

## CiTO, the Citation Typing Ontology

An article submitted for publication in the BioOntologies 2009 Special Issue of the *Journal of Biomedical Semantics* by

### David Shotton

Image Bioinformatics Research Group, Department of Zoology, University of Oxford  
South Parks Road, Oxford OX1 3PS, UK

Email address: [david.shotton@zoo.ox.ac.uk](mailto:david.shotton@zoo.ox.ac.uk)

[Note to BioOntology2009 Reviewers: Since the EasyChair system being used to submit papers for review permits uploading of only a single PDF file, I have concatenated this paper and its three Supplementary Information Files into a single PDF document. When re-submitted to *J. Biomedical Semantics*, after substitution of the awaited DOIs for these four documents, they will be submitted independently and in their correct formats.]

## Abstract

CiTO, the Citation Typing Ontology, is an ontology for describing the nature of reference citations in scientific research articles and other scholarly works, and for publishing these descriptions on the Semantic Web. Citations are described in terms of the factual and rhetorical relationships between citing publication and cited publication, the in-text and global citation frequencies of each cited work, and the nature of the cited work itself, including its peer review status. This paper describes CiTO and illustrates its usefulness both for the annotation of bibliographic reference lists and for the visualization of citation networks. The latest version of CiTO is CiTO Version 1.4, [to be] published on 16 November 2009. CiTO is written in the Web Ontology Language OWL, uses the namespace <http://purl.org/net/cito/>, and is available from <http://purl.org/net/cito/>. This site uses content negotiation to deliver to the user an OWLDoc Web version of the ontology if accessed via a Web browser, or the OWL ontology itself if accessed from an ontology management tool such as Protégé (<http://protege.stanford.edu/>). Work is ongoing to extend CiTO and to harmonize it with other ontologies describing bibliographies and the rhetorical structure of scientific discourse.

## Structured digital abstract

Basic bibliographic metadata and a summary of the content of this article, recorded in a structured machine-readable form, is available as **Supplementary Information File S1** accompanying this paper, downloadable from [DOI to be supplied by the *Journal of Biomedical Informatics*]. The information is encoded as RDF (<http://www.w3.org/RDF/>; [http://en.wikipedia.org/wiki/Resource\\_Description\\_Framework](http://en.wikipedia.org/wiki/Resource_Description_Framework)), serialized in Notation3 format (<http://en.wikipedia.org/wiki/Notation3>).

## Keywords

bibliography, BIBO, citation, citation frequency, citation network, DCMI, expression, FRBR, manifestation, ontology, reference, rhetoric, SWAN, SWAP, work

# Introduction

## What is CiTO

CiTO, the Citation Typing Ontology, is an ontology for describing the nature of reference citations in scientific research articles and other scholarly works, and for publishing these descriptions on the Semantic Web. Citations are described in terms of the factual and rhetorical relationships between citing publication and cited publication, the in-text and global citation frequencies of each cited work, and the nature of the cited work itself, including its peer review status. This paper describes CiTO and illustrates its usefulness both for the annotation of bibliographic reference lists and for the visualization of citation networks.

The latest version of CiTO is CiTO Version 1.4, [to be] published on 16 November 2009. CiTO is written in the Web Ontology Language OWL, uses the namespace <http://purl.org/net/cito/>, and is available from <http://purl.org/net/cito/>. This site uses content negotiation to deliver to the user an OWLDoc Web version of the ontology if accessed via a Web browser, or the OWL ontology itself if accessed from an ontology management tool such as Protégé<sup>1</sup>. The CiTO wiki<sup>2</sup> documents CiTO development. [Note to reviewers: To go live in late November 2009.]

## What is meant by a citation

In the context of the Citation Typing Ontology, a bibliographic citation is a reference within a particular citing work of another publication (e.g. a journal article, a book chapter or a web page) termed the cited work. In scientific research articles, citations commonly take two forms: a condensed form within the text of the article (e.g. (Shotton and Attaran, 1998), or [14]), hereafter termed an *in-text citation*, and a full form within a reference list at the end of the article (e.g. Shotton, D.M. and Attaran, A. (1998). Variant antigenic peptide promotes cytotoxic T lymphocyte adhesion to target cells without cytotoxicity. *Proc. Natl. Acad. Sci. USA.* **95**:15571-15576.). This use of the word 'citation' should be distinguished from the common related use of this word to indicate the cited work itself. Within CiTO, 'cite' and 'citation' denote the performative act of citation itself, not the target of that citation.

## CiTO scope and usage

### Citation networks

The first purpose of CiTO is to enable the citations within a citing work to be recorded and published in machine-readable form as RDF<sup>3</sup>, thus (serialized in Notation3 format<sup>4</sup>):

```
<http://example1.com/citingwork> cito:cites
  <http://example2.com/citedwork> .
```

Even this simple statement that a citation exists opens significant possibilities, for example in enabling the easy creation of citation networks simply by combining the RDF citation lists from several papers.

Reciprocally we can say:

<sup>1</sup> <http://protege.stanford.edu/>.

<sup>2</sup> <http://ibrg.zoo.ox.ac.uk/cito/>.

<sup>3</sup> <http://www.w3.org/RDF/>; [http://en.wikipedia.org/wiki/Resource\\_Description\\_Framework](http://en.wikipedia.org/wiki/Resource_Description_Framework).

<sup>4</sup> <http://en.wikipedia.org/wiki/Notation3>.

```
<http://example2.com/citingwork> cito:isCitedBy
<http://example1.com/citedwork> .
```

which is useful in certain circumstances, despite the logical redundancy from a reasoning viewpoint.

While the advent of on-line publishing and bibliographic search engines has made the problem of finding individual research articles considerably easier, the present scholarly citation system inadequately exposes the knowledge networks that exist within the scientific literature, linking papers, authors and research projects. Much of the problem stems from the lack of freely available citation data. In this Open Access age, it is a scandal that reference lists from journal articles, the core elements of the academic data cycle, are not freely available for use by scholars.

If CiTO-enabled machine-readable citation data were to be associated with all scholarly publications and published freely on the Web, the construction and interrogation of citation networks would become trivially simple, with enormous advantages to scholarship. Figure 1 shows a simple citation network linking a few papers directly or indirectly cited by Reis *et al.* (2008) [1], the target research article for our recent semantic enhancement demonstration<sup>5</sup> described by Shotton *et al.* (2009) [2]. This diagram was created automatically by using an RDF graph of CiTO citations as input to the RDF graph visualization tool Welkin<sup>6</sup>, with the nodes arranged along a vertical temporal axis.

### Citation characterization

The second purpose of CiTO is to permit characterization of bibliographic citations. The reasons that one publication cites others are varied. Usually, it is because the more recently published citing work has gained assistance of some sort, perhaps in the form of background information, ideas, methods or data, from the older cited works. It is for this reason that Google Scholar has as its strapline “Stand on the shoulders of giants”, echoing Sir Isaac Newton’s famous remark to his rival Robert Hooke “If I have seen a little further, it is by standing on the shoulders of Giants”. However, more rarely, citations may also be made to critique or refute previous works. CiTO makes it possible to capture and publish such distinctions, i.e. the intent of the author when citing a particular publication, permitting authors (or others) to create metadata describing their citations, quite distinct from metadata describing the cited works themselves. The full list of possible citation typing relationships presently recordable using CiTO is as follows:

#### Relationships between citing and cited document in CiTO:

<i>cites</i>	<i>citesAsAuthority</i>	<i>citesAsMetadataDocument</i>
<i>citesAsSourceDocument</i>	<i>citesForInformation</i>	<i>confirms</i>
<i>corrects</i>	<i>credits</i>	<i>critiques</i>
<i>disagreesWith</i>	<i>discusses</i>	<i>extends</i>
<i>isCitedBy</i>	<i>obtainsBackgroundFrom</i>	<i>obtainsSupportFrom</i>
<i>refutes</i>	<i>reviews</i>	<i>sharesAuthorsWith</i>
<i>updates</i>	<i>usesDataFrom</i>	<i>usesMethodIn</i>

<sup>5</sup> <http://dx.doi.org/10.1371/journal.pntd.0000228.x001>

<sup>6</sup> <http://simile.mit.edu/wiki/Welkin>

These relationships are all object properties within CiTO. A single citation can be characterized by several different relationships, both factual and rhetorical. In Notation3 format, such characterizations can be made as follows:

```
<http://example1.com/citingwork>
  cito:cites <http://example2.com/citedwork> ;
  cito:usesMethodIn <http://example2.com/citedwork> ;
  cito:extends <http://example2.com/citedwork> ;
  cito:sharesAuthorsWith <http://example2.com/citedwork> ; .
```

### Citation frequency

The third purpose of CiTO is to permit citation frequency to be recorded, of two different types, *local* and *global*. We are familiar with journal impact factors, based on the global frequency of citation of the papers they contain by the scholarly community as a whole. Despite their vulnerability to abuse and 'spiking' [3, 4], such impact factors are widely used to evaluate the quality of journals, and, less properly, the quality of individual papers and the academic merits of their authors and institutions, on the crude premise that all citations are 'votes of confidence' in the cited papers. Another and lesser used aspect of citation frequency relates to the local importance of a cited publication to the citing publication. Put crudely, if Paper A cites Paper B once, but cites Paper C ten times at different points within the text, then, *from the point of view of the citing paper*, Paper C is more significant, irrespective of its global citation frequency relative to Paper B.

CiTO permits one to record both the in-text local citation frequency from Paper A to each of the papers it cites, and also the global citation frequency of each cited papers, as determined by consulting third-party authorities such as Google Scholar<sup>7</sup>, the ISI Web of Knowledge<sup>8</sup> and SCOPUS<sup>9</sup>. Such global citation counts providing proxy estimates of the importance of each cited paper to the whole academic community. In CiTO, such information is recorded using the following properties:

#### Citation frequency encoding in CiTO

Classes:

*GlobalCitationCount*                      *InTextCitationCount*

Object properties:

*globalCitationFrequency*              *globalCountSource*  
*inTextCitationFrequency*              *inTextCitationTarget*

Datatype properties:

*globalCountDate*                      *globalCountValue*              *inTextCountValue*

---

<sup>7</sup> <http://scholar.google.com/>.

<sup>8</sup> <http://www.isiwebofknowledge.com/>.

<sup>9</sup> <http://www.scopus.com/>.

In-text and global citation information for particular cited publications can be recorded in the following manner.

```
<http://example1.com/citingwork>
  cito:cites <http://example2.com/citedwork> ;
  cito:inTextCitationFrequency [
    a cito:InTextCitationCount ;
    cito:inTextCountValue "10"^^xsd:integer ;
    cito:inTextCitationTarget <http://example2.com/citedwork> ;
  ] ; .

<http://example2.com/citedwork>
  cito:isCitedBy <http://example1.com/citingwork> ;
  cito:globalCitationFrequency [
    a cito:GlobalCitationCount ;
    cito:globalCountValue "206"^^xsd:integer ;
    cito:globalCountSource <http://scholar.google.com>;
    cito:globalCountDate "2009-03-11"^^xsd:date ;
  ] ; .
```

There is intentional redundancy in these sets of triples, since 'A cites B' and 'B is cited by A' could both be deduced from the other statements. This level of redundancy has a practical usefulness, since the direct citation statements can be used on their own to provide clean input to citation network visualization programs such as Welkin (Figure 1), and since the explicit reciprocal statement in the second set of triples would preserve the identity of the citing work if the 'citing' and 'cited' sets of triples were to be separated.

An alternative view of the same citation network as shown in Figure 1 is provided by Figure 2, in which the node size is proportional to the cube root of the number of global citations received by each pre-2006 reference, using numerical data from Google Scholar, while the bumps on each citing reference are proportional to the square root of the number of in-text citations of the cited paper within each citing paper, an indication of the importance of the cited paper to the citing paper.

### Characterization of cited works

The fourth purpose of CiTO is to enable the cited works themselves to be characterized, so that someone reading a reference list marked up using CiTO can better appreciate their nature. In making this characterization, CiTO has adopted the FRBR (Functional Requirements for Bibliographic Records) classification<sup>10, 11</sup> developed by the United States Library of Congress for characterizing different aspects of a publication (Figure 3). This FRBR classification distinguishes *Works*, *Expressions*, *Manifestations* and *Items*:

<sup>10</sup> <http://www.ifla.org/VII/s13/frbr/frbr1.htm>.

<sup>11</sup> <http://www.loc.gov/cds/downloads/FRBR.PDF>.

A *Work* is a distinct intellectual or artistic creation, an abstract concept recognised through its various expressions. An example of a *Work* is your latest research paper.

An *Expression* is the specific form that a *Work* takes each time it is ‘realized’ in physical or electronic form. For your latest research paper, Draft 5, the preprint, and the published version to which the publisher assigned a unique DOI (Digital Object Identifier)<sup>12</sup>, are all *Expressions* of the same work.

A *Manifestation* of an expression of a scholarly work defines its particular physical or electronic embodiment. If your latest research paper appeared as an article in a print journal, and also in the on-line version of that journal as an HTML page, and as a downloadable PDF file, these are three separate manifestations of the same ‘version of record’ *Expression* of your work, all bearing the same DOI.

An *Item* is one single copy of a *Manifestation*, for example the paper reprint of your article on your desk, or the copy of the PDF file of your article on your computer hard drive.

FRBR has recently been harmonized with the CIDOC Conceptual Reference Model<sup>13</sup> (CIDOC CRM) [5] and represented as FRBRoo<sup>14</sup>, an encoding of FRBR using the CIDOC CRM. On first encounter, the FRBR classification into *Works*, *Expressions*, *Manifestations* and *Items* might seem a little fussy, and its application to CiTO, detailed below, might appear to result in occasionally redundant terminology, e.g. *Work: Report; Expression: ReportDocument*. However, this level of granularity of description is of enormous value, since it avoids ambiguities of meaning that abound in ‘flatter’ bibliographic ontologies, as discussed below. CiTO follows FRBR by defining subclasses of *Work*, *Expression* and *Manifestation* to suit typical scientific usage, but does not concern itself with *Items*.

#### **Sub-classes of *Work* in CiTO:**

<i>BookReview</i>	<i>CaseForSupport</i>	<i>Catalogue</i>
<i>Dataset</i>	<i>Discussion</i>	<i>Editorial</i>
<i>GrantApplication</i>	<i>Image</i>	<i>Message</i>
<i>Model</i>	<i>MovingImage</i>	<i>NewsItem</i>
<i>Ontology</i>	<i>Opinion</i>	<i>PersonalCommunication</i>
<i>Patent</i>	<i>PatentApplication</i>	<i>Presentation</i>
<i>Proposition</i>	<i>Protocol</i>	<i>ReferenceWork</i>
<i>Report</i>	<i>ResearchPaper</i>	<i>Review</i>
<i>Software</i>	<i>Specification</i>	<i>StillImage</i>
<i>Taxonomy</i>	<i>TechnicalStandard</i>	<i>Text</i>
<i>WorkingPaper</i>		

<sup>12</sup> <http://www.doi.org/>.

<sup>13</sup> <http://cidoc.ics.forth.gr/index.html>.

<sup>14</sup> [http://cidoc.ics.forth.gr/frbr\\_inro.html](http://cidoc.ics.forth.gr/frbr_inro.html).

Among these, *CaseForSupport* is typically a component of a *GrantApplication* which may be referenced separately, and *MovingImage* and *StillImage* are sub-classes of *Image*, use of these more specific terms being preferable to the more general one wherever possible. The class *MovingImage* encompasses any series of visual representations imparting an impression of motion when shown in succession; examples include animations, movies, television programs, videos, and computational simulations.

#### Sub-classes of *Expression* in CiTO:

<i>BlogEntry</i>	<i>Book</i>	<i>BookChapter</i>
<i>BookSection</i>	<i>CaseForSupportDocument</i>	<i>ConferencePaper</i>
<i>ConferencePoster</i>	<i>Database</i>	<i>Document</i>
<i>Email</i>	<i>Figure</i>	<i>File</i>
<i>GrantApplicationDocument</i>	<i>JournalArticle</i>	<i>JournalItem</i>
<i>Letter</i>	<i>MagazineArticle</i>	<i>Manuscript</i>
<i>PatentDocument</i>	<i>PatentApplicationDocument</i>	<i>Preprint</i>
<i>PresentationFile</i>	<i>ReportDocument</i>	<i>Spreadsheet</i>
<i>Table</i>	<i>TextFile</i>	<i>Thesis</i>
<i>WebInformationSource</i>	<i>WikiEntry</i>	

Among these, *BlogEntry* and *WikiEntry* are subclasses of *WebInformationSource*; *BookChapter* is a subclass of *BookSection*; *CaseForSupportDocument*, *GrantApplicationDocument*, *PatentDocument*, *PatentApplicationDocument* and *ReportDocument* are subclasses of *Document*; and *JournalArticle* is a subclass of *JournalItem*. The more specific terms should be used in preference to the more general ones wherever possible.

Full definitions of all these *Work* and *Expression* sub-classes are given in the ontology itself<sup>15</sup>.

At the fundamental philosophical level, the target of a citation is the *Work* itself, rather than any particular *Expression* of that work. However, there are three pragmatic reasons why the object of a CiTO citation should normally be an *Expression* of a particular work.

First, publication of RDF citation information as Linked Data requires that both the citing work and the cited work are referenced by means of URIs. *Works* in FRBR are abstract concepts, and as such are typically not assigned URIs. It is only the published '**version of record**' of a paper that is assigned a DOI, which can be used to create such a unique dereferenceable URI – this applies both to the citing work and the cited work.

---

<sup>15</sup> <http://purl.org/net/cito/>.

Second, while in principle the citation holds true for any *Expression* of the work, for example a translation into another language, in reality the object of the citation originally made by the author on a particular day was a particular *Expression* of the work, namely the particular published ‘version of record’ that he or she first located, then read, and finally cited.

Finally, CiTO may be used to specify the number of in-text citations to the cited work, and the number of global citations that cited work has received at the time of citation. The number of in-text citations to a particular cited work within your most recent research paper, and also the total number of distinct references cited, probably changed as the paper was developed through various drafts. Thus the version that matters for CiTO in determining the number of in-text citations is the final published ‘version of record’ *Expression* of your own paper. Similarly, the version of the cited article that matters for determining the global citation counts is its ‘version of record’ *Expression*, since it is only those of which citing third parties are normally aware and to which their citations are directed.

It is thus the *Expressions* of scholarly works that normally form the domain and range of CiTO object properties describing the nature of a citation. However, for “born-on-the-web” information presented in a *WebSite* or an individual *WebPage*, where there is no separately identifiable *Expression* of the *WebInformationSource*, CiTO citations can be made to the URI of the *WebSite* or individual *WebPage* directly.

If an author wishes, when using CiTO, to add citation typings to references cited within his or her citing work *prior* to publication, the blank node `_:ThisWork` may be employed to denote the author's citing work. Similarly, if the citation is to a preprint that has yet to appear as a ‘version of record’ expression with a DOI, that cited work can be described in RDF by a string of the form “Jones AB and Smith CD (2009) Title (Preprint)”. These blank nodes can subsequently be replaced by the URI of the unique DOI identifier of the ‘version of record’ when the author's citing paper is published. Similarly the string placeholder for the cited work can be replaced by the appropriate DOI-based URI, once Jones and Smith's cited preprint is finally published.

Although scholarly citations do not usually required specification of the *Manifestation* of the cited *Expression* of a *Work*, CiTO does permit the nature of the *Manifestation* to be recorded in terms of the following categories:

**Sub-classes of *Manifestation* in CiTO:**

<i>Blog</i>	<i>DigitalMediaObject</i>	<i>OnlineDocument</i>
<i>PrintDocument</i>	<i>WebPage</i>	<i>WebSite</i>
<i>Wiki</i>		

Clearly, these CiTO subclasses of *Work*, *Expression* and *Manifestation* are not exhaustive. They are not meant to be. The purpose of CiTO is to be as simple as possible while yet being fit for purpose in the new digital world. Cited works are more completely described in other ontologies, as discussed below.

The peer-review status of an expression of a work can also optionally be recorded, information that could enable searches designed to retrieve only peer-reviewed articles:

**Peer review status:** *peerReviewed*, qualified by a Boolean operator *True* or *False*.

CiTO thus has a number of subclasses of *Work*, *Expression* and *Manifestation* that enable accurate characterization of cited publications. When using CiTO for this purpose, publications should be characterized using a single disjoint subclass for *Work* and also for *Expression*. Each *Expression* can optionally also be given a *Manifestations* type and a *peerReviewed* status, as in the following example:

```
<http://example2.com/citedpaper>
  dcterms:bibliographicCitation "Full bibliographic details" ;
  rdfs:label "FirstAuthor et al. (Year)"; # label
  rdf:type cito:ResearchPaper ; # work type
  rdf:type cito:JournalArticle ; # expression type
  rdf:type cito:WebPage ; # manifestation type
  cito:peerReviewed "true"^^xsd:Boolean ; .
```

## The relationship of CiTO with other metadata schemas and ontologies

### CiTO and FRBR

While CiTO follows the *Work*, *Expression*, *Manifestation* classification of FRBR, as explained above, the scope of CiTO is more limited than FRBR, since CiTO covers scholarly works that contain bibliographic references, rather than artistic works such as plays or photographs that usually do not. Of course, a citation may occasionally be to an artistic work, such as a reference to *Macbeth*.

### CiTO and SWAP

The Scholarly Works Application Profile (SWAP)<sup>16</sup> describes the metadata requirements for a scholarly work. SWAP, like CiTO, follows the FRBR model, but its scope is different from that of CiTO, in that SWAP concerns itself with items of metadata surrounding the scholarly work that fall outside the scope of a bibliographic citation, such as funding agency and copyright holder. Conversely, CiTO is concerned with the factual and rhetorical relationships *between* citing and cited works, something which cannot be captured within the metadata of a single work. As far as possible, CiTO has adopted SWAP's terminology and class definitions.

### CiTO and BIBO

Among many previous efforts to create metadata schemas and ontologies for characterizing bibliographic references, BIBO, the Bibliographic Ontology<sup>17</sup> written in OWL, provides the much-needed ability to describe the nature of cited works in RDF to a high degree of granularity, in terms of *Title*, *Abstract*, *Journal*, *Volume*, *Pages*, *ISSN*, *DOI*, *dataCopyrighted*, *editor*, etc. In addition to covering conventional scholarly works, BIBO also covers things outside that realm, including broadcasts (e.g. *Interviewer*, *Performer*, *Producer*) and legal entities (e.g. *CourtReporter*, *Hearing*,

<sup>16</sup> <http://www.ukoln.ac.uk/repositories/digirep/index/SWAP>.

<sup>17</sup> <http://bibliontology.com/>.

*LegalCaseDocument*). However, it is lacking equivalent classes for approximately two-thirds of the CiTO subclasses of *Work*, *Expression* and *Manifestation*, e.g. *JournalArticle* and *ConferencePaper*, terms that are of central importance in academic citations.

Unfortunately, BIBO has not adopted the *Work*, *Expression*, *Manifestation* classification of FRBR, which leads to lack of precision in nomenclature. For example, while CiTO has *Work: ResearchPaper*; *Expression: JournalArticle*, BIBO has *AcademicArticle*, which conflated these two concepts. Similarly, BIBO's definition of *Standard* is "A document describing a standard", whereas CiTO has *Work: TechnicalStandard* ("A defined specification or requirement for a technical method, practice, process or protocol involved in, for example, manufacturing, computation, electronic communication, or digital media."); and *Expression: Document* (A physical or electronic *Expression* of a *Work*, conveying a body of information primarily in textual form).

The only relationships in BIBO of potential relevance for the characterization of citations themselves are *affirmedBy*, *annotates*, *reviewOf*, *translationOf*. While CiTO also has *reviews*, the other three terms are unique and useful.

Since the primary purpose of CiTO is to characterise citations, while that of BIBO is to characterize cited works, the two ontologies are essentially orthogonal. However, until BIBO adopts the FRBR data model and provides the missing classes required to describe cited works, CiTO will continue to use its own terms for cited works, expressing equivalences with BIBO wherever possible.

### CiTO and SWAN

SWAN (Semantic Web Applications in Neuromedicine)<sup>18</sup> is a project to develop knowledge bases for the neurodegenerative disease research communities. Within a set of modular ontologies created within SWAN<sup>19</sup> is the SWAN Scientific Discourse Relationships Ontology<sup>20</sup>, designed for characterization of rhetorical statements within text.

The purpose of the SWAN Scientific Discourse Relationships Ontology is to characterize the rhetorical structures that exist within scientific writings. For example, it can be used to encode the related triples *Statement\_A derivedFrom JournalArticle* and *Statement\_A refersTo Gene*. Its primary purpose is therefore wider than that of CiTO. Nevertheless, the SWAN Scientific Discourse Relationships Ontology includes the relationships:

<i>agreesWith</i>	<i>arisesFrom</i>	<i>cites</i>
<i>consistentWith</i>	<i>disagreesWith</i>	<i>discusses</i>
<i>inconsistentWith</i>	<i>motivatedBy</i>	

which are terms identical or similar to those for relationships within CiTO, although the targets of those relationships are subtly different. A collaboration has recently been formed, under the umbrella of the emerging HypER (Hypotheses, Evidence & Relationships) research community<sup>21</sup> that includes this author and the leader of the SWAN project, to harmonize CiTO and SWAN, and to distinguish more clearly the role of CiTO in describing citations (including support for citation counts, citation characterization and citation networks) from that of the SWAN Scientific Discourse

<sup>18</sup> <http://swan.mindinformatics.org/>.

<sup>19</sup> <http://swan.mindinformatics.org/ontology.html>.

<sup>20</sup> <http://swan.mindinformatics.org/spec/1.2/discourserelationships.html>.

<sup>21</sup> <http://hyp-er.wik.is/>.

Relationships Ontology in describing the wider rhetorical structures that exist in scientific writings. At that time, CiTO will also be integrated more fully with other vocabularies, for example by making *cito:cites* a subclass of *dc:references*. The outcomes of that collaboration will be reported in due course.

### Granularity and scope

The commentary tradition of classical and biblical scholarship has well-developed methods for citing individual sections, paragraphs or verses of referenced works. In contrast, modern scientific references are typically made to the cited works as complete entities. It was to enhance this standard practice that CiTO was developed. However, there are calls to permit a scientific article to be created compositionally from a set of pre-defined independent parts [6-8], and for individual rhetorical elements within the text to be referenced directly [9, 10]. Indeed, it is perfectly possible, using hidden XML or RDFa code behind the displayed human-readable Web document, for the text of an on-line article to be marked up semantically to the level of the paragraph, the sentence or even the individual word, or to particular rhetorical elements (hypotheses, claims, supporting statements, refutations, etc.). Various tools to enable that to be done are in early-stage development, and such moves will require support from appropriate ontologies.

### CiTO vocabulary definitions

CiTO adopts the Dublin Core Metadata Initiative (DCMI) Type Vocabulary<sup>22</sup> definitions for the terms *Dataset*, *Image*, *MovingImage*, *Software*, *StillImage* and *Text*. Other CiTO class names and their definitions include all items in the vocabulary defined by SWAP for subclasses of the *dc:type* property *Text*, with only minor defined nomenclature variations.

CiTO extends the vocabularies mentioned above by defining new relationships between citing work and cited work, and by including a number of additional sub-classes of *Work*, *Expression* and *Manifestation*. In CiTO, all class names and properties are given full definitions, which may be found in the ontology itself<sup>10</sup> and in textual form in **Supplementary Information File S2** accompanying this paper<sup>23</sup>.

CiTO has been developed with the scientific research community in mind. Its expansion to fulfill the citation needs of other disciplines will require engagement with appropriate domain experts. For example, classical scholarship in the commentary tradition requires comparison of textual variations between individual manuscripts (using the traditional meaning of the word: hand-written documents). Here, the FRBR concept of *Item* becomes important, but, for these unique creations, the distinction between *Manifestation* and *Item* becomes blurred.

## Examples of CiTO in use

The first example of the use of CiTO for annotation of the reference list in an on-line biomedical research article can be seen in our enhanced version of Reis *et al.* (2008) [1]. Here, the human readable CiTO mark-up can be made visible by first going to the References section of the paper (click the 'References' tab above the article's title), and then by turning on the optional citation typing display (click the 'Turn citation typing on'

---

<sup>22</sup> <http://dublincore.org/documents/dcmi-type-vocabulary/>.

<sup>23</sup> <http://dx.doi.org/DOI to be supplied by the Journal of Biomedical Informatics>.

button just before the first reference). Figure 4 provides a snapshot of the CiTO mark-up of the first few references in that paper. An exemplar downloadable file containing all the references from that article with their CiTO mark-up and their citation frequency information in RDF N3 format is also available<sup>24</sup>. CiTO has also been used to annotate the references of this article, which are available in a structured machine-readable form in **Supplementary Information File S3** accompanying this paper<sup>25</sup> (see below). In both cases, the CiTO terms used, shown in italics, have been rendered more readable than the class or property labels in the ontology, by reverting from CamelCase (e.g. *obtainsBackgroundFrom, JournalArticle*) to normal English (i.e. *obtains background from, Journal Article*).

## Conclusion

CiTO version 1.3, published on 5 May 2009, was described in a preliminary report [11]. CiTO version 1.4, described in this paper, represents a significant extension of the ontology, with 3 new object properties, 7 new subclasses and 3 deprecated subclasses of *Work*, 2 subclasses of *Work* with revised definitions, 10 new and 2 renamed subclasses of *Expression* with new definitions, 3 subclasses of *Expression* with revised definitions, 3 new subclasses of *Manifestation*, and 2 subclasses of *Manifestation* with revised definitions. Domain and range restrictions on CiTO terms have also been relaxed. Full details of these changes are given in Supplementary Information File S2<sup>23</sup>. The deprecations and class name changes are possible at this very early stage of the ontology's life, since none of them affect existing markup using the ontology.

In developing CiTO, I have sought to create an ontology sufficient in scope for the types of bibliographic citation encountered in biological research articles. Authors should be able to use it to type their own citations, although there is clearly scope for the development of an ontology-backed tool (e.g. a Word plug-in) that would assist that process during paper writing. Alternatively, citation typing can be made at the time of publication or later.

CiTO is published as open source under a Creative Commons attribution licence, and I invite community engagement in its use and extension, and in the development of authoring tools that can use it.

## Competing interests

None.

## Acknowledgements

I am most grateful to Katie Portwin who participated in the development of the initial CiTO prototype, to Alistair Miles for guidance in RDF modeling and syntax, and for technical help in coding and publishing the CiTO ontology, and to Sandhya Vellore who determined the citation counts encoded in Figure 2. The development of CiTO forms part of the work of the Ontogenesis Network, supported by EPSRC grant EP/E021352/1.

---

<sup>24</sup> <http://dx.doi.org/10.1371/journal.pntd.0000228.x004>.

<sup>25</sup> [http://dx.doi.org/DOI to be supplied by the \*Journal of Biomedical Informatics\*](http://dx.doi.org/DOI%20to%20be%20supplied%20by%20the%20Journal%20of%20Biomedical%20Informatics).

## References

1. Reis RB, Ribeiro GS, Felzemburgh RDM, Santana FS, Mohr S, Melendez AXTO, Queiroz A, Santos AC, Ravines RR, Tassinari WS, Carvalho MS, Reis MG, Ko AI: **Impact of environment and social gradient on *Leptospira* infection in urban slums.** *PLoS Neglected Tropical Diseases* 2008, **2**: e228. doi:[10.1371/journal.pntd.0000228](https://doi.org/10.1371/journal.pntd.0000228)  
CiTO: *cites for information, uses data from, Research Paper, Journal Article, peer reviewed.*
2. Shotton D, Portwin K, Klyne G, Miles A: **Adventures in semantic publishing: exemplar semantic enhancement of a research article.** *PLoS Computational Biology* 2009 **5**: e1000361. doi: [10.1371/journal.pcbi.1000361](https://doi.org/10.1371/journal.pcbi.1000361).  
CiTO: *cites for information, shares authors with, Research Paper, Journal Article, peer reviewed.*
3. Amin M, Mabe M: **Impact factors: use and abuse.** *Medicina (Buenos Aires)* 2003, **63**:347-354. Available at [http://www.scielo.org.ar/scielo.php?pid=S0025-76802003000400011&script=sci\\_arttext&tlng=en](http://www.scielo.org.ar/scielo.php?pid=S0025-76802003000400011&script=sci_arttext&tlng=en).  
CiTO: *cites for information, Discussion, Journal Article, peer reviewed.*
4. Amin M, Mabe M: **Impact factors: use and abuse.** *Perspectives in Publishing* 2000, **1**:1-6. Available at [http://www.elsevier.com/framework\\_editors/pdfs/Perspectives1.pdf](http://www.elsevier.com/framework_editors/pdfs/Perspectives1.pdf).  
CiTO: *cites for information, Discussion, Magazine Article, not peer reviewed.*
5. Doerr M, Iorizzo D: **The dream of a global knowledge network - a new approach.** *ACM J Comput Cultur Heritage* 2008, **1**:Article 5 (June 2008), 23 pages. doi: [10.1145/1367080.1367085](https://doi.org/10.1145/1367080.1367085).  
CiTO: *cites as authority, cites for information, Proposition, Journal Article, peer reviewed.*
6. Joost G, Kircz J: **Modularity: the next form of scientific information presentation?** *Journal of Documentation* 1998, **54**:210-235. Available at <http://www.emeraldinsight.com/Insight/html/Output/Published/EmeraldAbstractOnlyArticle/Pdf/2780540204.pdf>.  
CiTO: *cites for information, Proposition, Journal Article, peer reviewed.*
7. Murray-Rust P, Rzepa HS, Tyrrell SM, Zhang Y: **Representation and use of chemistry in the global electronic age.** *Organic and Biomolecular Chemistry* 2004, **2**:3192-3203. doi:[10.1039/b410732b](https://doi.org/10.1039/b410732b).  
CiTO: *cites for information, Proposition, Journal Article, peer reviewed.*
8. Sumner T, Buckingham Shum S: **Open peer review and argumentation: loosening the paper chains on journals.** *Ariadne (Bi-Monthly Magazine of the UK Electronic Libraries Programme)* 1996, **Issue 5 (September 1996)**. Available at <http://www.ariadne.ac.uk/issue5/jime/intro.html>.  
CiTO: *cites for information, Discussion, Magazine Article, not peer reviewed.*
9. de Waard A, Shum SB, Carusi A, Park J, Samwald M, Sandor A: **Hypotheses, Evidence and Relationships: The HypER Model of Representing Scientific Knowledge.** Workshop on Semantic Web Applications i Scientific Discourse, 8th International Semantic Web Conference (ISWC 2009, Washington DC; 2009. Available from <http://ceur-ws.org/Vol-523/deWaard.pdf>.  
CiTO: *cites for information, Proposition, Conference Paper, peer reviewed.*

10. de Waard A, Kircz J: **Modeling scientific research articles – shifting perspectives and persistent issues**. *Proc. ELPUB2008 Conference on Electronic Publishing; June 2008, pp 234-245; Toronto, Canada. 2008*. Available at [http://elpub.scix.net/data/works/att/234\\_elpub2008.content.pdf](http://elpub.scix.net/data/works/att/234_elpub2008.content.pdf).  
CiTO: *cites for information, Proposition, Conference Paper, peer reviewed*.
11. Shotton D: **CiTO, the Citation Typing Ontology, and its use for annotation of reference lists and visualization of citation networks**. In *Bio-Ontologies 2009 Special Interest Group meeting at ISMB 2009; 28-29 June 2009; Stockholm. 2009*. Available at [http://imageweb.zoo.ox.ac.uk/pub/2009/publications/Shotton\\_ISMB\\_BioOntology\\_CiTO\\_final\\_postprint.pdf](http://imageweb.zoo.ox.ac.uk/pub/2009/publications/Shotton_ISMB_BioOntology_CiTO_final_postprint.pdf).  
CiTO: *cites for information, extends, obtains background from, shares authors with, uses data from, Proposition, Conference Paper, peer reviewed*.

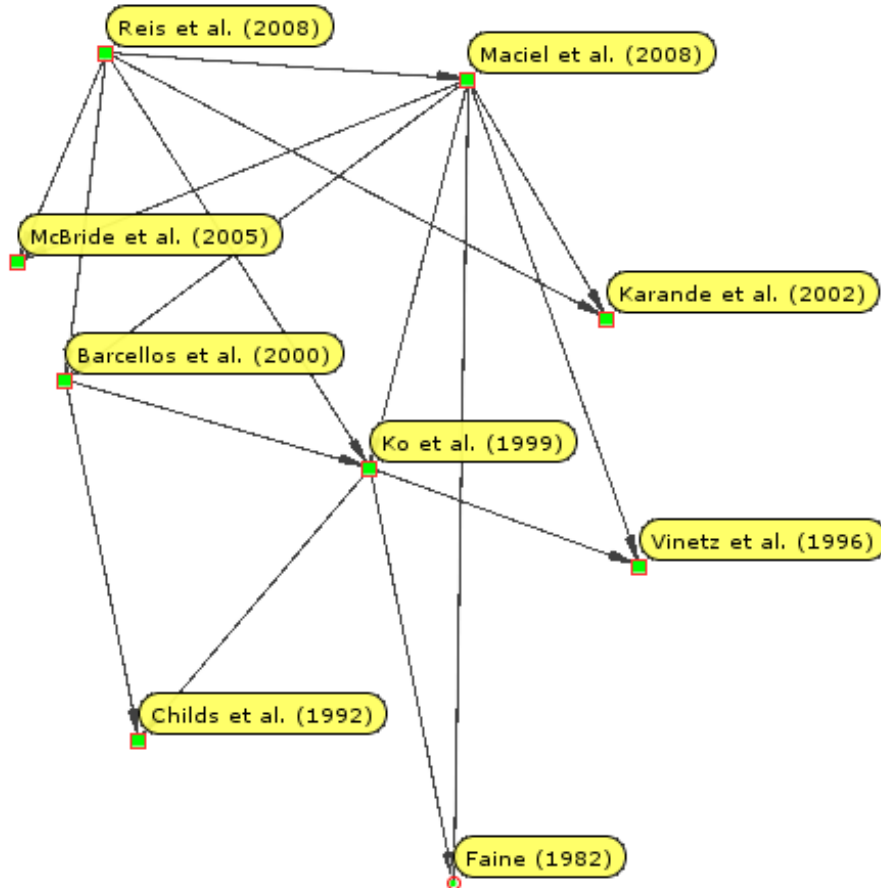
## Machine-readable reference list with citation typing

The eleven bibliographic references made in this article, typed using the Citation Typing Ontology and recorded in a structured machine-readable form, are available as **Supplementary Information File S3** accompanying this paper<sup>25</sup>. This file also records the twenty seven Web sites referenced in this article. The information is encoded as RDF<sup>2</sup>, serialized in Notation3 format<sup>3</sup>.

## Figures

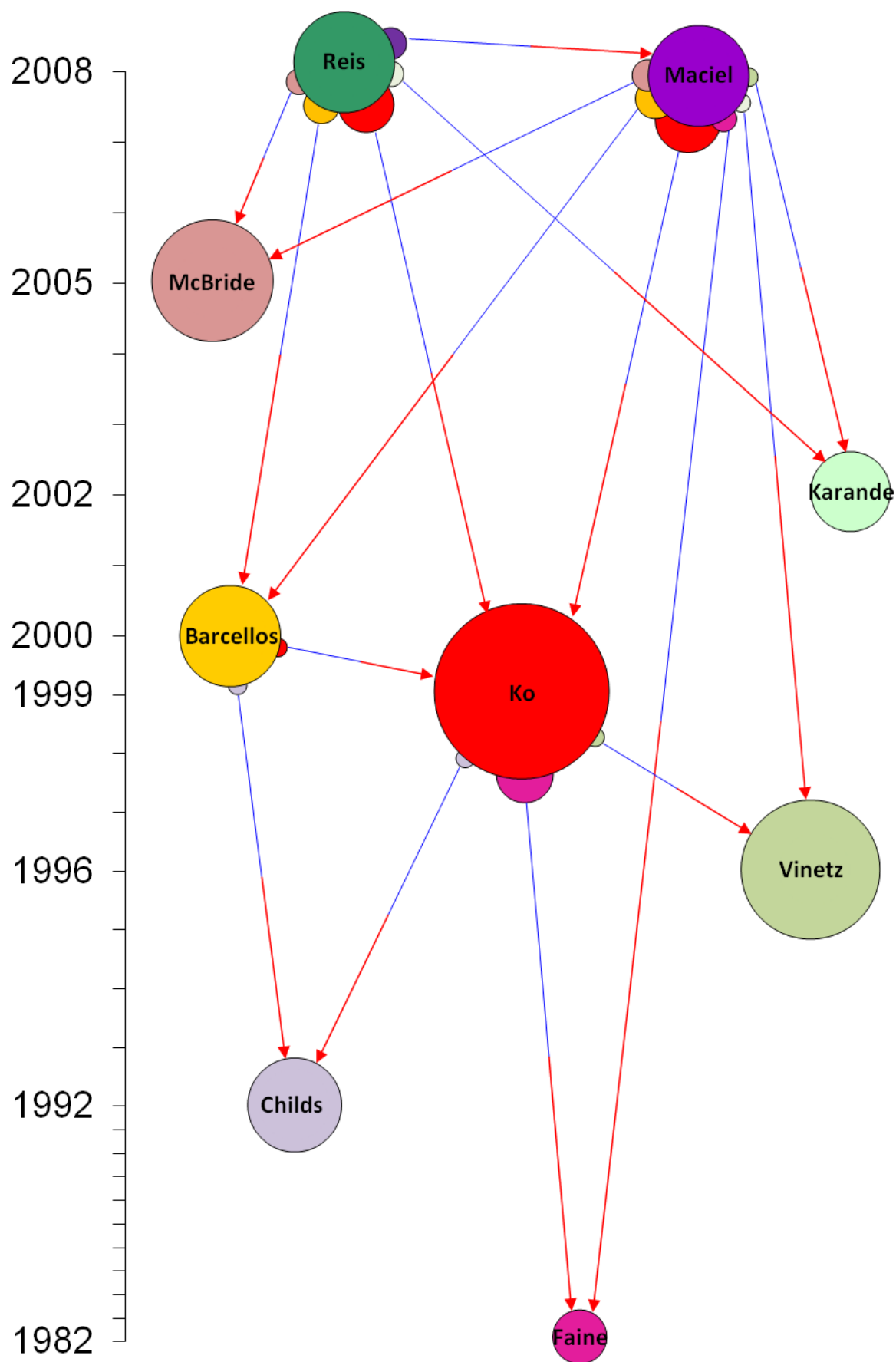
**Figure 1 - A CiTO citation network**

A citation network of selected articles directly or indirectly cited by Reis et al. (2008) [1], automatically displayed using the open source RDF graphing application Welkin, from an input RDF graph of *cito:cites* relationships.



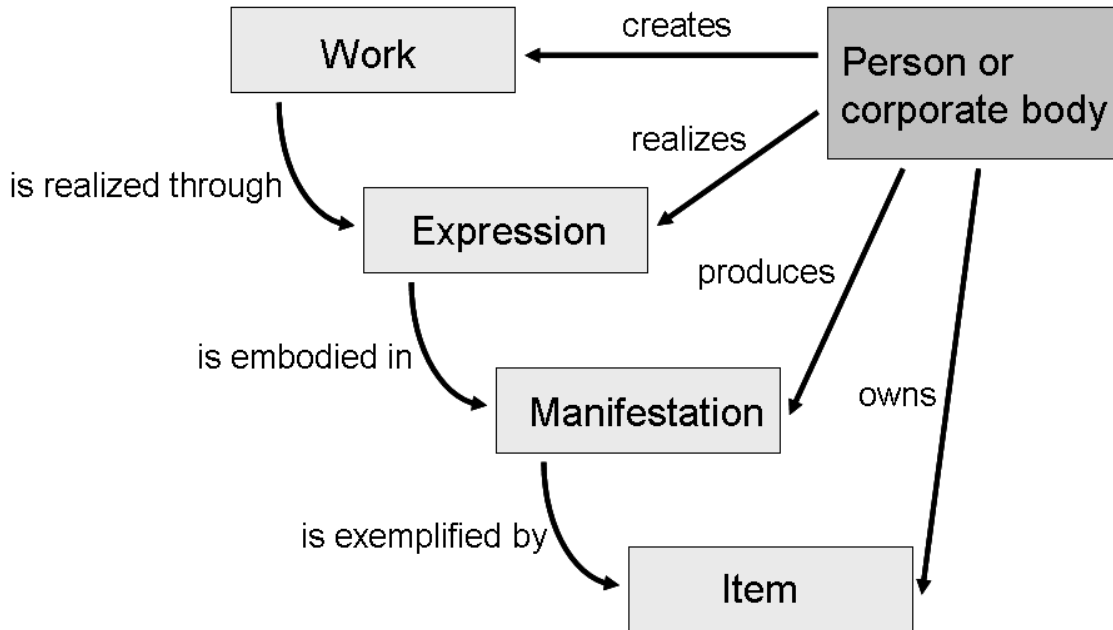
**Figure 2 - An alternative representation of a CiTO citation network, displaying both in-text and global citation frequencies**

This figure shows the same citation network as Figure 1, but was created manually to encode citation frequency information. The node size of each pre-2006 reference is proportional to the cube root of the number of global citations received, using numerical data from Google Scholar acquired on March 11 2009. The bumps on each citing reference are proportional to the square root of the number of in-text citations of the cited paper within each citing paper, an indication of the importance of the cited paper to the citing paper, and have a colour that matches the colour of the cited paper.



### Figure 3 - The FRBR classification

The diagram shows the relationships between *Works*, *Expressions*, *Manifestations* and *Copies*, and their relationship to people and/or corporate bodies in the FRBR classification. CiTO does not use the FRBR class *Copy*.



### Figure 4 - An example of the use of CiTO to annotate a reference list

The first three references from the reference list of the enhance version of Reis et al. (2008) [1], with the citation typing display turned on. Above the references are buttons to re-order the references, and to turn off the citation typing display. This figure was first published in Shotton *et al.* [2].

Sort by:

1. United Nations Human Settlements Programme (2003) The challenge of slums: Global report on human settlements 2003. London: Earthscan Publications Ltd. [Link](#) (CiTO: *obtains background from, Report, Book, Online Document, not peer reviewed*)
2. Riley LW, Ko AI, Unger A, Reis MG (2007) Slum health: Diseases of neglected populations. BMC Int Health Hum Rights 7: 2. [DOI PubMed PubMedCentral](#) (CiTO: *obtains background from, shares authors with, Opinion, Journal Article, peer reviewed*)
3. Sclar ED, Garau P, Carolini G (2005) The 21st century health challenge of slums and cities. Lancet 365: 901–903. [DOI PubMed](#) (CiTO: *obtains background from, Opinion, Journal Article, peer reviewed*)

# CiTO, the Citation Typing Ontology

David Shotton (2010) *Journal of Biomedical Semantics* \*\*: \*\*\*\_\*\*\*.

## Supplementary File S1: Publication Metadata

[Note to BioOntology2009: This file will be published as a raw text file. It is here included with the CiTO paper in PDF format for the convenience of reviewers]

[Note to reviewers: This RDF file will be validated once the missing DOIs have been inserted. However, the file in its present shape will give you the general idea.]

===

```

@prefix cito: <http://purl.org/net/cito/>.
@prefix frbr: <http://purl.org/vocab/frbr/core#>.
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>.
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#>.
@prefix dc: <http://purl.org/dc/elements/1.1/>.
@prefix cc: <http://web.resource.org/cc/>.
@prefix foaf: <http://xmlns.com/foaf/0.1/>.
@prefix prism: <http://prismstandard.org/namespaces/1.2/basic/>.
@prefix geo: <http://www.w3.org/2003/01/geo/wgs84_pos#>.
@prefix cito: <http://purl.org/net/cito/>.
@prefix dcterms: <http://purl.org/dc/terms/>.
@prefix time: <http://www.w3.org/2006/time#> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .
@prefix projectfunding: <http://vocab.ouls.ox.ac.uk/projectfunding#> .
@base <http://dx.doi.org/doi to be supplied by JMBS> # The CiTO paper in JBMS

# This file contains metadata descriptions of the article by
# Shotton DM (2010) CiTO, the Citation Typing Ontology. Journal of Biomedical Semantics **: ***_***.
# The metadata are encoded as RDF using N3 format.

# This document information file has been prepared by and is copyright (c) David Shotton, University of Oxford, 5 November 2009. This document is an open access reference work distributed under the terms of the Creative Commons Attribution License 2.5, which permits unrestricted use, distribution, and reproduction in any medium, provided that the original author and source are credited.
# Contact <david.shotton@zoo.ox.ac.uk> for further information.

# about this metadata document ...
<http://dx.doi.org/doi to be supplied by JMBS> # Supplementary File S1
  dc:creator [ a foaf:Person ; foaf:name "David Shotton" ; foaf:mbox
<mailto:david.shotton@zoo.ox.ac.uk> ; ] ;
  dc:date "2009-11-05"^^xsd:date ;
  dcterms:license <http://creativecommons.org/licenses/by/2.5/> ;
  cito:citesAsSourceDocument <http://dx.doi.org/doi to be supplied by JMBS> ;
.

# about the paper it describes ...
<http://dx.doi.org/doi to be supplied by JBMS> # The CiTO paper in JBMS
  dcterms:issued "2010-??-??" ;
  cito:citesAsMetadataDocument <http://dx.doi.org/doi to be supplied by JMBS> ;
  rdf:type cito:Proposition ; # work
  rdf:type cito:JournalArticle ; # expression
  cito:peerReviewed "true"^^xsd:boolean ; # peer review status
  dc:title "CiTO, the Citation Typing Ontology";
  dc:identifier <http://dx.doi.org/doi to be supplied by JBMS> ;
  dc:language "en" ;
  dcterms:publisher [
    a dcterms:Agent ;

```

```

foaf:homepage <http://www.biomedcentral.com/> ;
dc:title "BioMed Central" ;
];

dcterms:issued "2010";
dcterms:abstract ""

<p> CiTO, the Citation Typing Ontology, is an ontology
for describing the nature of reference citations in scientific research articles and
other scholarly works, and for publishing these descriptions on the Semantic Web.
Citation are described in terms of the factual and rhetorical relationships between
citing publication and cited publication, the in-text and global citation frequencies
of each cited work, and the nature of the cited work itself, including its peer review
status. This paper describes CiTO and illustrates its usefulness both for the
annotation of bibliographic reference lists and for the visualization of citation
networks. The latest version of CiTO is CiTO Version 1.4, published on 16 November
2009. CiTO is written in the Web Ontology Language OWL, uses the namespace
http://purl.org/net/cito/, and is available from http://purl.org/net/cito/. This site
uses content negotiation to deliver to the user an OWLDoc Web version of the ontology
if accessed via a Web browser, or the OWL ontology itself if accessed from an ontology
management tool such as Protégé (http://protege.stanford.edu/). Work is ongoing to
extend CiTO and to harmonize it with other ontologies describing bibliographies and
the rhetorical structure of scientific discourse.</p>
""^^rdfs:XMLLiteral ;

## Author
dc:creator [ a foaf:Person ; foaf:name "David M. Shotton " ; ] ;
dc:creator [
foaf:firstName "David";
foaf:surname "Shotton";
foaf:name "David Shotton";
foaf:workplaceHomePage
<http://www.zoo.ox.ac.uk/staff/academics/shotton_dm.htm>;
];

## Copyright
dcterms:license <http://creativecommons.org/licenses/by/2.5/>;

## Bibliographic metadata
prism:publicationName "Journal of Biomedical Semantics ";
prism:eIssn "2041-1480";
prism:publicationDate "2010-**-**";
prism:volume "**";
prism:number "**";
prism:startingPage "**";
prism:endingPage "**";
dcterms:bibliographicCitation " David Shotton (2010) CiTO, the Citation
Typing Ontology. Journal of Biomedical Semantics **: **-**. doi: to be supplied by
JBMS ";

## Tags / Keywords
dc:subject "bibliography";
"Bibliographic Ontology";
"BIBO";
"citation";
"citation frequency";
"citation network";
"Citation Typing Ontology";
"CiTO";
"Dublin Core Metadata Initiative";
"DCMI";
"Functional Requirements for Bibliographic Records";
"FRBF";
"FRBRoo";
"FRBR expression";
"FRBR manifestation";
"FRBR work";

```

```

        "ontology";
        "reference";
        "rhetoric";
        "Scientific Discourse Relationships Ontology";
        "Semantic Web Applications in Neuromedicine";
        "SWAN";
        "Scholarly Works Application Profile";
        "SWAP";

## Geo-coordinates of study location
    dct:spatial [
        a dct:Location ;
        geo:lat      "+51.7583";
        geo:long     "-01.2503";
        rdfs:label   "Oxford, United Kingdom ";
    ];

## Temporal coordinates of study
    dct:temporal [
        a dct:PeriodOfTime ;
        time:hasBeginning [ a time:Instant ; time:inXSDDateTime
"2008-08-18"^^xsd:datetime ; ] ;
        time:hasEnd [ a time:Instant ; time:inXSDDateTime
"2009-11-05"^^xsd:datetime ; ] ;
    ];

## Project funding
    projectfunding:FundingBody <http://www.epsrc.ac.uk/> ;
    projectfunding:Project <http://www.ontonet.org/> .

    <http://www.epsrc.ac.uk/>
        dc:title "The Engineering and Physical Sciences Research Council." .
    <http://www.ontonet.org/>
        dc:title "The Ontogenesis Network." .

Project funding details yet to be encoded in RDF

# Grant number: EP/E021352/1
# Project purpose: The creation, ontogeny and evolution of biomedical
ontologies
# Principal investigator: Dr David Shotton
# PI's institution: http://www.ox.ac.uk/ University of Oxford
# PI's department: http://www.zoo.ox.ac.uk/ Department of Zoology
# PI's research group: http://ibrg.zoo.ox.ac.uk/ Image Bioinformatics
Research Group

# /end

```

# CiTO, the Citation Typing Ontology

David Shotton (2010) *Journal of Biomedical Semantics* \*\*: \*\*\*\_\*\*\*.

## Supplementary File S2: The CiTO Vocabulary and Definitions

[**Note to BioOntology2009: This file will be published as an HTML document. It is here included with the CiTO paper in PDF format for the convenience of reviewers**]

### Provenance information

The URL of this document is [[J. Biomedical Semantics DOI to be supplied](#)].

This document was written by David Shotton, Image Bioinformatics Research Group, Department of Zoology, University of Oxford ([david.shotton@zoo.ox.ac.uk](mailto:david.shotton@zoo.ox.ac.uk)), and was last modified on 4 November 2009.

© 2009 David Shotton. This document is an open access reference work distributed under the terms of the Creative Commons Attribution License 2.5 (<http://creativecommons.org/licenses/by/2.5/>), which permits unrestricted use, distribution, and reproduction in any medium, provided that the original author and source are credited.

### History

The version of CiTO that this document describes is Version 1.4, [to be] published on 16 November 2009. CiTO is written in the Web Ontology Language OWL, uses the namespace <http://purl.org/net/cito/>, and is available from <http://purl.org/net/cito/>. The previous version of CiTO, Version 1.3, was published on 5 May 2009.

### Introduction

CiTO, the Citation Typing Ontology, is an ontology for describing the nature of reference citations in scientific research articles and other scholarly works on the Semantic Web. CiTO v1.4 is described in the paper for which this is Supplementary File S2:

Shotton, D (2010) CiTO, the Citation Typing Ontology. *J. Biomedical Semantics* \*\*: \*\*\*\_\*\*\*, doi: \*\*\*\*\*.

This supplementary file describes the CiTO Vocabulary in greater detail, giving definitions for each term. The terms given below are the *labels* used for the object properties and classes in the Citation Typing Ontology, which are identical to the CiTO class and property names. The definitions given in this document are identical to the definitions of the properties and classes in CiTO itself.

### Namespace

The namespace for CiTO is <http://purl.org/net/cito/>. The URI of each term in the ontology is thus formed by using the term name preceded by 'http://purl.org/net/cito/', e.g. <http://purl.org/net/cito/Book>.

### Colours

The colours used for properties and classes in this document are the same as those employed in the first on-line example of CiTO's use given at <http://dx.doi.org/10.1371/journal.pntd.0000228.x001#refs>, which can be revealed by clicking on the "Turn Citation Typing On" button at the start of the References section.

These colours, which are employed for convenience only, and have no semantic meaning other than to distinguish CiTO terms of different types, are:

<i>Object Properties</i> describing citations	<b>blue</b>
<i>Work</i> and its sub-classes	<b>pink</b>
<i>Expression</i> and its sub-classes	<b>red</b>
<i>Manifestation</i> and its sub-classes	<b>green</b>
<i>Data Property</i> relevant to the Peer Review Status	<b>brown</b>
<i>Classes, Object Properties</i> and <i>Data Properties</i> relevant to Citation Frequencies	<b>orange</b>

## **CiTO Object Properties:**

(Relationships from a citing work A to a cited work B - Direction A → B.)

These relationships describe why a citing work cites a cited work. When using CiTO, a single citation should be described as having one or more of these relationships, which are both factual and rhetorical in nature.

<i>cites</i>	A statement of fact that the citing work cites the cited work. (This is implicit in human-readable reference lists, and need not be stated when annotating them using CiTO. However, the statement is useful in machine-readable metadata for construction of citation networks and other purposes.) (Inverse property: <i>isCitedBy</i> .)
<i>citesAsAuthority</i>	The citing work refers to the cited work as providing an authoritative description or definition of the subject under discussion.
<i>citesAsMetadataDocument</i>	The citing work refers to the cited work as containing metadata about the citing work. (Inverse property: <i>citesAsSourceDocument</i> .)
<i>citesAsSourceDocument</i>	The citing work refers to the cited work as the source about which the citing work contains metadata. (Inverse property: <i>citesAsMetadataDocument</i> .)
<i>citesForInformation</i>	The citing work refers the reader to the cited work as a source of information on the subject discussed in the text.
<i>confirms</i>	The citing work confirms facts, ideas or statements presented in the cited work.
<i>corrects</i>	The citing work corrects ideas or statements presented in the cited work.
<i>credits</i>	The citing work acknowledges contributions made by the cited work.
<i>critiques</i>	The citing work critiques facts, ideas or statements presented in the cited work.
<i>disagreesWith</i>	The citing work disagrees with ideas or statements presented in the cited work.
<i>discusses</i>	The citing work discusses facts, ideas or statements presented in the cited work.
<i>extends</i>	The citing work extends facts, ideas or understandings presented in the cited work.
<i>isCitedBy</i>	A statement of fact that the cited work is cited by the citing work. (Inverse property: <i>cites</i> .)
<i>obtainsBackgroundFrom</i>	The citing work obtains background information from the cited work.
<i>obtainsSupportFrom</i>	The citing work obtains intellectual or factual support from the cited work.
<i>refutes</i>	The citing work refutes ideas or statements presented in the cited work.
<i>reviews</i>	The citing work reviews ideas or statements presented in the cited work.
<i>sharesAuthorsWith</i>	The citing work has at least one author in common with the cited work.
<i>updates</i>	The citing work updates facts, ideas or understandings presented in the cited work.
<i>usesDataFrom</i>	The citing work used data from the cited work.
<i>usesMethodIn</i>	The citing work uses a method described in the cited work.

## **CiTO Work, specifying the nature or type of a scholarly work, and its sub-classes**

*Work* As defined by FRBR (<http://www.ifla.org/VII/s13/frbr/frbr1.htm>), a *Work* is a distinct intellectual or artistic creation - an abstract entity that is recognised through its various expressions. CiTO restricts that definition to a work of scholarship.

When using CiTO, a *Work* should be assigned to one of the following sub-classes:

<i>BookReview</i>	A written review of the content, scope and quality of a book.
<i>CaseForSupport</i>	That portion of a <i>GrantApplication</i> that provides a description of a proposed project and gives reasons why it is worthy of funding. (See also <i>GrantApplication</i> , which typically contains a <i>CaseForSupport</i> )

<i>Catalogue</i>	An itemized list or catalogue of items, typically offered for sale by a vendor, for example laboratory reagents.
<i>Dataset</i>	A collection of related facts, often expressed in numerical form and encoded in a defined structure.
<i>Discussion</i>	A discussion of issues.
<i>Editorial</i>	The opinions of an editor expressed in a published work.
<i>GrantApplication</i>	A request for financial support from a grant-giving body in support of a project, for example an academic research project. (See also <i>CaseForSupport</i> , which is typically contained within a <i>GrantApplication</i> .)
<i>Image</i>	A visual representation other than text, including all types of <i>Moving Image</i> and <i>Still Image</i> , subclass terms that should be used in preference to <i>Image</i> .
<i>Model</i>	A mathematical, graphical or physical representation of some physical or theoretical reality.
<i>MovingImage</i>	A series of visual representations imparting an impression of motion when shown in succession. Examples include animations, movies, television programs, videos, and computational simulations. (Use where appropriate in preference to the superclass <i>Image</i> .)
<i>NewsItem</i>	A news item.
<i>Ontology</i>	A formal representation of a set of concepts within a domain of knowledge, and the relationships between those concepts.
<i>Opinion</i>	An opinion on an issue or topic.
<i>Patent</i>	A formal disclosure of a new invention, made in to record registration of intellectual property rights.
<i>PatentApplication</i>	A formal disclosure of a new invention, made in application for a <i>Patent</i> .
<i>PersonalCommunication</i>	Information communicated personally from one individual to one or more another persons or organizations.
<i>Presentation</i>	A set of images of text and/or pictures used when communicating ideas or research results to an audience.
<i>Proposition</i>	A explanation, exposition, proposal or proposition of a new concept, hypothesis, idea, method or theory.
<i>Protocol</i>	A predefined written procedural method for the design and implementation of a scientific experiment, a clinical procedure, or a randomized controlled trial for evidence-based assessment; or a standard in information automation involving computational, cryptographic or communications procedures.
<i>ReferenceWork</i>	A standard reference work containing factual information.
<i>Report</i>	A formal factual, statistical, technical or research report issued by an individual, group, agency, government body or other institution.
<i>ResearchPaper</i>	A report of original research findings.
<i>Review</i>	A scholarly review of others' work.
<i>Software</i>	A computer program in source or compiled form designed to execute a particular task.
<i>Specification</i>	An explicit set of requirements to be satisfied by a material, product, or service.
<i>StillImage</i>	A static visual representation, including diagrams, drawings, graphic designs, plans, maps, photographs and prints. (Use where appropriate in preference to the superclass <i>Image</i> .)
<i>Taxonomy</i>	A classification arranged in a hierarchical structure of classes and subclasses, showing parent-child <i>isA</i> relationships, or <i>broader_than</i> - <i>narrower_than</i> relationships.
<i>TechnicalStandard</i>	A defined specification or requirement for a technical method, practice, process or protocol involved in, for example, manufacturing, computation, electronic communication, or digital media.

<i>Text</i>	A work that is primarily words for reading. (This is a generic term used when the text cannot be more specifically described. Where the <i>Text</i> can be better described using an alternative class name in CiTO, that more specific description should be used.)
<i>WorkingPaper</i>	A working paper or discussion paper circulated publicly or to a group of peers.

## **CiTO Expression, specifying the nature or type of the Expression of a Work, and its sub-classes**

*Expression* As defined by FRBR (<http://www.ifla.org/VII/s13/frbr/frbr1.htm>), an *Expression* is the specific form that a *Work* takes each time it is ‘realized’ in physical or electronic form. The citations that matter for CiTO are those to be found in the final published expression of a *Work*, known to publishers as the ‘version of record’.

When using CiTO, an *Expression* should be assigned to one of the following sub-classes:

<i>BlogEntry</i>	Information presented in a <i>Blog</i> . (Subclass of <i>WebInformationSource</i> .)
<i>Book</i>	A non-serial publication that is complete in one volume or a designated finite number of volumes. Books are often identified with an ISBN.
<i>BookChapter</i>	A defined chapter of a book, usually with a separate title or number. (Subclass of <i>BookSection</i> . Where the contribution is another type of book section, for example a preface or index, use the more generic term <i>BookSection</i> .)
<i>BookSection</i>	A defined section of a book, such as a preface, chapter or index, usually with a separate title or number. (Where the contribution is a chapter, use the more specific term <i>BookChapter</i> .)
<i>CaseForSupportDocument</i>	An <i>Expression</i> of a <i>CaseForSupport</i> . (Subclass of <i>Document</i> .)
<i>ConferencePaper</i>	A paper submitted and/or presented at a conference, workshop or other event.
<i>ConferencePoster</i>	A poster submitted and/or presented at a conference, workshop or other event.
<i>Database</i>	A structured collection of records or data stored in a computer system.
<i>Document</i>	A physical or electronic <i>Expression</i> of a <i>Work</i> , conveying a body of information primarily in textual form.
<i>Email</i>	A <i>PersonalCommunication</i> transmitted as an item of electronic mail, typically based on the Simple Mail Transfer Protocol (SMTP).
<i>Figure</i>	A graphic, diagram or image within a publication that is unaligned with the main body of text, typically having its own descriptive legend.
<i>File</i>	A computer-readable block of information, typically recorded in a particular format by a specific software application and stored digitally in a form available for re-use.
<i>GrantApplicationDocument</i>	An <i>Expression</i> of a <i>GrantApplication</i> . (Subclass of <i>Document</i> .)
<i>JournalArticle</i>	An article or paper published in a scholarly journal. (Subclass of <i>JournalItem</i> . Where the contribution is another type of journal item, e.g. an article, editorial, research report, debate, letter or response, use the more generic term <i>JournalItem</i> .)
<i>JournalItem</i>	A contribution to a scholarly journal, e.g. an article, editorial, research report, debate, letter or response. (Where the contribution is an article, use more specific term <i>JournalArticle</i> .)
<i>Letter</i>	A <i>PersonalCommunication</i> in written or printed form and usually transmitted by mail.
<i>MagazineArticle</i>	An article or paper published in a magazine or periodical, that is typically not peer-reviewed.
<i>Manuscript</i>	A handwritten or printed <i>Text</i> document. The term is used both to describe an unpublished paper or report submitted to a publisher for publication, and to describe a handwritten document on paper or parchment, which historically might have been produced by manual copying of another such document.
<i>PatentDocument</i>	The physical or electronic <i>Expression</i> of a <i>Patent</i> . (Subclass of <i>Document</i> .)

<i>PatentApplicationDocument</i>	The physical or electronic <i>Expression</i> of a <i>PatentApplication</i> . (Subclass of <i>Document</i> .)
<i>Preprint</i>	An author's original scholarly work as submitted to and/or accepted by a journal for publication. (For the version of the article published by the journal and forming the 'version of record', use <i>JournalArticle</i> .)
<i>PresentationFile</i>	A computer file containing or representing a <i>Presentation</i> . (Subclass of <i>File</i> .)
<i>ReportDocument</i>	The embodiment of a report, usually in printed form. (Use when the <i>Report</i> is not expressed in a <i>Book</i> , <i>BookSection</i> , <i>JournalItem</i> or other more specific form of <i>Expression</i> .)
<i>Spreadsheet</i>	A computer file that displays a grid of rows and columns, in which each cell can contain alphanumeric text, a numeric value, or a formula that defines how the content of that cell is to be calculated from the content of any other cell or cells.
<i>Table</i>	A graphical means of presenting data within a publication in a grid of rows and columns, appearing unaligned with the main body of text and typically having its own title, within which the cells usually contain alphanumeric text or numeric values.
<i>TextFile</i>	An <i>Expression</i> of a <i>Text</i> - an electronic information file consisting of alphanumeric text that may be unstructured (plain text) or may contain mark-up codes specifying the presentation of the text (font, size, position, etc.). (Subclass of <i>File</i> , used in CiTO for the expression of a textual document that cannot be better described by another more specific type of <i>Expression</i> .)
<i>Thesis</i>	A thesis or dissertation submitted for examination in completion of a course of study at an institution of higher education.
<i>WebInformationSource</i>	A generic class of <i>Expression</i> for "born-on-the-Web" information on a particular topic, comprising <i>Text</i> , <i>Images</i> and/or other <i>Works</i> , that is not better described by a more specific CiTO <i>Expression</i> , and that is typically manifested on the World Wide Web in a <i>WebPage</i> or <i>WebSite</i> .
<i>WikiEntry</i>	Information placed in a <i>Wiki</i> . (Subclass of <i>WebInformationSource</i> .)

## **CiTO Manifestation, specifying the manifestation of an expression of a work, and its sub-classes**

*Manifestation* As defined by FRBR (<http://www.ifla.org/VII/s13/frbr/frbr1.htm>), a *Manifestation* of an *Expression* of a *Work* defines its particular physical or electronic embodiment. Examples of different manifestations of a single 'version of record' expression of a scholarly work include an article in a print journal, the on-line version of that article as an HTML Web page, and a downloadable PDF file of the same article.

When using CiTO, a *Manifestation* of an *Expression* of a *Work* may be left unspecified, or may be categorized as belonging to one of the following broad sub-classes:

<i>Blog</i>	A type of <i>WebSite</i> , usually maintained by an individual, with regular entries of commentary, descriptions of events, or other material such as images or videos, with entries commonly displayed in reverse-chronological order. (Subclass of <i>WebSite</i> )
<i>DigitalMediaObject</i>	A magnetic, optical or solid state digital memory device used to record, transport and play back digital data, image or sound files (e.g. a DVD, CD-ROM, DV tape, USB flash drive or similar device).
<i>OnlineDocument</i>	A document, stored electronically on a computer system, that is not itself a <i>WebPage</i> or <i>WebSite</i> , and that is available for viewing or downloading across the Internet. Online documents may be stored in a variety of electronic file formats, e.g. PDF, plain text or word processor file format.
<i>PrintDocument</i>	A document that is available in physical printed form, typically on paper.

<i>WebPage</i>	A manifestation of a <i>WebInformationSource</i> on the World Wide Web that is part of a <i>WebSite</i> , usually structured in HTML or XHTML format and made accessible in a single Web browser window using the Hypertext Transport Protocol.
<i>WebSite</i>	A manifestation of one or more <i>WebInformationSources</i> on the World Wide Web, comprising a collection of one or more related <i>WebPages</i> , <i>Images</i> and/or other digital assets hosted on a Web server and accessed through a single domain name or IP address.
<i>Wiki</i>	A collaborative <i>WebSite</i> , usually maintained by a project team or group, that provides easy-to-edit <i>WebPages</i> that can be used to accumulate related information for shared use by the group, and to publish such information. (Subclass of <i>WebSite</i> .)

## **CiTO Data Property relevant to the Peer Review Status of the Expression of a Work**

<i>peerReviewed</i>	A Boolean data property having the value 'True' if the cited work has been peer reviewed, or 'False' if the cited work has not been peer reviewed. [When using CiTO, the truth value of <i>peerReviewed</i> may be left unspecified.]
---------------------	---

## **CiTO Classes and Properties relevant to Citation Frequencies**

### **Classes:**

<i>GlobalCitationCount</i>	The number of times a work has been cited globally, as determined from a particular bibliographic information source on a particular date.
<i>InTextCitationCount</i>	The number of times a cited work has been cited within the text of a citing work.

### **Object Properties:**

<i>globalCitationFrequency</i>	The property linking an expression of a work to its <i>GlobalCitationCount</i> .
<i>globalCountSource</i>	The URI of the bibliographic information source of information concerning the <i>GlobalCitationCount</i> of the work.
<i>inTextCitationFrequency</i>	The property linking an expression of a cited work to its <i>InTextCitationCount</i> within a citing work.
<i>inTextCitationTarget</i>	The URI of the cited work for which the <i>InTextCitationCount</i> is relevant.

### **Data Properties:**

<i>globalCountDate</i>	The date on which the <i>GlobalCitationCount</i> of the work was recorded from a named bibliographic information source.
<i>globalCountValue</i>	An integer defining the value of the <i>GlobalCitationCount</i> of the work recorded from a named bibliographic information source on a particular date.
<i>inTextCountValue</i>	An integer defining the value of the <i>InTextCitationCount</i> of the cited work within the citing work.

## **Changes between version 1.3 and version 1.4 of CiTO**

### **New Object Properties and Data Properties**

*citesAsAuthority*

*citesAsMetadataDocument*

*citesAsSourceDocument*

## Change to Object Properties and Data Properties

Domain and range restrictions on *cite* and its sub-properties removed.

Domain restrictions on *globalCitationFrequency*, *inTextCitationFrequency* and *peerReviewed* removed.

Range restriction on *inTextCitationTarget* removed.

## New subclasses of *Work*:

*CaseForSupport*

*PatentApplication*

*PersonalCommunication* [Formerly *Message*]

*Presentation*

*Proposition* [Formerly *Explanation*]

*TechnicalStandard*

*Text* [Formerly *ScholarlyText*]

## Deprecated subclasses of *Work*:

*Explanation* [Replaced by *Proposition*]

*Message* [Replaced by *PersonalCommunication*].

*ScholarlyText* [Replaced by *Text*]

## Subclasses of *Work* with revised definitions:

*GrantApplication* (See also *CaseForSupport*, which is typically contained within a *GrantApplication*.)

*Patent* [*PatentApplication* separated from this]

## New subclasses of *Expression*:

*BlogEntry* (Subclass of *WebInformationSource*.) [Formerly *Blog*.]

*CaseForSupportDocument* (Subclass of *Document*.)

*Document*

*File*

*GrantApplicationDocument* (Subclass of *Document*.)

*Letter*

*Manuscript*

*MagazineArticle*

*PatentApplicationDocument* (Subclass of *Document*.)

*PresentationFile* (Subclass of *File*.) [Formerly *Presentation*]

*WebInformationSource*

*WikiEntry* (Subclass of *WebInformationSource*.)

**Deprecated subclasses of *Expression*:**

None

**Subclasses of *Expression* with revised definitions:**

*Email*

*PatentDocument* (Subclass of *Document*.)

*TextFile* (Subclass of *File*.)

**New subclasses of *Manifestation*:**

*Blog* (Subclass of *WebSite*)

*WebSite*

*Wiki* (Subclass of *WebSite*)

**Deprecated subclasses of *Manifestation*:**

None

**Subclasses of *Manifestation* with revised definitions:**

*OnlineDocument*

*WebPage*

**New Classes and Properties relevant to Citation Frequencies**

None.

***Acknowledgements***

The contributions to this work of Katie Portwin, who participated in the development of the initial CiTO prototype, and of Alistair Miles, who provided guidance in RDF modelling and syntax and help in ontology coding and publication, are gratefully acknowledged.

The development of CiTO forms part of the work of the Ontogenesis Network, a network of excellence to foster the creation, ontogeny and evolution of biological, bioinformatics and medical ontologies, supported by EPSRC grant EP/E021352/1.

/end

# CiTO, the Citation Typing Ontology

David Shotton (2010) *Journal of Biomedical Semantics* \*\*: \*\*\*\_\*\*\*.

## Supplementary File S3: Citation Metadata

[Note to BioOntology2009: This file will be published as a raw text file. It is here included with the CiTO paper in PDF format for the convenience of reviewers]

Note to reviewers: This RDF file will be validated once the missing DOIs have been inserted. However, the file in its present shape will give you the general idea.

===

```

@prefix cito: <http://purl.org/net/cito/>.
@prefix frbr: <http://purl.org/vocab/frbr/core#>.
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>.
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#>.
@prefix dc: <http://purl.org/dc/elements/1.1/>.
@prefix cc: <http://web.resource.org/cc/>.
@prefix foaf: <http://xmlns.com/foaf/0.1/>.
@prefix prism: <http://prismstandard.org/namespaces/1.2/basic/>.
@prefix geo: <http://www.w3.org/2003/01/geo/wgs84_pos#>.
@prefix cito: <http://purl.org/net/cito/>.
@prefix dcterms: <http://purl.org/dc/terms/>.
@prefix time: <http://www.w3.org/2006/time#> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .
@base <http://dx.doi.org/doi to be supplied by JMBS>

# This file contains metadata descriptions of citations in the article by
# Shotton DM (2010) CiTO, the Citation Typing Ontology. Journal of Biomedical Semantics **: ***_***.
# The metadata are encoded as RDF using N3 format.

# This document information file has been prepared by and is copyright (c) David Shotton, University of Oxford, 5 November 2009. This document is an open access reference work distributed under the terms of the Creative Commons Attribution License 2.5, which permits unrestricted use, distribution, and reproduction in any medium, provided that the original author and source are credited.
# Contact <david.shotton@zoo.ox.ac.uk> for further information.

# about this metadata document ...
<http://dx.doi.org/doi to be supplied by JMBS> # Supplementary File S3
    dc:creator [ a foaf:Person ; foaf:name "David Shotton" ; foaf:mbox
<mailto:david.shotton@zoo.ox.ac.uk> ; ] ;
    dc:date "2009-11-05"^^xsd:date ;
    dcterms:license <http://creativecommons.org/licenses/by/2.5/>;
    cito:citesAsSourceDocument http://dx.doi.org/doi to be supplied by JMBS ;
.

# about the paper it describes ...
<http://dx.doi.org/doi to be supplied by JBMS> # The CiTO paper in JBMS
    dcterms:issued "2010-??-??" ;
    rdf:type cito:Proposition ; # work
    rdf:type cito:JournalArticle; # expression
    cito:peerReviewed "true"^^xsd:boolean ; # peer review status
    dc:title "CiTO, the Citation Typing Ontology" ;
    dc:identifier <http://dx.doi.org/doi to be supplied by JBMS> ;
    dc:language "en" ;
    cito:citesAsMetadataDocument http://dx.doi.org/doi to be supplied by JMBS ;

```

```

# The following reference list is for this paper, which has 11 bibliographic
references and also cites 27 Web sites.
# For the bibliographic references, it records not only the number of times each cited
paper is cited in the text of the citing paper,
# but also the nature of the relationship between the citing paper and the cited
paper.

# The following details are divided into three sections:
#   Section 1  Details of the bibliographic citations in the citing paper;
#   Section 2  Details of the cited papers;
#   Section 3  Details of Web sites cited in the citing paper.

#   Section 1  Details of the bibliographic citations in the citing paper

<http://dx.doi.org/doi to be supplied by JMBS>      # The CiTO paper in JBMS

#1 Cited in-text 4 times
  cito:cites <http://dx.doi.org/10.1371/journal.pntd.0000228> ;
  cito:inTextCitationFrequency [
    a cito:InTextCitationCount ;
    cito:inTextCountValue "4"^^xsd:integer ;
    cito:inTextCitationTarget <http://dx.doi.org/10.1371/journal.pntd.0000228> ;
  ] ;
  cito:citesForInformation <http://dx.doi.org/10.1371/journal.pntd.0000228> ;
  cito:usesDataFrom <http://dx.doi.org/10.1371/journal.pntd.0000228> ;

#2 Cited in-text 2 times
  cito:cites <http://dx.doi.org/10.1371/journal.pcbi.1000361> ;
  cito:inTextCitationFrequency [
    a cito:InTextCitationCount ;
    cito:inTextCountValue "2"^^xsd:integer ;
    cito:inTextCitationTarget <http://dx.doi.org/10.1371/journal.pcbi.1000361> ;
  ] ;
  cito:citesForInformation <http://dx.doi.org/10.1371/journal.pcbi.1000361> ;
  cito:sharesAuthorsWith <http://dx.doi.org/10.1371/journal.pcbi.1000361> ;

#3 Cited in-text 1 time
  cito:cites <http://www.scielo.org.ar/scielo.php?pid=S0025-
76802003000400011&script=sci_arttext&tlng=en> ;
  cito:inTextCitationFrequency [
    a cito:InTextCitationCount ;
    cito:inTextCountValue "1"^^xsd:integer ;
    cito:inTextCitationTarget <http://www.scielo.org.ar/scielo.php?pid=S0025-
76802003000400011&script=sci_arttext&tlng=en> ;
  ] ;
  cito:citesForInformation <http://www.scielo.org.ar/scielo.php?pid=S0025-
76802003000400011&script=sci_arttext&tlng=en> ;

#4 Cited in-text 1 time
  cito:cites <http://www.elsevier.com/framework_editors/pdfs/Perspectives1.pdf> ;
  cito:inTextCitationFrequency [
    a cito:InTextCitationCount ;
    cito:inTextCountValue "1"^^xsd:integer ;
    cito:inTextCitationTarget
<http://www.elsevier.com/framework_editors/pdfs/Perspectives1.pdf> ;
  ] ;
  cito:citesForInformation <http://www.elsevier.com/framework_editors/pdfs/Perspectives1.pdf>
;

#5 Cited in-text 1 time

```

```

cito:cites <http://doi.acm.org/10.1145/1367080.1367085> ;
cito:inTextCitationFrequency [
  a cito:InTextCitationCount ;
  cito:inTextCountValue "1"^^xsd:integer ;
  cito:inTextCitationTarget <http://doi.acm.org/10.1145/1367080.1367085> ;
] ;
cito:citesForInformation <http://doi.acm.org/10.1145/1367080.1367085> ;

#6 Cited in-text 1 time
cito:cites
<http://www.emeraldinsight.com/Insight/html/Output/Published/EmeraldAbstractOnlyArticle/Pdf/2780540204.pdf> ;
cito:inTextCitationFrequency [
  a cito:InTextCitationCount ;
  cito:inTextCountValue "1"^^xsd:integer ;
  cito:inTextCitationTarget
<http://www.emeraldinsight.com/Insight/html/Output/Published/EmeraldAbstractOnlyArticle/Pdf/2780540204.pdf> ;
] ;
cito:citesForInformation
<http://www.emeraldinsight.com/Insight/html/Output/Published/EmeraldAbstractOnlyArticle/Pdf/2780540204.pdf> ;

#7 Cited in-text 1 time
cito:cites <http://dx.doi.org/10.1039/b410732b> ;
cito:inTextCitationFrequency [
  a cito:InTextCitationCount ;
  cito:inTextCountValue "1"^^xsd:integer ;
  cito:inTextCitationTarget <http://dx.doi.org/10.1039/b410732b> ;
] ;
cito:citesForInformation <http://dx.doi.org/10.1039/b410732b> ;

#8 Cited in-text 1 time
cito:cites <http://www.ariadne.ac.uk/issue5/jime/intro.html> ;
cito:inTextCitationFrequency [
  a cito:InTextCitationCount ;
  cito:inTextCountValue "1"^^xsd:integer ;
  cito:inTextCitationTarget <http://www.ariadne.ac.uk/issue5/jime/intro.html> ;
] ;
cito:citesForInformation <http://www.ariadne.ac.uk/issue5/jime/intro.html> ;

#9 Cited in-text 1 time
cito:cites <http://ceur-ws.org/Vol-523/deWaard.pdf> ;
cito:inTextCitationFrequency [
  a cito:InTextCitationCount ;
  cito:inTextCountValue "1"^^xsd:integer ;
  cito:inTextCitationTarget <http://ceur-ws.org/Vol-523/deWaard.pdf> ;
] ;
cito:citesForInformation <http://ceur-ws.org/Vol-523/deWaard.pdf> ;

#10 Cited in-text 1 time
cito:cites <http://elpub.scix.net/data/works/att/234_elpub2008.content.pdf> ;
cito:inTextCitationFrequency [
  a cito:InTextCitationCount ;
  cito:inTextCountValue "1"^^xsd:integer ;
  cito:inTextCitationTarget <http://elpub.scix.net/data/works/att/234_elpub2008.content.pdf>
;
] ;
cito:obtainsBackgroundFrom <http://elpub.scix.net/data/works/att/234_elpub2008.content.pdf> ;

```

```
#11 Cited in-text 1 time
  cito:cites
<http://imageweb.zoo.ox.ac.uk/pub/2009/publications/Shotton_ISMB_BioOntology_CiTO_final_postprint.pdf> ;
  cito:inTextCitationFrequency [
    a cito:InTextCitationCount ;
    cito:inTextCountValue "1"^^xsd:integer ;
    cito:inTextCitationTarget
<http://imageweb.zoo.ox.ac.uk/pub/2009/publications/Shotton_ISMB_BioOntology_CiTO_final_postprint.pdf> ;
  ] ;
  cito:citesForInformation
<http://imageweb.zoo.ox.ac.uk/pub/2009/publications/Shotton_ISMB_BioOntology_CiTO_final_postprint.pdf> ;
  cito:extends
<http://imageweb.zoo.ox.ac.uk/pub/2009/publications/Shotton_ISMB_BioOntology_CiTO_final_postprint.pdf> ;
  cito:obtainsBackgroundFrom
<http://imageweb.zoo.ox.ac.uk/pub/2009/publications/Shotton_ISMB_BioOntology_CiTO_final_postprint.pdf> ;
  cito:sharesAuthorsWith
<http://imageweb.zoo.ox.ac.uk/pub/2009/publications/Shotton_ISMB_BioOntology_CiTO_final_postprint.pdf> ;
  cito:usesDataFrom
<http://imageweb.zoo.ox.ac.uk/pub/2009/publications/Shotton_ISMB_BioOntology_CiTO_final_postprint.pdf> ;
.
```

## # Section 2 Details of the cited papers

```
# The following are citation details for the cited documents themselves, including
publication dates in the format
# yyyy-mm-dd which allows temporal sorting. Where an exact date cannot be determined,
the date used is just the year,
# e.g. dcterms:issued "2003" or just the year and month e.g. dcterms:issued "2005-10".
# The earliest possible date is used: thus a journal issue dated "May-June 2004"
becomes dcterms:issued "2004-05", while
# one dated "10 November 2007-16 November 2007" becomes dcterms:issued "2007-11-10".
```

```
#1
```

```
<http://dx.doi.org/10.1371/journal.pntd.0000228>
  dcterms:bibliographicCitation " Reis RB, Ribeiro GS, Felzemburgh RDM, Santana FS, Mohr
S, Melendez AXTO, Queiroz A, Santos AC, Ravines RR, Tassinari WS, Carvalho MS, Reis MG, Ko AI:
Impact of environment and social gradient on Leptospira infection in urban slums. PLoS Neglected
Tropical Diseases 2008, 2: e228." ;
  dcterms:issued "2008-04-23" ;
  cito:isCitedBy <http://dx.doi.org/doi to be supplied by JBMS> ;
  rdf:type cito:ResearchPaper ; # work
  rdf:type cito:JournalArticle ; # expression
  cito:peerReviewed "true"^^xsd:boolean ; # peer review status
# Google Scholar on 3 November 2009: Cited 4 times.
# ISI Web of Knowledge on 3 November 2009: Cited 3 times.
  cito:citationFrequency [
    a cito:CitationCount ;
    cito:countValue "4"^^xsd:integer ;
    cito:countSource <http://scholar.google.com> ;
    cito:countDate "2009-11-03"^^xsd:date ;
  ] ;
  cito:citationFrequency [
    a cito:CitationCount ;
```

```

    cito:countValue "3"^^xsd:integer ;
    cito:countSource <http://http://apps.isiknowledge.com> ;
    cito:countDate "2009-11-03"^^xsd:date ;
  ];
.

#2
<http://dx.doi.org/10.1371/journal.pcbi.1000361>
  dcterms:bibliographicCitation " Shotton D, Portwin K, Klyne G, Miles A: Adventures in semantic publishing: exemplar semantic enhancement of a research article. PLoS Computational Biology 2009 5: e1000361." ;
  dcterms:issued "2009-04-17" ;
  cito:isCitedBy <http://dx.doi.org/doi to be supplied by JBMS> ;
  rdf:type cito:ResearchPaper ; # work
  rdf:type cito:JournalArticle; # expression
  cito:peerReviewed "true"^^xsd:boolean ; # peer review status
# Google Scholar on 3 November 2009: Cited 9 times.
# ISI Web of Knowledge on 3 November 2009: Cited 0 times.
  cito:citationFrequency [
    a cito:CitationCount ;
    cito:countValue "9"^^xsd:integer ;
    cito:countSource <http://scholar.google.com> ;
    cito:countDate "2009-11-03"^^xsd:date ;
  ];
  cito:citationFrequency [
    a cito:CitationCount ;
    cito:countValue "0"^^xsd:integer ;
    cito:countSource <http://http://apps.isiknowledge.com> ;
    cito:countDate "2009-11-03"^^xsd:date ;
  ];
.

#3
<http://www.scielo.org.ar/scielo.php?pid=S0025-76802003000400011&script=sci_arttext&tlng=en>
  dcterms:bibliographicCitation "Amin M, Mabe M: Impact factors: use and abuse. Medicina (Buenos Aires) 2003, 63:347-354." ;
  dcterms:issued "2003-07" ;
  cito:isCitedBy <http://dx.doi.org/doi to be supplied by JBMS> ;
  rdf:type cito:Discussion ; # work
  rdf:type cito:JournalArticle; # expression
  cito:peerReviewed "true"^^xsd:boolean ; # peer review status
# Google Scholar on 3 November 2009: Cited 246 times.
# ISI Web of Knowledge on 3 November 2009: Cited 9 times.
  cito:citationFrequency [
    a cito:CitationCount ;
    cito:countValue "246"^^xsd:integer ;
    cito:countSource <http://scholar.google.com> ;
    cito:countDate "2009-11-03"^^xsd:date ;
  ];
  cito:citationFrequency [
    a cito:CitationCount ;
    cito:countValue "9"^^xsd:integer ;
    cito:countSource <http://http://apps.isiknowledge.com> ;
    cito:countDate "2009-11-03"^^xsd:date ;
  ];
.

#4
<http://www.elsevier.com/framework_editors/pdfs/Perspectives1.pdf>
  dcterms:bibliographicCitation " Amin M, Mabe M: Impact factors: use and abuse. Perspectives in Publishing 2000, 1:1-6." ;

```

```

dcterms:issued "2000-10";
cito:isCitedBy <http://dx.doi.org/doi to be supplied by JBMS> ;
rdf:type cito:Discussion ; # work
rdf:type cito:MagazineArticle; # expression
cito:peerReviewed "false"^^xsd:boolean ; # peer review status
# Google Scholar on 3 November 2009: Cited 0 times.
# ISI Web of Knowledge on 3 November 2009: Cited 0 times.
cito:citationFrequency [
  a cito:CitationCount ;
  cito:countValue "0"^^xsd:integer ;
  cito:countSource <http://scholar.google.com> ;
  cito:countDate "2009-11-03"^^xsd:date ;
];
cito:citationFrequency [
  a cito:CitationCount ;
  cito:countValue "0"^^xsd:integer ;
  cito:countSource <http://http://apps.isiknowledge.com> ;
  cito:countDate "2009-11-03"^^xsd:date ;
];
.

#5
<http://doi.acm.org/10.1145/1367080.1367085>
  dcterms:bibliographicCitation "Doerr M, Iorizzo D: The dream of a global knowledge network - a new approach. ACM J Comput Cultur Heritage 2008, 1:Article 5 (June 2008), 23 pages." ;
  dcterms:issued "2008-06";
  cito:isCitedBy <http://dx.doi.org/doi to be supplied by JBMS> ;
  rdf:type cito:Proposition ; # work
  rdf:type cito:JournalArticle; # expression
  cito:peerReviewed "true"^^xsd:boolean ; # peer review status
# Google Scholar on 3 November 2009: Cited 3 times.
# ISI Web of Knowledge on 3 November 2009: Cited 0 times.
cito:citationFrequency [
  a cito:CitationCount ;
  cito:countValue "3"^^xsd:integer ;
  cito:countSource <http://scholar.google.com> ;
  cito:countDate "2009-11-03"^^xsd:date ;
];
cito:citationFrequency [
  a cito:CitationCount ;
  cito:countValue "0"^^xsd:integer ;
  cito:countSource <http://http://apps.isiknowledge.com> ;
  cito:countDate "2009-11-03"^^xsd:date ;
];
.

#6
<http://www.emeraldinsight.com/Insight/html/Output/Published/EmeraldAbstractOnlyArticle/Pdf/2780540204.pdf>
  dcterms:bibliographicCitation " Joost G, Kircz J: Modularity: the next form of scientific information presentation? Journal of Documentation 1998, 54:210-235." ;
  dcterms:issued "1998-03";
  cito:isCitedBy <http://dx.doi.org/doi to be supplied by JBMS> ;
  rdf:type cito:Proposition ; # work
  rdf:type cito:JournalArticle; # expression
  cito:peerReviewed "true"^^xsd:boolean ; # peer review status
# Google Scholar on 3 November 2009: Cited 41 times.
# ISI Web of Knowledge on 3 November 2009: Cited 22 times.
cito:citationFrequency [
  a cito:CitationCount ;
  cito:countValue "41"^^xsd:integer ;
  cito:countSource <http://scholar.google.com> ;

```

```
    cito:countDate "2009-11-03"^^xsd:date ;
  ];
cito:citationFrequency [
  a cito:CitationCount ;
  cito:countValue "22"^^xsd:integer ;
  cito:countSource <http://http://apps.isiknowledge.com> ;
  cito:countDate "2009-11-03"^^xsd:date ;
];
.

#7
<http://dx.doi.org/10.1039/b410732b>
  dcterms:bibliographicCitation "Murray-Rust P, Rzepa HS, Tyrrell SM, Zhang Y:
Representation and use of chemistry in the global electronic age. Organic and Biomolecular Chemistry
2004, 2:3192-3203.";
  dcterms:issued "2004-10-22";
  cito:isCitedBy <http://dx.doi.org/doi to be supplied by JBMS> ;
  rdf:type cito:Proposition; # work
  rdf:type cito:JournalArticle; # expression
  cito:peerReviewed "true"^^xsd:boolean ; # peer review status
# Google Scholar on 3 November 2009: Cited 25 times.
# ISI Web of Knowledge on 3 November 2009: Cited 17 times.
  cito:citationFrequency [
    a cito:CitationCount ;
    cito:countValue "25"^^xsd:integer ;
    cito:countSource <http://scholar.google.com> ;
    cito:countDate "2009-11-03"^^xsd:date ;
  ];
cito:citationFrequency [
  a cito:CitationCount ;
  cito:countValue "17"^^xsd:integer ;
  cito:countSource <http://http://apps.isiknowledge.com> ;
  cito:countDate "2009-11-03"^^xsd:date ;
];
.

#8
<http://www.ariadne.ac.uk/issue5/jime/intro.html>
  dcterms:bibliographicCitation " Sumner T, Buckingham Shum S: Open peer review and
argumentation: loosening the paper chains on journals. Ariadne (Bi-Monthly Magazine of the UK
Electronic Libraries Programme) 1996, Issue 5 (September 1996).";
  dcterms:issued "1996-09";
  cito:isCitedBy <http://dx.doi.org/doi to be supplied by JBMS> ;
  rdf:type cito:Review ; # work
  rdf:type cito:JournalArticle; # expression
  cito:peerReviewed "true"^^xsd:boolean ; # peer review status
# Google Scholar on 3 November 2009: Cited 14 times.
# ISI Web of Knowledge on 3 November 2009: Cited 0 times.
  cito:citationFrequency [
    a cito:CitationCount ;
    cito:countValue "14"^^xsd:integer ;
    cito:countSource <http://scholar.google.com> ;
    cito:countDate "2009-11-03"^^xsd:date ;
  ];
cito:citationFrequency [
  a cito:CitationCount ;
  cito:countValue "0"^^xsd:integer ;
  cito:countSource <http://http://apps.isiknowledge.com> ;
  cito:countDate "2009-11-03"^^xsd:date ;
];
.
```

#9

<<http://ceur-ws.org/Vol-523/deWaard.pdf>>

dcterms:bibliographicCitation " de Waard A, Shum SB, Carusi A, Park J, Samwald M, Sandor A: **Hypotheses, Evidence and Relationships: The Hyper Model of Representing Scientific Knowledge**. Workshop on Semantic Web Applications in Scientific Discourse, 8th International Semantic Web Conference (ISWC 2009, Washington DC; 2009." ;

dcterms:issued "2009-10-26" ;

cito:isCitedBy <[http://dx.doi.org/doi to be supplied by JBMS](http://dx.doi.org/doi%20to%20be%20supplied%20by%20JBMS)> ;

rdf:type cito:Proposition ; # work

rdf:type cito:ConferencePaper ; # expression

cito:peerReviewed "true"^^xsd:boolean ; # peer review status

# Google Scholar on 3 November 2009: Cited 0 times.

# ISI Web of Knowledge on 3 November 2009: Cited 0 times.

cito:citationFrequency [

a cito:CitationCount ;

cito:countValue "0"^^xsd:integer ;

cito:countSource <<http://scholar.google.com>> ;

cito:countDate "2009-11-03"^^xsd:date ;

];

cito:citationFrequency [

a cito:CitationCount ;

cito:countValue "0"^^xsd:integer ;

cito:countSource <<http://http://apps.isiknowledge.com>> ;

cito:countDate "2009-11-03"^^xsd:date ;

];

.

#10

<[http://elpub.scix.net/data/works/att/234\\_elpub2008.content.pdf](http://elpub.scix.net/data/works/att/234_elpub2008.content.pdf)>

dcterms:bibliographicCitation " de Waard A, Kircz J: **Modeling scientific research articles – shifting perspectives and persistent issues**. *Proc. ELPUB2008 Conference on Electronic Publishing; June 2008, pp 234-245; Toronto, Canada. 2008.*" ;

dcterms:issued "2008-06" ;

cito:isCitedBy <[http://dx.doi.org/doi to be supplied by JBMS](http://dx.doi.org/doi%20to%20be%20supplied%20by%20JBMS)> ;

rdf:type cito:Proposition ; # work

rdf:type cito:ConferencePaper ; # expression

cito:peerReviewed "true"^^xsd:boolean ; # peer review status

# Google Scholar on 3 November 2009: Cited 0 times.

# ISI Web of Knowledge on 3 November 2009: Cited 0 times.

cito:citationFrequency [

a cito:CitationCount ;

cito:countValue "0"^^xsd:integer ;

cito:countSource <<http://scholar.google.com>> ;

cito:countDate "2009-11-03"^^xsd:date ;

];

cito:citationFrequency [

a cito:CitationCount ;

cito:countValue "0"^^xsd:integer ;

cito:countSource <<http://http://apps.isiknowledge.com>> ;

cito:countDate "2009-11-03"^^xsd:date ;

];

.

#11

<[http://imageweb.zoo.ox.ac.uk/pub/2009/publications/Shotton\\_ISMB\\_BioOntology\\_CiTO\\_final\\_postprint.pdf](http://imageweb.zoo.ox.ac.uk/pub/2009/publications/Shotton_ISMB_BioOntology_CiTO_final_postprint.pdf)>

dcterms:bibliographicCitation " Shotton D: **CiTO, the Citation Typing Ontology, and its use for annotation of reference lists and visualization of citation networks**. In *Bio-Ontologies 2009 Special Interest Group meeting at ISMB 2009; 28-29 June 2009; Stockholm. 2009.*" ;

dcterms:issued "2009-06-28" ;

```

    cito:isCitedBy <http://dx.doi.org/doi to be supplied by JBMS> ;
    rdf:type cito:Proposition ; # work
    rdf:type cito:ConferencePaper; # expression
    cito:peerReviewed "true"^^xsd:boolean ; # peer review status
# Google Scholar on 3 November 2009: Cited 0 times.
# ISI Web of Knowledge on 3 November 2009: Cited 0 times.
    cito:citationFrequency [
      a cito:CitationCount ;
      cito:countValue "0"^^xsd:integer ;
      cito:countSource <http://scholar.google.com> ;
      cito:countDate "2009-11-03"^^xsd:date ;
    ];
    cito:citationFrequency [
      a cito:CitationCount ;
      cito:countValue "0"^^xsd:integer ;
      cito:countSource <http://http://apps.isiknowledge.com> ;
      cito:countDate "2009-11-03"^^xsd:date ;
    ];
.

# Section 3 Details of Web sites cited in the citing paper.

# This section simply lists in alphabetical order the 27 Web sites cited in the text
of the paper, and identifies what they are.

<http://dx.doi.org/doi to be supplied by JMBS> # The CiTO paper in JBMS
    cito:cites <http://bibliontology.com/> .
    cito:citesAsAuthority <http://bibliontology.com/> .
<http://bibliontology.com/> dc:subject "The Bibliographic Ontology (BIBO)." .

<http://dx.doi.org/doi to be supplied by JMBS> # The CiTO paper in JBMS
    cito:cites <http://cidoc.ics.forth.gr/frbr_inro.html> .
    cito:citesAsAuthority <http://cidoc.ics.forth.gr/frbr_inro.html> .
<http://cidoc.ics.forth.gr/frbr_inro.html> dc:subject "An encoding of Functional
Requirements for Bibliographic Records (FRBR) using CIDOC CRM." .

<http://dx.doi.org/doi to be supplied by JMBS> # The CiTO paper in JBMS
    cito:cites <http://cidoc.ics.forth.gr/index.html> .
    cito:citesAsAuthority <http://cidoc.ics.forth.gr/index.html> .
<http://cidoc.ics.forth.gr/index.html> dc:subject "The CIDOC Conceptual Reference
Model (CRM)." .

<http://dx.doi.org/doi to be supplied by JMBS> # The CiTO paper in JBMS
    cito:cites <http://dublincore.org/documents/dcmi-type-vocabulary/> .
    cito:citesAsAuthority <http://dublincore.org/documents/dcmi-type-vocabulary/> .
<http://dublincore.org/documents/dcmi-type-vocabulary/> dc:subject "The Dublin Core
Metadata Initiative (DCMI) Type Vocabulary." .

<http://dx.doi.org/doi to be supplied by JMBS> # The CiTO paper in JBMS
    cito:cites <http://dx.doi.org/10.1371/ journal.pntd.0000228.x001> .
    cito:citesForInformation <http://dx.doi.org/10.1371/ journal.pntd.0000228.x001> .
<http://dx.doi.org/10.1371/ journal.pntd.0000228.x001> dc:subject " The semantically
enhanced version of Reis et al. (2008) PLoS Neglected Tropical Diseases 2008, 2:e228
described in Shotton D, Portwin K, Klyne G, Miles A: Adventures in semantic
publishing: exemplar semantic enhancement of a research article. PLoS Computational
Biology 2009 5: e1000361 <http://dx.doi.org/10.1371/journal.pcbi.1000361>." .

<http://dx.doi.org/doi to be supplied by JMBS> # The CiTO paper in JBMS
    cito:cites <http://dx.doi.org/10.1371/journal.pntd.0000228.x004> .
    cito:citesForInformation <http://dx.doi.org/10.1371/journal.pntd.0000228.x004> .

```

<<http://dx.doi.org/10.1371/journal.pntd.0000228.x004>> dc:subject "The machine-readable CiTO-annotated reference list from Reis et al. (2008) PLoS Neglected Tropical Diseases 2008, 2:e228, encoded in RDF serialized in Notation3 format." .

<<http://dx.doi.org/doi to be supplied by JMBS>> # The CiTO paper in JBMS  
 cito:cites <<http://dx.doi.org/DOI to be supplied by JBMS>> .  
 cito:citesAsMetadataDocument <<http://dx.doi.org/DOI to be supplied by JBMS>> .  
 <<http://dx.doi.org/DOI to be supplied by JBMS>> dc:subject "Supplementary Data File S1 of Shotton DM (2010) CiTO, the Citation Typing Ontology. *Journal of Biomedical Semantics* \*\*: \*\*\*\_\*\*." .

<<http://dx.doi.org/doi to be supplied by JMBS>> # The CiTO paper in JBMS  
 cito:cites <<http://dx.doi.org/DOI to be supplied by JBMS>> .  
 cito:citesAsAuthority <<http://dx.doi.org/DOI to be supplied by JBMS>> .  
 cito:citesForInformation <<http://dx.doi.org/DOI to be supplied by JBMS>> .  
 <<http://dx.doi.org/DOI to be supplied by JBMS>> dc:subject "Supplementary Data File S2 of Shotton DM (2010) CiTO, the Citation Typing Ontology. *Journal of Biomedical Semantics* \*\*: \*\*\*\_\*\*." .

<<http://dx.doi.org/doi to be supplied by JMBS>> # The CiTO paper in JBMS  
 cito:cites <<http://dx.doi.org/DOI to be supplied by JBMS>> .  
 cito:citesAsMetadataDocument <<http://dx.doi.org/DOI to be supplied by JBMS>> .  
 <<http://dx.doi.org/DOI to be supplied by JBMS>> dc:subject "Supplementary Data File S3 of Shotton DM (2010) CiTO, the Citation Typing Ontology. *Journal of Biomedical Semantics* \*\*: \*\*\*\_\*\*." .

<<http://dx.doi.org/doi to be supplied by JMBS>> # The CiTO paper in JBMS  
 cito:cites <<http://en.wikipedia.org/wiki/Notation3>> .  
 cito:citesForInformation <<http://en.wikipedia.org/wiki/Notation3>> .  
 <<http://en.wikipedia.org/wiki/Notation3>> dc:subject "Notation3 serialization of RDF." .

<<http://dx.doi.org/doi to be supplied by JMBS>> # The CiTO paper in JBMS  
 cito:cites <[http://en.wikipedia.org/wiki/Resource\\_Description\\_Framework](http://en.wikipedia.org/wiki/Resource_Description_Framework)> .  
 cito:citesForInformation  
 <[http://en.wikipedia.org/wiki/Resource\\_Description\\_Framework](http://en.wikipedia.org/wiki/Resource_Description_Framework)> .  
 <[http://en.wikipedia.org/wiki/Resource\\_Description\\_Framework](http://en.wikipedia.org/wiki/Resource_Description_Framework)> dc:subject "Wikipedia entry for Resource Description Framework (RDF)." .

<<http://dx.doi.org/doi to be supplied by JMBS>> # The CiTO paper in JBMS  
 cito:cites <<http://hyp-er.wik.is/>> .  
 cito:citesForInformation <<http://hyp-er.wik.is/>> .  
 <<http://hyp-er.wik.is/>> dc:subject "The wiki of HypER, an academic and professional community concerned with the representation of Hypothesis Evidence and Relationships in scientific discourse." .

<<http://dx.doi.org/doi to be supplied by JMBS>> # The CiTO paper in JBMS  
 cito:cites <<http://ibrg.zoo.ox.ac.uk/cito/>> .  
 cito:citesForInformation <<http://ibrg.zoo.ox.ac.uk/cito/>> .  
 <<http://ibrg.zoo.ox.ac.uk/cito/>> dc:subject "The CiTO wiki." .

<<http://dx.doi.org/doi to be supplied by JMBS>> # The CiTO paper in JBMS  
 cito:cites <<http://protege.stanford.edu/>> .  
 cito:citesForInformation <<http://protege.stanford.edu/>> .  
 <<http://protege.stanford.edu/>> dc:subject "The Protégé ontology editor." .

<<http://dx.doi.org/doi to be supplied by JMBS>> # The CiTO paper in JBMS  
 cito:cites <<http://purl.org/net/cito/>> .  
 cito:citesAsAuthority <<http://purl.org/net/cito/>> .  
 <<http://purl.org/net/cito/>> dc:subject "CiTO, the Citation Typing Ontology." .

<<http://dx.doi.org/doi to be supplied by JMBS>> # The CiTO paper in JBMS

```

cito:cites <http://scholar.google.com/> .
cito:citesForInformation <http://scholar.google.com/> .
cito:usedDataFrom <http://scholar.google.com/> .
<http://scholar.google.com/> dc:subject "Google Scholar, a bibliographic resource from
Google Inc." .

<http://dx.doi.org/doi to be supplied by JMBS> # The CiTO paper in JBMS
cito:cites <http://simile.mit.edu/wiki/Welkin> .
cito:citesForInformation <http://simile.mit.edu/wiki/Welkin> .
<http://simile.mit.edu/wiki/Welkin> dc:subject "Welkin, an open source RDF graph
visualization application." .

<http://dx.doi.org/doi to be supplied by JMBS> # The CiTO paper in JBMS
cito:cites <http://swan.mindinformatics.org/> .
cito:citesForInformation <http://swan.mindinformatics.org/> .
<http://swan.mindinformatics.org/> dc:subject " (Semantic Web Applications in
Neuromedicine (SWAN))." .

<http://dx.doi.org/doi to be supplied by JMBS> # The CiTO paper in JBMS
cito:cites <http://swan.mindinformatics.org/ontology.html> .
cito:citesForInformation <http://swan.mindinformatics.org/ontology.html> .
<http://swan.mindinformatics.org/ontology.html> dc:subject " The SWAN ontology
ecosystem." .

<http://dx.doi.org/doi to be supplied by JMBS> # The CiTO paper in JBMS
cito:cites <http://swan.mindinformatics.org/spec/1.2/discourserelationships.html>
.
cito:citesforInformation
<http://swan.mindinformatics.org/spec/1.2/discourserelationships.html> .
<http://swan.mindinformatics.org/spec/1.2/discourserelationships.html> dc:subject "The
SWAN Scientific Discourse Relationships Ontology." .

<http://dx.doi.org/doi to be supplied by JMBS> # The CiTO paper in JBMS
cito:cites <http://www.doi.org/> .
cito:citesAsAuthority <http://www.doi.org/> .
cito:citesForInformation <http://www.doi.org/> .
<http://www.doi.org/> dc:subject "The Digital Object Identifier (DOI).".

<http://dx.doi.org/doi to be supplied by JMBS> # The CiTO paper in JBMS
cito:cites <http://www.ifla.org/en/publications/functional-requirements-for-
bibliographic-records> .
cito:citesAsAuthority <http://www.ifla.org/en/publications/functional-
requirements-for-bibliographic-records> .
cito:citesForInformation <http://www.ifla.org/en/publications/functional-
requirements-for-bibliographic-records> .
<http://www.ifla.org/VII/s13/frbr/frbr1.htm> dc:subject "Functional Requirements for
Bibliographic Records (FRBR), a bibliographic data model." .

<http://dx.doi.org/doi to be supplied by JMBS> # The CiTO paper in JBMS
cito:cites <http://www.isiwebofknowledge.com/> .
cito:citesForInformation <http://www.isiwebofknowledge.com/> .
cito:usesDataFrom <http://www.isiwebofknowledge.com/> .
<http://www.isiwebofknowledge.com/> dc:subject "The ISI Web of Knowledge, a
bibliographic resource from Thomson Reuters." .

<http://dx.doi.org/doi to be supplied by JMBS> # The CiTO paper in JBMS
cito:cites <http://www.loc.gov/cds/downloads/FRBR.PDF> .
cito:citesForInformation <http://www.loc.gov/cds/downloads/FRBR.PDF> .
<http://www.loc.gov/cds/downloads/FRBR.PDF> dc:subject "A description of the
Functional Requirements for Bibliographic Records (FRBR) bibliographic data model." .

<http://dx.doi.org/doi to be supplied by JMBS> # The CiTO paper in JBMS

```

```
cito:cites <http://www.scopus.com/> .
cito:citesForInformation <http://www.scopus.com/> .
<http://www.scopus.com/> dc:subject "Scopus, a bibliographic resource from Elsevier
BV." .

<http://dx.doi.org/doi to be supplied by JMBS>          # The CiTO paper in JBMS
cito:cites <http://www.ukoln.ac.uk/repositories/digirep/index/SWAP> .
cito:citesForInformation <http://www.ukoln.ac.uk/repositories/digirep/index/SWAP>
.
<http://www.ukoln.ac.uk/repositories/digirep/index/SWAP> dc:subject "The Scholarly
Works Application Profile (SWAP)." .

<http://dx.doi.org/doi to be supplied by JMBS>          # The CiTO paper in JBMS
cito:cites <http://www.w3.org/RDF/> .
cito:citesAsAuthority <http://www.w3.org/RDF/> .
cito:citesForInformation <http://www.w3.org/RDF/> .
<http://www.w3.org/RDF/> dc:subject "The Resource Description Framework (RDF)." .

# /end
```