The central source for reference linking

DOI Name Information and Guidelines

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1 Introduction

CrossRef is a Registration Agency of the International DOI Foundation and therefore registers Digital Object Identifiers for its members. A CrossRef DOI® (Digital Object Identifier) name is a unique string created to identify a piece of scholarly content in the online environment.

General information about DOIs and the DOI System can be found at the website of the International DOI Foundation (http://www.doi.org/).

For the purpose of assigning DOIs and registering them with CrossRef, you need only familiarize yourself with the contents of this document.

2 Basic DOI syntax

The DOI is made up of two components, a prefix and a suffix, separated by a forward slash. See figure 1.

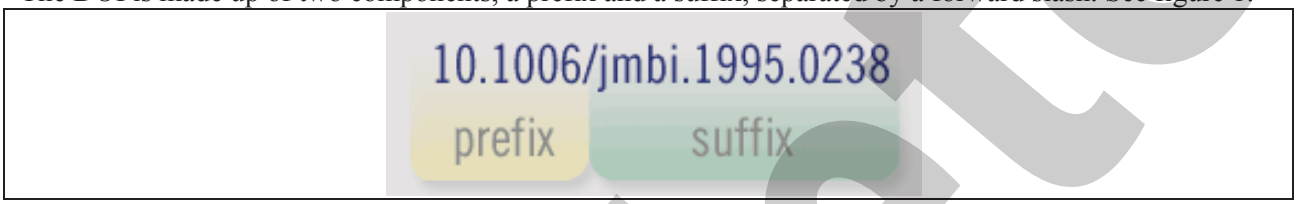

Figure 1

2.1 DOI prefix

All CrossRef DOI prefixes begin with "10" to distinguish the DOI from other implementations of the Handle System (http://www.handle.net/) followed by a number of four or more digits.

In general each CrossRef member has one prefix, but it is possible for members to have multiple prefixes (e.g. a prefix for each journal title, or for different imprints).

The unique DOI prefix is assigned to organizations by CrossRef and is included in the CrossRef membership fee. It is not necessary to get a DOI prefix prior to joining CrossRef or to pay a separate fee to the International DOI Foundation.

2.2 DOI suffix

The suffix is determined by the publisher and must be unique within a prefix. See below for more information and examples of DOI structures.

3 DOI ownership and transfer

The DOI for a given content item must be created and assigned by the publisher or other organization with authority to register DOI on the publisher's behalf.

Once assigned to a content item, the DOI is permanently assigned to it regardless of changes in ownership or location of the content. While publishers must create and register DOIs using their own unique prefix, once a DOI is assigned, ownership and control of individual DOIs are transferred along with content ownership or control.

This means that over time, as a result of mergers and acquisitions, publishers may have numerous DOIs in their systems containing prefixes of other publishers. It is imperative that once a DOI number is registered, it is never changed. The metadata or URL associated with it may change, but not the number.

Example: Ownership of *The CrossRef Journal* passes from Publisher A to Publisher B.

- Control of the DOIs for articles in the journal will be given to Publisher B, who can then update the metadata and URLs for those DOIs. Publisher B must not assign new DOIs to the transferred content.
- Publisher B will assign DOIs to *new* content in *The CrossRef Journal* using its own prefix and DOI structure.
- Publisher A will continue to assign DOIs to other content using their existing prefix.

Because DOIs are transferred among publishers, the prefix of a DOI does not reliably identify the publisher of an item. Ownership should not be inferred from the prefix of an item's DOI.

CrossRef has published a document to provide guidelines for handling the transfer of content from one publisher to another; "DOI Ownership Transfer Guidelines":
http://www.crossref.org/02publishers/TitleandDOIownership.pdf

4 CrossRef content types

CrossRef currently supports the registration of DOIs for the following content types.

- Journals: journal title, volume, issue and article
- Books/Reference Works: book series and/or volume title, chapter/section/entry
- Conference proceedings: multi-volume title, title, paper
- Dissertations and Thesis
- Technical Reports and Working Papers
- Standards
- Components: sub-items of journal articles, book chapters/entries and conference papers including figures, tables, graphs and supplemental data.
- Database Records

5 CrossRef DOI Guidelines

The following are best practice guidelines for organizations assigning DOIs for registration with CrossRef.

While the DOI prefix is fixed and assigned by CrossRef to the publisher, the syntax of the DOI suffix is very flexible and is not prescribed. CrossRef offers the following *strongly recommended* guidelines for DOI suffix structures and DOI construction for all content types.

The suffix should reflect a consistent, logical system that can be easily documented and readily implemented. If existing internal identifiers are in use within your organization (e.g. ISBN or PII), these could be used as the DOI suffix. Bibliographic information can be used in a DOI string, but it will have no meaning within the CrossRef or DOI systems.

5.1 Structured suffixes

A suffix may be used to reflect hierarchical information or levels of granularity depicted in delimited substrings of characters known as nodes. For instance, the first node might be a multiple-letter code for the journal title, while successive nodes encode year of article acceptance and order of article acceptance.

As an example the scheme used by John Wiley & Sons is to use a short code for the journal and an article number, e.g. doi:10.1002/bip.20596 is the DOI for an article from the journal Biopolymers. DOI suffix schemes should be extensible, and suffix nodes should be used for this purpose. For instance article components such as figures, graphs, and supplementary materials can be assigned DOIs. This system can be extended to article components by adding another node e.g. 10.1002/bip.20596.f1 for the first figure in the article.

Similarly, in the case of electronic books, the AAP recommends the following syntactic structure for the DOI suffix:

/Whole work. Next granular level. Next granular level. Etc.

While meaning may be inferred from the structure of a DOI such information resides in the metadata associated with each DOI registered at CrossRef. The CrossRef system should be queried for retrieval of explicit metadata.

Examples:

Publication Item	Sample DOI	Comment
Journal article	10.1513/pats.200402-016MS	Title descriptor followed by publication date
	10.1046/j.1445-2197.2003.02820.x	ISSN with pub year
	10.1246/bcsj.73.1653	Title descriptor followed by volume and page
	10.1115/1.1286317	An opaque suffix
Journal article component	10.2210/pdb2c73/pdb	Parent DOI is 10.2210/pdb
	10.1107/S1600536806055784/bi2125sup1.cif	Parent DOI is 10.1107/S1600536806055784 mime_type="chemical/x-cif"
	10.1371/journal.pone.0000188.g001	Parent DOI is 10.1371/journal.pone.0000188, this is a figure from the article
	10.1172/JCI27602DS1	Supplemental data to parent DOI 10.1172/JCI27602
Conference proceeding article	10.1063/1.1920984	An opaque suffix
	10.1109/ICEEE.2004.1433923	Title followed by pub year
Book	10.1002/0471758132	Suffix is the book's ISBN
Book Chapter	10.1002/0471758132.ch1	
Technical Report	10.2172/897503 10.1037/ce100001	An opaque suffix
	10.1044/policy.RP1982-00125	Internal descriptor along with publication year
	10.1599/0409Moynihan	Year/month of pub plus author
Dissertation	10.2986/tren.009-0347	An opaque suffix
Standard		
Database record		

5.2 Uniqueness

The suffix must be unique within the prefix. i.e. every DOI assigned by a prefix owner must be unique.

5.3 Case-sensitivity

According to the Niso specification DOIs are case-insensitive and must be treated as such by any DOI-aware system. This means that the DOIs 10.1234/abc and 10.1234/ABC are actually the same DOI. CrossRef maintains the case of the DOI as submitted by the publisher for aesthetic purposes only.

5.4 DOI usability

DOIs should be as concise as possible, in consideration of human readability. DOIs will be displayed online and in print, and will be re-typed by end users.

5.5 Assigning DOIs to different formats (work vs. manifestation)

DOIs can be assigned to any type of intellectual property in any medium.
As a matter of current policy, the CrossRef DOI identifies the work, not its various potential manifestations. This means separate DOIs are not assigned to each format of a given article. The print, PDF, and HTML versions of the same article all share the same DOI. Different formats of the same article can be pointed to from the response page to which the DOI resolves.

As the DOI and CrossRef systems develop -- for example to handle multiple resolution -- CrossRef's policies will change accordingly.

5.6 Assigning multiple DOIs to republished works

CrossRef only permits registration of DOIs for Definitive Works (or Versions of Record, if not formally published) but not for Duplicative Works, as defined in the CrossRef Glossary. This means that only original scholarly material, for which there is no actual DOI at the time of submission, and no expected duplication in future, is admissible for CrossRef DOI registration. CrossRef does not permit multiple DOIs to be assigned to certain closely related versions of a work, and hence does not support assignment of DOIs to Pre-prints or Post-prints of Definitive Works or to the Personal Version or a Self-archived Copy of a Definitive Work. For the same reasons, materials for which DOI duplication can be reasonably anticipated, such as an Authors Original Draft of a work being prepared for publication, are not admissible for CrossRef DOI registration.

CrossRef recognizes that a work may be legitimately republished, for example an article is published in a topical journal and later in an annual summary. In such cases where the work may be cited in more than one publication and the metadata for each appearance sufficiently differentiates them from one another, multiple DOIs may be assigned where each DOI points to the different location. This approach maintains a consistent linking experience for the reader who expects to find the cited item in a specific location. This condition may apply in the following metadata differences:

- Publication title and ISSN or ISBN must be different (language is a sufficient difference in title)
- Volume/issue/page should be different with allowances for pure coincidence
- Article number if used must be different

5.7 DOIs are not derivable

A DOI must not be considered derivable. That is, although a DOI may have been generated by the registering publisher according to a formula or algorithm, a content item's DOI must not be 'reverse engineered' by re-constructing it according to the perceived algorithm. The CrossRef database is the definitive reference for looking up DOIs registered by its members.

5.8 Allowed characters in a CrossRef DOI

According to the DOI specification, ANSI/**NISO** Z39.84- 2005, the suffix may be any alphanumeric string However, experience has shown that certain characters cause difficulty when encountered by browsers. Therefore CrossRef limits a DOI to only using the following characters:

"a-z", "A-Z", "0-9" and "-._;()/"

This rule was put into effect on January 1, 2009 and affects only the creation of new DOIs. Any DOI created prior to this date will remain active and the CrossRef system will permit updates to the metadata for those DOIs.

6 CrossRef DOI deposit rules

6.1 Timely DOI deposit

DOIs must be deposited with CrossRef as soon as possible after online publication of the content.

While a DOI may have been created and assigned prior to publication, it is extremely important for the reliability of the CrossRef resolution system that pre-publication DOIs remain for internal use only, and that they are not displayed online or in print or distributed to secondary publishers prior to online availability of the content.

Until a DOI and its metadata are deposited with CrossRef, the DOI will not work and the user will get an error message. CrossRef regularly receives error reports of users trying to resolve DOIs that have not been registered with CrossRef. If DOIs are not registered, they will not function.

It is not necessary to register DOIs separately with the IDF since this will be done automatically as part of the CrossRef metadata submission process. For technical details on the metadata submission process, please read the CrossRef Help Documentation - http://www.crossref.org/help/

6.2 Content published online ahead of print

Some providers publish DOIs to articles that are not yet published in print.

If content items are published online ahead of print publication, both versions must use the same DOI. The DOI must be submitted to CrossRef as soon as possible after the content is published online. For this reason a DOI suffix structure which includes pagination information in the DOI suffix could not be used **reliably**.

NOTE: the pagination information is a FIELD in the metadata. When the journal becomes available in print, the DOI must be updated to include the additional metadata identifying the pagination.

One possible solution used by the American Physical Society is to do away with conventional pagination and use an article identifier (APS uses a six digit number*) that appears in print and online in place of page number. Other publishers may use the manuscript number of the article or a sequential number. Please refer to the sample DOIs below.

* Page/article numbers with greater than 6 digits may be incompatible with some library systems.

6.3 The response page

When metadata and DOIs are deposited with CrossRef, the publisher *must* have active response pages in place so that they can resolve incoming links.

As soon as metadata and DOIs are deposited in CrossRef, other users of the system will be able to retrieve the DOIs and create links.

A minimal response page *must contain* a full bibliographic citation displayed to the user. A response page without bibliographic information should *never* be presented to a user. Additionally, this response page must display some mechanism by which the user can gain access to the full text. Access is completely controlled by the publisher.

Most CrossRef publishers take users to the abstract page and permit authenticated users to access the full text automatically. If the full text is available at no charge, users can access it immediately. Many publishers also present unauthenticated users with pay-per-view options.

6.4 Multiple Resolution

Some CrossRef publishers offer access to their content through two or more resources. For example, Wolters-Kluwer Health offers content to its journals through Ovid Web Gateway for institutional users, and through its journal web sites for its society and individual members. CrossRef's multiple resolution can be managed in as follows :

1) The DOI link goes to an interim page that displays the link choices available for that DOI. The Interim page must contain metadata describing the article.

Additional information on implementing multiple resolution can be found in CrossRef's help.

6.5 Metadata accuracy and updates

Metadata deposited with CrossRef must parse per a currently accepted XML schema (http://www.crossref.org/help/CrossRef_Help_CSH.htm#Appendices/CrossRef%20Schema.htm) and should abide by our Metadata Guidelines (http://www.crossref.org/02publishers/metadata_guidelines.html). Metadata should also pass semantic tests using a tool like the CrossRef data conformance checker at http://xmlprobe.com/online-validators/crossref. A general purpose parser that tests XML for being well formed and valid is available at http://www.crossref.org/02publishers/55InstructionsForNewSchema.html.

It is the responsibility of the publisher who owns a DOI to maintain the accuracy of its metadata and URL in the CrossRef system. When a DOI is first created the publisher associated with the DOI's prefix is established as its owner. Unless an owner transfer process is performed the DOI remains owned by this publisher even if the journal title is transferred to another publisher.

There is no charge for sending updates or revisions to previously submitted records or for performing ownership transfers. Updates or revisions are complete replacements of metadata. Previously submitted metadata for the record is not retained.

6.6 Further information

Rules about depositing content and what DOIs resolve to can be found in the Membership Qualifications and Rules - http://www.crossref.org/08downloads/memberrules.pdf - and the PILA Membership Agreement - http://www.crossref.org/08downloads/CR_MembershipAgreement.pdf.

7 Use and Display of DOIs

Every DOI is registered with at least one standard web URL. With the implementation of multiple resolution, multiple URLs may be registered with each DOI. In the future, other data types may also be registered with each DOI.

The core functionality of the DOI system is to resolve a DOI to the registered URL.
A DOI should be preceded by a lowercase "doi:". For example, the DOI 10.1006/jmbi.1998.2354 would be displayed as doi:10.1006/jmbi.1998.2354. Using the lowercase DOI follows the URI specification http://www.ietf.org/rfc/rfc2396.txt where FTP and HTTP are written as "ftp:" and "http:".

7.1 Resolution via the DOI Proxy

The DOI Proxy server - http://dx.doi.org/ - resolves DOIs. To resolve a DOI via a standard web hyperlink, the DOI number itself should be attached to the address for the proxy server. For example, the DOI 10.1006/jmbi.1998.2354 would be made an active link as http://dx.doi.org/10.1006/jmbi.1998.2354.

The DOI Proxy is the definitive resolution service for DOIs and should be used for all DOI links. Although websites provided by CrossRef members may resolve DOIs directly, this is not a recommended approach as the DOI would cease to resolve if the content item is transferred to another location or publisher. By using the DOI proxy, the DOI proxy will continue to resolve the DOI once its associated metadata is updated with the new location.

7.2 HTTP encoding of DOIs

It is important to note that in this example of a URL, the DOI number 10.1006/jmbi.1998.2354 incorporated in a URL and transported by the HTTP protocol and therefore has to follow guidelines for URIs. The syntax for URIs (a URL is a URI - http://www.ietf.org/rfc/rfc2396.txt) is much more restrictive than the syntax for DOIs and some characters are reserved and will need encoding. For information on the

DOI Syntax and character issues see the NISO DOI Syntax standard - http://www.niso.org/standards/standard_detail.cfm?std_id=480.

In the future HTTP may no longer be the dominant protocol and systems will handle DOIs natively. This means that doi:10.1006/jmbi.1998.2354 could be automatically resolved without the addition of the http://dx.doi.org/. However, at the present time a DOI should be displayed as doi:10.1006/jmbi.1998.2354 and the DOI identifier itself can be an active link as in http://dx.doi.org/10.1006/jmbi.1998.2354.

7.3 Display of DOIs

The primary purpose of DOIs in the CrossRef system is to create persistent links to publishers' content, notably as reference links in electronic journal articles. DOIs for article references are retrieved from CrossRef and added to references lists. How the links are actually added depends on the publisher's online system. However, DOIs should be considered part of the basic bibliographic information for an article.

A DOI for a piece of content (article, book chapter, conference proceeding) should also be displayed in the header information for the online AND print versions of the content (see Figure 2). The DOI can also be used for citing the content. For example, many publishers instruct readers to use a DOI to cite an online article published without a volume, issue or page number.

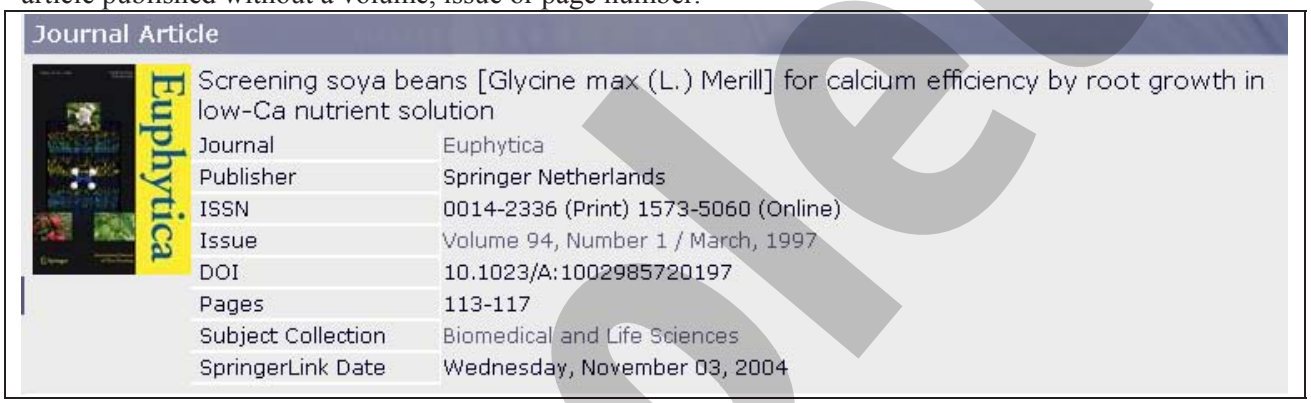

Figure 2 - DOI in Bibliographic Header

7.3.1 Displaying DOIs in print

A DOI assigned to the electronic version of an article should also be included in the header for the print version of that article.

To make the DOI system transparent for readers, we recommend listing the DOI -- for example, as above in Figure 2 -- as "doi:10.1006/jmbi.1998.2354". In order to show users how to resolve a DOI, it is possible to have the DOI followed by: "available via http://dx.doi.org/". This will take users to a form where the DOI can be entered and resolved

7.3.2 DOIs in citations

DOIs do not replace traditional bibliographic citations but are a very useful addition, especially if articles are published online with volume, issue, and page numbers.

Further information for including DOIs in a variety of citation formats is available in the CrossRef Reference Guidelines available at http://www.crossref.org/02publishers/guidelines.html

7.3.3 DOIs in citation export services

CrossRef has prepared separate documentation for publishers on how to integrate DOIs into their "Download Citation"/"Export References" services. See http://www.crossref.org/02publishers/guidelines.html

7.3.4 DOI as a reference link

CrossRef recommends that "CrossRef" be used as the display text for reference links. Some publishers use "Article" or make the actual journal citation the link.

More information on this can be found in the "CrossRef Branding Guidelines" http://www.crossref.org/images/branding/branding.pdf.

7.3.5 Instructions for Authors

Publishers should include information about using DOIs in their instructions for authors.

For example, Nature has information for authors for its Advanced Online Publication http://www.nature.com/nature/journal/vaop/ncurrent/about.html where articles are published online before being assigned volume, issue, and page numbers.

Springer provides information to its authors on Online First http://www.springerlink.com. Articles in Online First are published before being assigned volume, issue, and page numbers, and DOIs are used to cite the articles

7.3.6 Summary

- DOIs, along with volume, issue and page numbers, should be part of the standard bibliographic metadata for an article
- DOIs should be displayed in bibliographic headers for online AND print articles
- In citations, DOIs should be presented as doi:10.1038/35016083 (doi should be lowercase and no space should be between the doi: and the start of the DOI string)
- Wherever possible, the DOI should be an active link but the http://dx.doi.org/ need not be displayed (e.g. doi:10.1126/science.1065467)
- In a reference link to full text, CrossRef recommends that "CrossRef" be used as the display text for the link. More information on this can be found in the "CrossRef Branding Guidelines"

8 CrossRef as an IDF Registration Agency

The IDF (International DOI Foundation) appoints Registration Agencies (RAs) to accept deposits of DOIs, URLs, and metadata for a given Community of Interest.

CrossRef is an IDF RA for scholarly publishers and accepts deposits for journals, conference proceedings and books. CrossRef holds the metadata associated with DOIs and deposits the DOIs and URLs in the central DOI system. CrossRef also provides a retrieval system for the DOIs it registers.

CrossRef works with the IDF on general DOI policy and technical issues. Many CrossRef members are also members of the IDF in order to participate in general DOI developments, however, CrossRef membership is all that is necessary to deposit and retrieve DOIs. Separate IDF membership is not necessary but does provide important support for the DOI system.

9 Examples of DOI structure

Crossref publishers have established many varying schemes for creating their DOI suffixes. Here is a list of sample DOIs for some current CrossRef publishers:

Publisher	Content type	DOI	Notes
Academic Press	Journal article	10.1006/jmbi.1998.2354	Four letter code for journal, year of acceptance and a sequential number
American Institute of	Journal article	10.1063/1.125173	Sequential numbers,

Physics			first node designates the production center that assigned the DOI suffix
American Chemical Society	Journal article	10.1021/cm960127g	
American Mathematical Society	Journal article	10.1090/S0002-9939-00-05422-8	Uses existing identifier PII
American Physical Society	Journal article	10.1103/PhysRevLett.88.088302	The APS has replaced page numbers with an article code that can be assigned on acceptance of an article. The DOI uses a journal abbreviation, volume number and the article code
Blackwell Publishers	Journal article	10.1046/j.1432-1327.2001.02263.x	
CSHL Press	Journal article	10.1101/gr.10.12.1841	
Geological Society of America	Journal article	10.1130/0091-7613(2001)	
IEEE	Journal article	10.1109/16.8842	
Kluwer	Journal article	10.1023/A:1003629312096	
MIT Press		10.1162/003355300554872	
Nature Publishing Group	Journal article	10.1038/26989	Journal title and sequential number
Oxford University Press	Journal article	10.1093/ageing/29.1.57	
AAAS/Science	Journal article	10.1126/science.286.5445.1679e	
The Royal Society	Journal article	10.1098/rspa.2001.0787	
University of Chicago Press	Journal article	10.1086/301055	sequential numbers

10 Information for the end-user

If you encounter a DOI in text or header information, you can resolve it by embedding it in an HTTP hyperlink to the DOI proxy, http://dx.doi.org, which redirects the DOI to the currently registered location for this content item. For example, doi:10.1006/jmbi.1998.2354 can be resolved as http://dx.doi.org/10.1006/jmbi.1998.2354. If you click on this link, you will arrive at the appropriate response page for this article at the Journal of Molecular Biology web site.

There you will see that the DOI is included in article header information or on the title page. To include the DOI in a citation to this article, you simply append it at the end, prefaced by "doi:" as follows:

Brian G. Turner, Michael F. Summers. "Structural Biology of HIV." Journal of Molecular Biology, 285(1), pp. 1-32. doi:10.1006/jmbi.1998.2354.