information about archiving arrangements may be included in the Crossref metadata submission but this is not a requirement for CHORUS participants as CHORUS gets archiving information directly from CLOCKSS and Portico.

8. Other Metadata Elements

In addition to all the metadata types described above which are essential to CHORUS, there are some additional metadata elements that are optional but desirable for a CHORUS participating publisher. As Crossref updates its metadata schema several times per year, for the latest specification be sure to check the Crossref website:

<https://support.crossref.org/hc/en-us/articles/214169586-Metadeposit-schema>

Abstracts. While not mandatory, CHORUS Publishers should include abstracts for funded articles in the metadata. Crossref supports including abstracts in the metadata; the supported format is currently NISO JATS XML 1.0; Crossref has not yet announced when they will accept abstracts as JATS 1.1. For publishers whose XML is JATS 1.0 or NLM 3.0, it is straightforward to include this in the metadata submission to Crossref (JATS 1.0 is backward compatible with NLM 3.0.) For publishers using other DTDs or earlier version of NLM, conversion programming might be required. Abstracts included in the Crossref metadata are then available in the same way as other Crossref bibliographic information.

Crossmark. Although not a requirement for CHORUS, publisher participation in Crossmark to record updates, errata, etc., is a good mechanism to document versions of articles (updates, corrections, retractions, etc.) and direct readers to the latest version. A side benefit is that the Crossmark user interface widget can then display the funding metadata without any additional implementation requirements for the publisher platform.

ORCID Identifiers. Crossref also supports inclusion of ORCID IDs as a component of contribution information. For publishers who collect ORCID IDs from authors, adding this to the metadata is of significant value to funders as it gives them a tool to connect researchers to publications.

A technical note: Crossref data model collects researcher ORCID IDs and funding records as separate properties of the article not linked to each other within the deposit schema, so in the case of a multi-author article there is no way to link specific authors with specific funding records. Some of the peer-review system implementations of Crossref Funding Data and ORCID data collection do actually align authors and funding thereby collecting more metadata than Crossref currently supports and therefore it requires some manipulation to collapse that metadata down to the Crossref flat model. This may change in the future if Crossref implements support for intramural funding information in its funding metadata; no plan yet.

9. CHORUS Open/Public Accessibility Audit Support

As publishers make content open/public access and registered with CHORUS it is useful to notify CHORUS how the publisher identifies accessible content accessible on the website so that the CHORUS automated audit can confirm appropriately. For new publisher members, CHORUS staff reviews the publisher's website, identifies markers (features that confirm open/public access) and then discusses that with the Publishers to ensure that CHORUS understands correctly. Those markers can be text such as "Open Access" "Open Manuscript" "Download PDF", "CHORUS AM", etc.

The CHORUS Automated Public Access Auditor (APAA) software tool audits websites to confirm that articles are openly/publicly accessible as per the registered licenses and access dates. That tool searches the article DOI page for markers that indicate open/public access. On the CHORUS Publisher Admin page you can review the current markers that are used by APAA auditing. If there are any enhancements or changes on your website that impacts the markers used by CHORUS, you should send that information to support@chorusaccess.org so that APAA can be updated.

FUNDER-SPECIFIC TASKS

As Funders become CHORUS participants, a funder-specific implementation task may be part of the participation agreement. As of 2018 only one such task: for US DOE.

CHORUS Policy: *Publishers who make AMs publicly accessible and want DOE to link to the AM on their site from DOE PAGES must prompt authors of DOE funded research to submit the AM to DOE and must provide a screenshot or example demonstrating their prompting practice via their CHORUS Publisher Admin page.*

From the CHORUS & DOE Funder-Participation Agreement:

If Publisher Member does not make a VOR publicly accessible on its website, but does make an AM publicly accessible on its website, Funder will link in a prominent manner to the AM on the Publisher Member website for those Publisher Members who prompt authors to submit AMs to Funder.

Publishers are not required to submit the AM to DOE; only to prompt the author to do the submission at the appropriate point in the manuscript submission workflow (accepted manuscripts only). With the goal of integrating prompting into the manuscript submission workflow, interim steps could include measures such as a web page denoting author instructions, author communication during the submission or revision process, and/or other ways).

Because CHORUS has to report to DOE how publisher members are prompting, a feature has been added the Publisher Admin page in CHORUS to allow publishers to upload screen shots of their prompt implementation. The menu item is “Prompt Samples | Upload”. Depending on how the prompt is executed, the publisher should upload a sample screen shot (e.g. the author instructions web page) or a sample of the author communication (e.g. an acceptance email that includes prompting).

DOE had provided CHORUS with a URL for their manuscript submission systems for use in the prompts: <https://www.osti.gov/elink/am-submission/> On the CHORUS Publisher Admin Page, a publisher can sign up for email alerts when a participating funder changes its submission URL.

XML FOR METADATA

This section consists of examples of ways to encode Crossref metadata needed for CHORUS in a variety of XML full text DTDs such as NISO JATS and NLM. This is for information only; the only CHORUS requirement is to deposit metadata with Crossref so how publishers manage that metadata in their systems and in their content is their decision. As Crossref updates its metadata deposit schema several times a year, be sure to check on the Crossref website for the latest version and for full documentation. No changes to Funding Metadata in the current version 4.4.1.

Crossref Funding Metadata XML

The funding information in the Crossref metadata deposit uses a sub-schema (fundref.xsd) included in the deposit schema (currently crossref4.4.1.xsd). Examples from Crossref:

```
<fr:program name="fundref">
  <fr:assertion name="funder_name">U.S. Department of Energy
    <fr:assertion name="funder_identifier">
      https://doi.org/10.13039/100000015
    </fr:assertion>
  </fr:assertion>
  <fr:assertion name="award_number">
    DE-FC26-07NT43098
  </fr:assertion>
</fr:program>
```

The funder identifier element has to be inside the funder name element to be associated correctly. If there is article information that includes multiple funding sources then use “fundgroup” as a wrapping per funder.

```
<fr:program name="fundref">
  <fr:assertion name="fundgroup">
    <fr:assertion name="funder_name">U.S. Department of Energy
      <fr:assertion name="funder_identifier">
        https://doi.org/10.13039/100000015
      </fr:assertion>
    </fr:assertion>
    <fr:assertion name="award_number">
      DE-FC26-07NT43098
    </fr:assertion>
  </fr:assertion>
  <fr:assertion name="fundgroup">
    <fr:assertion name="funder_name">National Science Foundation
      <fr:assertion name="funder_identifier">
        https://doi.org/10.13039/100000001
      </fr:assertion>
    </fr:assertion>
    <fr:assertion name="award_number">
```

```

        CBET-106
    </fr:assertion>
    <fr:assertion name="award_number">
        CBET-7259
    </fr:assertion>
</fr:assertion>
</fr:program>

```

NISO JATS XML for Funding Metadata

JATS 1.1 was approved and published by NISO in January 2016. Version 1.1 included new features specifically to support Crossref funder identifiers, features that were not included in JATS version 1.0. The example belows show only how to encode the funding metadata elements in JATS 1.1; see the JATS 1.1 documentation for examples of how to encode additional related information such as the principal award recipient, the principal investigator, and funding statements. In the example below the attribute value on <funding-group> is just a suggestion not a requirement.

```

<article-meta>
  ...
  <funding-group specific-use="Crossref Funding Data">
    <award-group>
      <funding-source country="US">
        <institution-wrap>
          <institution>U.S. Department of Energy</institution>
          <institution-id institution-id-type="open-funder-registry">
            10.13039/1000000015
          </institution-id>
        </institution-wrap>
      </funding-source>
      <award-id>DE-FC26-07NT43098</award-id>
    </award-group>
  </funding-group>
  ...
</article-meta>

```

JATS 1.0 did not support including funding metadata encoded robustly. So if still using JATS 1.0 then this is a possible example: the attribute values on the funding group and named-content elements are suggestions only, not requirements, but they do match the assertion names in the Crossref metadata deposit format.

```

<article-meta>
  ...
  <funding-group specific-use="Crossref Funding Data">
    <award-group>
      <funding-source>
        <named-content content-type="funder_name">
          U.S. Department of Energy
        </named-content>
        <named-content content-type="funder_identifier">
          10.13039/1000000015

```

```

        </named-content>
      </funding-source>
      <award-id>DE-FC26-07NT43098</award-id>
    </award-group>
  </funding-group>
  ...
</article-meta>

```

NLM DTD XML. NISO JATS 1.0 was fully backward compatible with NLM DTD 3.0 so the JATS 1.0 example above would also be possible in NLM DTD 3.0. For publishers still using NLM DTD version 2.3 or earlier, there is no easy way to include Crossref Funding data information as the award-group element shown above was new in NLM 3.0. One solution would be to use the custom metadata element in NLM DTD 2.3:

```

<article-meta>
  ...
  <custom-meta-wrap>
    <custom-meta>
      <meta-name>fundref:funder_name</meta-name>
      <meta-value>U.S. Department of Energy</meta-value>
    </custom-meta>
    <custom-meta>
      <meta-name>fundref:funder_identifier</meta-name>
      <meta-value>https://doi.org/10.13039/100000015</meta-value>
    </custom-meta>
    <custom-meta>
      <meta-name>fundref:award_number</meta-name>
      <meta-value>DE-FC26-07NT43098</meta-value>
    </custom-meta>
  </custom-meta-wrap>
  ...
</article-meta>

```

If there is more than one set of funding information (name/identifier/award), a separate custom-meta-wrap element could be used for each set.

License Metadata XML Examples

Example of license metadata in Crossref Schema:

```

<ai:program name="AccessIndicators">
  <ai:license_ref applies_to="am" start_date="2015-07-01">
    http://creativecommons.org/licenses/by/4.0/
  </ai:license_ref>
</ai:program>

```

The Crossref Schema also includes free_to_read with start_date but that is not connected specifically to a version (AM or VOR) and the start_date for free_to_read is optional so CHORUS does not use that metadata and the CHORUS TWG does not recommend using that Crossref Schema element for the open/public accessibility starting date. An example:

```

<ai:program name="AccessIndicators">
  <ai:free_to_read start_date="2019-01-01"/>
  <ai:license_ref applies_to="vor" start_date="2018-01-01">
    http://www.crossref.org/license
  </ai:license_ref>
  <ai:license_ref applies_to="vor" start_date="2018-01-01">
    http://www.crossref.org/license
  </ai:license_ref>
</ai:program>

```

NISO JATS 1.1 added support for NISO Access License Indicator metadata, which is related to the Crossref Access Indicators metadata but not exactly the same. As part of the change to support NISO ALI, the URL for the license moved from an attribute to an element content. There is no equivalent to the Crossref `applies_to` attribute; `specific_use` is a suggestion as to how to encode that in JATS 1.1.

```

<license>
  <ali:license_ref xmlns:ali="http://www.niso.org/schemas/ali/1.0/"
    specific-use="am" start_date="2015-07-01">
    http://creativecommons.org/licenses/by/4.0/
  </ali:license_ref>
  ...
</license>

```

NISO JATS 1.0 encoded licenses URLs as attributes and did not support somewhere to record the start date as a property. Using `@specific-use` to capture the Crossref applies-to information is a suggestion.

EXAMPLE. License metadata in JATS 1.0

```

<license specific-use="vor"
  xlink:href="http://publishername.org/licenses/1.0v1/" />
<license specific-use="am"
  xlink:href="http://creativecommons.org/licenses/by/2.0/" />

```

The examples above do not include the `<free_to_read>` element in NISO ALI and Crossref because using that element is not a CHORUS requirement. For more information about `<free_to_read>` see the websites of Crossref, NISO ALI, and JATS.

POSSIBLE FUTURE ITEMS

This section is documenting possible future metadata tasks and future XML solutions that may be relevant for CHORUS participants and upcoming new standards and standard updates. So not current requirements, just information about possible future tasks and possible future implementations.

Metadata Vocabulary Attributes: NISO JATS 1.2

JATS 1.2 was approved and published by NISO in March 2019. In JATS 1.2 there are four new attributes added to support metadata vocabularies robustly: `@vocab`, `@vocab-identifier`, `@vocab-term`, and `@vocab-term-identifier`. So this would be a slight change in encoding Crossref funder IDs in grant information. The `@id-type` value would be "doi" not "open-funder-registry" as that would `@vocab`. A new example:

```
<funding-source country="US">
  <institution-wrap>
    <institution>Genentech Corp.</institution>
    <institution-id institution-id-type="doi"
      vocab="open-funder-registry"
      vocab-identifier="10.13039/open_funder_registry"
      10.13039/100004328
    </institution-id>
  </institution-wrap>
```

This change could be significant if the publisher is submitting article XML for Crossref to extract metadata rather than submitting the Crossref metadata submission XML.

Research Resources Metadata: NISO JATS 1.2

A major new addition in JATS 1.2 is new front-matter group and elements for research support information not just funding information but what resources (e.g. Laboratories) supported this research. This was proposed by Mark Doyle (APS) Co-Chair of CHORUS TWG. Until Crossref and CHORUS track non-funding support metadata, this will be just publisher information. This is in the JATS 1.2 documentation: a new wrapper element that can contain both the funding group (the current funding information syntax) and the contributed resource group (the new metadata element). An example from JATS v1.2 draft documentation:

```
<article-meta>
...
<support-group>
  <funding-group>...</funding-group>
  <contributed-resource-group resource-type="user-facility">
    <award-group award-type="approved-proposal">
      <support-source>
        <institution-wrap>
          <institution>
            Spallation Neutron Source
          </institution>
        </institution-wrap>
        <institution-wrap>
          <institution>
            Oak Ridge National Laboratory
          </institution>
        <institution-id institution-id-type="doi">
```

```

        vocab="open-funder-registry"
        vocab-identifier="10.13039/open_funder_registry">
        10.13039/100006225
    </institution-id>
</institution-wrap>
</support-source>
<award-id>SPS 12345</award-id>
<principal-award-recipient>
    <string-name>
        <prefix>Dr.</prefix>
        <given-names>Albert</given-names>
        <surname>Einstein</surname>
    </string-name>
    <contrib-id contrib-id-type="orcid"
        authenticated="true">
        http://orcid.org/0000-0000-0000-0000
    </contrib-id>
</principal-award-recipient>
</award-group>
<support-description>
    <p>Beam time and computing resources</p>
</support-description>
</contributed-resource-group>
</support-group>
...
</article-meta>

```

Author Affiliation IDs: NISO JATS and Crossref XML

The Crossref, ORCID, and DataCite project to create an open organization ID registry has become the Research Organization Registry Community <https://ror.community/>. When this new registry is live (likely in 2019) it will then be usable for author affiliation information in Crossref metadata and ORCID; but a future pending update to the Crossref metadata deposit schema.

It will be valuable for CHORUS for publishers to collect affiliation metadata and include that in their Crossref metadata deposit; As CHORUS now has institution participants (e.g. University of Florida Library) as well as funder participants and the future CHORUS growth area is likely to be institutions, collecting Open/Public Access information for institutions via affiliation information to identify authors from an institution is the key component.

Workflow can be similar to collecting funder IDs; peer review systems also support affiliation IDs such as the Ringold registry. And/or can be a production task. Crossref is planning to merge the Open Funder Registry into this new registry; no timetable yet for that but likely not ID changes. Affiliation IDs have been supported in NISO JATS XML so not a new XML design.

EXAMPLE FROM JATS 1.1 using Ringold ID

```

<article-meta>
...
<contrib-group>

```

```

    <contrib contrib-type="author">
      <name>
        <surname>Gaillard</surname>
        <given-names>T. D.</given-names>
      </name>
      <xref ref-type="aff" rid="aff1"/>
    </contrib>
    <contrib contrib-type="author">
      <name>
        <surname>Clark</surname>
        <given-names>H. S.</given-names>
        <xref ref-type="aff" rid="aff1"/>
      </name>
    </contrib>
  </contrib-group>
  <aff id="aff1">
    <institution-wrap>
      <institution-id institution-id-type="Ringgold">
        1812
      </institution-id>
      <institution content-type="university">
        Harvard University
      </institution>
    </institution-wrap>
  </aff>
  ...
</article-meta>

```

Crossref has not yet updated their metadata deposit schema to support Organization Identifiers. In the current Crossref schema (4.4.1) <affiliation> is an element inside <anonymous> or <person_name> but currently has no attribute or subelement for an identifier. Currently in the Crossref schema affiliation names are included inside each author so not the same as JATS XML where each affiliation is a single entry referenced to from author names.

Website Metadata: Google Scholar HTML

HTML syntax supports including metadata in a web page (not visible text). Google Scholar had proposed that open access be included in the HTML pages and suggested this syntax:

```
<meta name="citation_fulltext_world_readable" content="">
```

Some publishers and hosting vendors have implemented this but it is not in the current Google Scholar publisher user documentation. Some CHORUS publishers have reported that they do this for VOR but not AM because they don't want Google to index AM if VOR is available. And Google Scholar has told CHORUS that using this on AM is causing problems in the Google indexing and causing VOR to drop out of the Google index. So not recommended yet.

This could be a future enhancement for the CHORUS APAA tool but not until Google Scholar has resolved problems; they have requested future discussion with CHORUS.