

# BEN (BIOSCI EDUCATION NETWORK) METADATA SPECIFICATION

VERSION 1.3.1

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## Revision History

| Date      | Version | Description of Document Updates      | Author            |
|-----------|---------|--------------------------------------|-------------------|
| 4/2003    | 1.2     |                                      | BEN Working Group |
| 28/6/2010 | 1.3     | Added resource type term ‘biography’ | Sergey Demidenko  |
| 27/6/2011 | 1.3.1   | Fixed date string format             | Sergey Demidenko  |

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## INTRODUCTION

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The Biosci Education Network (BEN) Collaborative established a portal site and is developing and maintaining digital library collections of biological sciences teaching and learning resources. Part of the development of the portal and digital library collections entailed the establishment of a metadata specification that all partners agreed to adhere to for describing their collection's material. The initial metadata specification was the result of ten-months of work and meetings by the working group members. The BEN portal site catalog and three partner collections (APS, ASM, and ESA) implemented the initial version of the specification for beta testing, conducted during the month of April 2002.

### VERSION NOTES AND REVISION SUMMARY:

The changes contained this version of the specification reflect the lessons learned from the April 2002 beta test, feedback based on implementation by BEN Collaborative partners, and input from registered user at the BEN portal site.

1. Additional resource types added to the vocabulary for 5.2 Learning Resource Type. 4/03
2. Field 5.10 Educational Description changed from required to optional. 4/03
3. Biological sciences entries added to the disciplines classification. 4/03
4. "Pedagogical use" and "content/curriculum standards" classification fields changed from required to optional. 4/03
5. Classification descriptions and keyword field changed from required to optional. 4/03

### BEN PROJECT BACKGROUND

With funding from National Science Foundation's National SMETE Digital Library (NSDL) program, the American Association for the Advancement of Science (AAAS) Directorate for Education and Human Resources - with other professional societies and coalitions for biology education - established BEN. Founding partners in the Collaborative include the:

- American Institute for Biological Sciences (AIBS).
- American Physiological Society (APS).
- American Society for Biochemistry and Molecular Biology (ASBMB).
- American Society for Microbiology (ASM).
- BioQUEST Curriculum Consortium (BCC).
- Ecological Society of America (ESA).
- National Association of Biology Teachers (NABT).
- National Biological Information Infrastructure (NBII).
- National Health Museum (NHM) - Access Excellence (AE).
- Science's Signal Transduction Knowledge Environment (STKE).
- Society of Toxicology (SOT).

The BEN Collaborative believes a biology-based digital library portal site is needed for several reasons, including:

- To overcome fragmentation in teaching of biology sub-disciplines.
- To facilitate interdisciplinary approaches to teaching modern biology.
- To provide visually based resources for teaching biology.

- To provide a platform to address controversial biology issues in a responsible, scientifically sound way.

Materials in the digital library are designed or selected primarily for biological sciences faculty at the undergraduate level, including ones that prepare K–12 educators. However, many of the library resources are useful for graduate and medical school educators, as well.

## **SCOPE**

The BEN metadata specification is for use by BEN Collaborative partners that want their collections of online biological sciences teaching and learning resources searchable at the BEN portal site.

## **PURPOSE**

The purpose of the BEN metadata specification is to support the cataloging of BEN learning resources and user discovery (searching and browsing) of biology teaching and learning resources. Metadata is descriptive information about a resource that supports the development and management of online collections and user access to the contents of the collections. Collections management includes the following types of activities:

- cataloging existing resources
- reviewing and adding new resources
- reviewing and added new versions of existing resources
- archiving and preserving resources and
- managing digital rights and intellectual property

## **SPECIFICATION DEVELOPMENT PROCESS**

This metadata specification was developed and is maintained by the BEN Metadata Working Group, comprised of BEN partner representatives responsible for the development and management of collections of their organization's educational resources. Technical staff support the committee by providing interpretation of standards and specifications and clarifying the implications of deviating from the base specifications on the implementation of databases, applications, and interoperability with other digital libraries.

As a result of the initial research and discussions, the IEEE Learning Objects Metadata standard was selected as the base specification for the BEN Collaborative Metadata specification. Although Dublin Core Metadata Initiative (DCMI) is the most widely implemented metadata specification, the BEN metadata specification is built upon IEEE Learning Objects Metadata (LOM) April 2001 draft standard 6.1 (available at <http://ltsc.ieee.org/wg12/index.html>) for the following reasons.

- 1) The IEEE LOM is better suited to supporting metadata about learning resources.
- 2) The IEEE LOM contains many more fields that support pedagogical and education-related information.
- 3) Other major educational digital library projects support the IEEE LOM directly, and there are known crosswalks between IEEE LOM and Dublin Core.

The working group members considered the types of resources currently available in their collections and resources that may be available in the future. The greatest discussion occurred around controlled vocabularies and keywords because these terms are used when cataloging and searching for resources. As much as possible, the perspective of the faculty user was placed in the forefront of the decision making process.

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## BEN METADATA SPECIFICATION RATIONALE AND DISCUSSION

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The metadata specification is divided into required and optional fields to maximize extensibility and utility for the current and future partners in the Collaborative. Individual partners may decide whether to use any or all of the optional fields based upon their collection requirements. The required fields are the ones that will be contained in the BEN portal catalog and used by the BEN portal search engine. The following paragraphs and tables identify the BEN required data fields, and indicate where and why there are any deviations from the IEEE LOM (hereinafter referred to as the LOM.) All metadata fields are referenced by their LOM data element number and name. The BEN specification conforms to the LOM's basic metadata structure, and the discussion is organized by the categories as identified in the LOM. Appendix B contains a complete table of BEN required and optional fields.

### GENERAL

Of the general category, only fields 1.2 through 1.5 are required in the BEN metadata specification. Per LOM Version 6.1, field 1.1 is currently not available for use; and all other fields were determined to be optional by the BEN Metadata Working Group. BEN's use of the required data fields (1.2 through 1.5) and their vocabularies does not deviate from the LOM.

| <i>Number/Name</i> | <i>Value</i>  | <i>Notes</i>  |
|--------------------|---|---|
| <b>1 General</b>   |   |   |
| 1.2 Title          | Free text language string up to 1000 characters in size   |   |
| 1.3 Catalog Entry  |   |   |
| 1.3.1 Catalog      | Partners catalog name. (example: ASM MicrobeLibrary)  | The use of "BEN" as a catalog name is reserved for the BEN portal catalog.  |
| 1.3.2 Entry        | langString (example: En, 00001)   | The Entry should be a unique identifier (catalog number) from the partners cataloguing system named in 1.3.1.                           |
| 1.4 Language       | Character string that corresponds to a two-letter language code as defined in ISO 639 and a country subcode from ISO 3266-1:1997. | Default language is English ("en") per the LOM. Multiple language fields are allowed for resources available in more than one language. |
| 1.5 Description    | Free text language string up to 2000 characters in size   |   |

### LIFE CYCLE

All of the fields in the LOM lifecycle category are required by BEN.

| <i>Number/Name</i>  | <i>Value</i>  | <i>Notes</i>   |
|---------------------|---|--|
| <b>2 Life Cycle</b> |   |  |
| 2.2 Status          | Available: Draft<br>Available: Revised<br>Available: Final<br>Unavailable | This is deviation from the LOM vocabulary for this field. This is similar to a vocabulary change made in the DLESE metadata specification. |

|                |   |   |
|----------------|---|---|
| 2.3 Contribute |   |   |
| 2.3.1 Role     | Author, Publisher, Contact, Contributor, Editor                     | BEN is using a subset of the LOM vocabulary. There can be multiple instances of the role field in any combination. For example, a resource with two authors and one publisher would have three instances of the role field. At least one instance of the publisher role and either one instance of author or editor us is required. |
| 2.3.2 Entity   | Vcard formatted information, recommended minimum version VCard 2.1. | For example, this can be a person's name and organization.  |
| 2.3.3 Date     | DateTime  | This is the date that the resource was developed. If the development date is not available, then this is the date the resource was contributed to the library.  |

### META-METADATA

In the meta-metadata category, 3.1 is not available for use for the same reason as 1.1 of the general category. All other meta-metadata fields are required by BEN and do not deviate from the LOM in any way.

| <i>Number/Name</i>     | <i>Value</i>  | <i>Notes</i>  |
|------------------------|---|---|
| <b>3 Meta-metadata</b> |   |   |
| 3.2 Catalog Entry      |   |   |
| 3.2.1 Catalog          | Partners catalog name. (example: ASM MicrobeLibrary)  | The use of "BEN" as a catalog name is reserved for the BEN portal catalog.  |
| 3.2.2 Entry            | langString (example: En, 00001)   | The Entry should be a unique identifier (catalog number) from the partners cataloguing system named in 3.2.1.   |
| 3.3 Contribute         |   |   |
| 3.3.1 Role             | Creator, Validator  | One instance of creator is required, and the corresponding entity should identify the person who created the metadata for the learning resource. One instance of validator is required, and the corresponding entity should identify the BEN partner organization that has reviewed or validated the metadata record. |
| 3.3.2 Entity           | Vcard formatted information, recommended minimum version VCard 2.1.   | For example, this can be a person's name and organization.  |
| 3.3.3 Date             | Date of contribution  |   |
| 3.4 Metadata Scheme    | Name and version of authoritative specification   | The first two instances of this field should be set to 'BEN-1.0' and 'LOM-1.0/D6.1'. Additional instances may be set if the metadata conforms to other metadata schemes.  |
| 3.5 Language           | Character string that corresponds to a two-letter language code as defined in ISO 639 and a country subcode from ISO 3266-1:1997. | Default is English, 'en'  |

## TECHNICAL

In the technical category, only the format and location are required by BEN. All other LOM technical data fields such as size, requirements, installation remarks, other platform requirements, and duration are optional. All of this information is potentially useful. However, none of the optional fields is considered essential to the BEN's collection management or resource discovery. Some of the optional field information may be automatically generated, if they are used.

| <i>Number/Name</i> | <i>Value</i>                     | <i>Notes</i>  |
|--------------------|----------------------------------|---|
| <b>4 Technical</b> |                                  |   |
| 4.1 Format         | IANA registered MIME types       | This information may be generated automatically based on the file extension or be supplied by the creator of the metadata record. Multiple instances of this field are allowed for resources that are provided in more than one format. |
| 4.3 Location       | Uniform Registered Locator (URL) | There may be multiple instances for resource that exist at more than one location.  |

## EDUCATIONAL

BEN requires only a subset of the LOM educational fields, which include 5.2 Learning Resource Type, 5.5 Intended End User Role, 5.6 Context, and 5.11 Language.

| <i>Number/Name</i>         | <i>Value</i>   | <i>Notes</i>   |
|----------------------------|--|--|
| <b>5 Educational</b>       |  |  |
| 5.2 Learning Resource Type | See table 1 on the next page for the BEN defined vocabulary.   | The vocabulary was developed based on the types of resources that are expected to be available from the BEN collection and the way in which potential users think about resource types.  |
| 5.5 Intended End User Role | Teacher, Author, Learner, Manager  | This is the LOM vocabulary for intended end user role.   |
| 5.6 Context                | Preschool<br>Primary elementary K-2<br>Intermediate elementary 3-5<br>Middle school 6-8<br>High school lower division 9-10<br>High school upper division 11-12<br>Undergraduate lower division 13-14<br>Undergraduate upper division 15-16<br>Graduate<br>Professional (degree program)<br>General public & informal education<br>Continuing education | This vocabulary was developed based on the working group's understanding of what is meaningful to the user. There can be multiple context fields in the case of a resource applicable to more than one context. For example, a resource may be suitable for high school upper division and undergraduate lower division. |
| 5.11 Language              | Character string that corresponds to a two-letter language code as defined in ISO 639 and a country subcode from ISO 3266-1:1997.  | When used in conjunction with field 1.4 Language, this field can be used to indicate applicability for non-native English speakers or a language immersion environment.  |

The grouping of the resource types in table 1 is for presentation purposes only. The metadata field will

contain only the resource type name.

Table 1. Learning Resource Type Vocabulary

| Grouping                         | Resource Type Name   |   |
|----------------------------------|--|---|
| Auditorium -<br>Multimedia       | <ul style="list-style-type: none"> <li>▪ animation</li> <li>▪ audio</li> <li>▪ video</li> <li>▪ diagram</li> <li>▪ graph/chart</li> <li>▪ table</li> <li>▪ 35 mm slide</li> <li>▪ digital presentation (PowerPoint)</li> </ul>   | <ul style="list-style-type: none"> <li>▪ illustration</li> <li>▪ map</li> <li>▪ photograph</li> <li>▪ image</li> <li>▪ simulation</li> <li>▪ application</li> <li>▪ discussion group/listserv</li> <li>▪ webcast</li> <li>▪ online tool</li> <li>▪ software</li> </ul>                              |
| Reading Room                     | <ul style="list-style-type: none"> <li>▪ meeting presentation</li> <li>▪ proceedings</li> <li>▪ book</li> <li>▪ book chapter</li> <li>▪ journal</li> <li>▪ journal article/issue</li> <li>▪ thesis/dissertation</li> </ul>   | <ul style="list-style-type: none"> <li>▪ report</li> <li>▪ abstract</li> <li>▪ memo</li> <li>▪ newsletter</li> <li>▪ non-journal article</li> <li>▪ pamphlet/brochure</li> <li>▪ biography</li> </ul>   |
| Reference Room                   | <ul style="list-style-type: none"> <li>▪ bibliography</li> <li>▪ index</li> <li>▪ dataset</li> <li>▪ dictionary/glossary</li> <li>▪ thesaurus</li> </ul>   | <ul style="list-style-type: none"> <li>▪ discussion group/listserv archive</li> <li>▪ manual</li> <li>▪ scientific standards and guidelines</li> <li>▪ review</li> <li>▪ database</li> </ul>  |
| Classroom -<br>pedagogical tools | <ul style="list-style-type: none"> <li>▪ educational standards</li> <li>▪ teaching strategies &amp; guidelines</li> <li>▪ course syllabus</li> <li>▪ lesson plan</li> <li>▪ lecture/lecture outline</li> <li>▪ laboratory exercise</li> <li>▪ laboratory manual</li> </ul> | <ul style="list-style-type: none"> <li>▪ assignment/activity (non-laboratory)</li> <li>▪ assessment: tool</li> <li>▪ assessment: exam with answer key</li> <li>▪ assessment: exam without answer key</li> <li>▪ assessment: other</li> <li>▪ fieldtrip guide</li> <li>▪ career materials</li> </ul> |

## RIGHTS

The rights section are required by BEN and used as specified in the LOM.

| <i>Number/Name</i>                   | <i>Value</i>   | <i>Notes</i>  |
|--------------------------------------|--|---|
| <b>6.0 Rights</b>                    |  |   |
| 6.1 Cost                             | Yes, No  |   |
| 6.2 Copyright and Other Restrictions | Yes, No  |   |
| 6.3 Description                      | Free text language string up to 1000 characters in size. | Required if fields 6.1 or 6.2 contain a value of “Yes”. For example, the ASM MicrobeLibrary rights and limitation policy would be described here or this could be a link to the policy. |

## RELATION AND ANNOTATION

The LOM relation and annotation categories are optional BEN categories and fields.

## CLASSIFICATION

Describing resources using the classification fields is essential to providing accurate and useful information to users searching for resources. Not all the purposes provided in the LOM were considered appropriate for the BEN users. Thus, BEN established its own specific set of purposes: Discipline, Content/Curriculum Standards, and Pedagogical Use.

An extensive discussion occurred around the discipline taxonomy. The working group considered various approaches, including biology textbook indexes and online classification schemes. The Digital Library for Earth Science Education (DLESE), Eisenhower National Clearinghouse, the Library of Congress, and the Open Directory classification schemes were reviewed as part of our research. After considerable discussion of the alternatives presented by an ad hoc subgroup, the working group elected to use the discipline taxonomy contained in table 2. The intent was to select a discipline taxonomy that would be natural to biological sciences faculty.

Because BEN is for faculty, the working group felt that the LOM did not sufficiently allow learning resources to be described in a meaningful way to educators. Therefore, ad hoc subgroups were established to develop two new classification schemes: Content/Curriculum Standards and Pedagogical Use. The development of the Content/Curriculum Standards and Pedagogical Use vocabularies also involved considerable research. In each instance, the ad hoc subgroups approached their decisions and recommendations from the perspective of biological sciences faculty. The use of a Content/Curriculum Standards classification scheme allows each partner to develop a classification based on standards applicable for the individual discipline (e.g., Medical Physiology Learning Objectives for the physiology discipline). The main goal in developing the Pedagogical Use purpose was to allow learning resources to be described according to the way in which they can be used to teach and learn.

The only classification group that is required is discipline. The other two classifications are optional though they are shown in the table for example purposes only.

| <i>Number/Name</i>      | <i>Value</i>                    | <i>Notes</i>   |
|-------------------------|---------------------------------|--|
| <b>9 Classification</b> |                                 |  |
| 9.1 Purpose             | Discipline                      |  |
| 9.2 Taxon Path          |                                 |  |
| 9.2.1 Source            | BEN Subject/Discipline Taxonomy |  |
| 9.2.2 Taxon             |                                 |  |
| 9.2.2.1 ID              | 2                               |  |
| 9.2.2.2 Entry           | Anatomy                         | See BEN Discipline Taxonomy in table 2 on the next page. |

|                |                                  |  |
|----------------|----------------------------------|--|
| 9.1 Purpose    | Content/Curriculum Standards     |  |
| 9.2 Taxon Path |                                  |  |
| 9.2.1 Source   | Medical Physiology Objectives    | Example source for content/curriculum standards. |
| 9.2.2 Taxon    |                                  |  |
| 9.2.2.1 ID     | GI-8                             | Sample entry from Medical Physiology Objectives. |
| 9.2.2.2 Entry  | Gastrointestinal/Large Intestine | Sample entry from Medical Physiology Objectives. |

|                |   |                               |
|----------------|---|-------------------------------|
| 9.1 Purpose    | Pedagogical Use   |                               |
| 9.2 Taxon Path |   |                               |
| 9.2.1 Source   | BEN Pedagogical Use Taxonomy  |                               |
| 9.2.2 Taxon    | <blank>   |                               |
| 9.2.2.1 ID     | 1 thru 5  |                               |
| 9.2.2.2 Entry  | <ol style="list-style-type: none"> <li>1. assess</li> <li>2. learn</li> <li>3. research</li> <li>4. plan</li> <li>5. teach</li> </ol> | BEN Pedagogical Use taxonomy. |

*Table 2. Discipline Taxonomy*

|                                 |                               |
|---------------------------------|-------------------------------|
| 1. agriculture & aquaculture    | 39. natural history           |
| 2. anatomy                      | 40. nephrology                |
| 3. anthropology & archaeology   | 41. neurobiology              |
| 4. behavioral science           | 42. nutrition & food sciences |
| 5. biochemistry                 | 43. paleontology              |
| 6. bioethics                    | 44. parasitology              |
| 7. bioinformatics               | 45. pathology                 |
| 8. biophysics                   | 46. pharmacology              |
| 9. biostatistics                | 47. phylogeny                 |
| 10. biotechnology               | 48. physiology                |
| 11. botany & plant science      | 49. population biology        |
| 12. cardiology                  | 50. psychology                |
| 13. cell biology                | 51. reproductive biology      |
| 14. conservation biology        | 52. respiratory biology       |
| 15. cryobiology                 | 53. sociobiology              |
| 16. developmental biology       | 54. soil biology              |
| 17. ecology                     | 55. systematics               |
| 18. education                   | 56. taxonomy & classification |
| 19. endocrinology               | 57. theoretical biology       |
| 20. entomology                  | 58. toxicology                |
| 21. environmental sciences      | 59. vertebrate biology        |
| 22. epidemiology                | 60. virology                  |
| 23. evolutionary biology        | 61. zoology                   |
| 24. exercise & kinesiology      | 62. genomics                  |
| 25. exobiology                  | 63. proteomics                |
| 26. forestry                    | 64. bacteriology              |
| 27. gastroenterology            | 65. public health             |
| 28. genetics & heredity         | 66. biocomplexity             |
| 29. geography                   | 67. biodiversity              |
| 30. histology                   | 68. structural biology        |
| 31. human biology               | 69. oceanography              |
| 32. hydrology & water resources | 70. hematology                |
| 33. immunology                  | 71. bioengineering            |
| 34. invertebrate biology        | 72. enzymology                |
| 35. marine biology              | 73. glycobiology              |
| 36. microbiology                | 74. metabolism                |
| 37. molecular biology           | 75. wildlife science          |
| 38. mycology                    | 76. range Science             |

Note: The disciplines can be presented to users alphabetically or in another organized structure for ease of viewing and use by searchers and catalogers. This is the actual taxonomy with the ID numbers associated with the entry or discipline name.

#### **ACCESSIBILITY**

The working group decided to address accessibility by using the existing descriptive text fields rather than the LOM accessibility restrictions classification.

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## REFERENCES

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The BEN Metadata Working Group reviewed multiple metadata specifications and other educational online gateways, portals, and sites that have implemented cataloging and searching based on the use of metadata. The focus of our review process was to investigate ways that organizations and sites were supporting the management of and access to teaching and learning resources. The sites, articles, working papers, and specifications that the BEN Metadata reviewed include but were not limited to:

Digital Library for Earth Systems Education (DLESE), *DLESE Controlled Vocabularies*,  
<http://www.dlese.org/Metadata/vocabularies/vocabs.htm>

Eisenhower National Clearinghouse (ENC), *Eisenhower National Clearinghouse Lists of Web sites Categorized by Subject Areas within Science*, <http://www.enc.org/weblinks/science/>

Gateway to Educational Materials (GEM), *GEM Audience Element Controlled Vocabulary*,  
[http://www.geminfo.org/Workbench/Metadata/Vocab\\_Audience.html](http://www.geminfo.org/Workbench/Metadata/Vocab_Audience.html)

Giersch and McArthur, *Accessibility and Metadata in Digital Libraries*, Draft White Paper, Eduprise, 16 March 200

iLumina, *Vocabulary Comparison Chart: IMS vs. iLumina*,  
[http://dl.uncwil.edu/documents/vocabulary\\_comparison\\_chart.htm](http://dl.uncwil.edu/documents/vocabulary_comparison_chart.htm)

IEEE P1484.12.1/D6.1, *Draft Standards for Learning Object Metadata, 29 August 2001*,  
[http://ltsc.ieee.org/doc/wg12/LOM\\_WD6-1\\_without\\_tracking.htm](http://ltsc.ieee.org/doc/wg12/LOM_WD6-1_without_tracking.htm)

Library of Congress, *Library of Congress Classification Outline*,  
<http://lcweb.loc.gov/catdire/cpsolcco/.cco.html>

Library of Congress, *Table of Core Metadata Elements for Library of Congress Digital Repository Development*,  
<http://lcweb.loc.gov/standards/metadata.htm>

National SMETE Digital Library (NSDL), *Recommended Metadata Elements to Support NSDL Resource Discovery*, [http://www.smete.org/nsdl/workgroups/standards/current\\_element\\_set.html](http://www.smete.org/nsdl/workgroups/standards/current_element_set.html)

Open Directory Project, *Open Directory: Classification of Websites in Science*,  
<http://directory.google.com/Top/Science/>, <http://dmoz.org/about.html>

SMETE Open Federation, [www.smete.org](http://www.smete.org)

World Wide Web Consortium (W3C), *Web Content Accessibility Guidelines 2.0*, Working Draft 24 August 2001, <http://www.w3.org/TR/2001/WD-WCAG20-20010824/>

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APPENDIX A. BEN WORKING GROUP MEMBERS

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*Metadata Working Group Members*

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Pedagogical Use

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**APPENDIX B. BEN METADATA SPECIFICATION VERSION 1.0**

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The following table includes the complete list of the LOM data fields with sample values, whether the field is BEN required (R is for required and O if for optional), and some of the working group's discussion notes.

| IEEE LOM Element    | Sample Value                     | BEN Required | Notes  |
|---------------------|----------------------------------|--------------|--|
| <b>1 General</b>    |                                  |              |  |
| 1.1 Identifier      |                                  | Not used     |  |
| 1.2 Title           | Phagocytosis                     | R            | Up to 1000 characters  |
| 1.3 Catalog Entry   |                                  | O            | If used, both catalog and entry are required   |
| 1.3.1 Catalog       | ASM MicrobeLibrary               | O            |  |
| 1.3.2 Entry         | En, 00001                        | O            |  |
| 1.4 Language        | English                          | R            | Default language is English;   |
| 1.4 Language        | French                           |              | Can be available in multiple languages   |
| 1.5 Description     | This is a video of phagocytosis. | R            | Up to 2000 characters  |
| 1.6 Keywords        | pathogenesis                     | O            | Can be single words or phrases   |
| 1.6 Keywords        | white cell                       |              |  |
| 1.6 Keywords        | pneumococcus                     |              |  |
| 1.7 Coverage        | <blank>                          | O            |  |
| 1.8 Structure       | atomic                           | O            |  |
| 1.9 Aggregation     | 1                                | O            |  |
| <b>2 Life Cycle</b> |                                  |              |  |
| 2.1 Version         | 1                                | O            |  |
| 2.2 Status          | Available: Final                 | R            | BEN vocabulary (Available: Draft, Revised, Final; Unavailable)   |
| 2.3 Contribute      |                                  |              |  |
| 2.3.1 Role          | Author                           | R            | IEEE vocabulary - Author or Editor (req'd), Publisher (req'd), Contact, or Contributor. There can be multiple instances of this field and there can be multiple instances of each role. At a minimum there should be publisher plus either author or editor. |
| 2.3.2 Entity        | Smith, University of Michigan    | R            | Use Vcard format.  |

|                        |  |          |   |
|------------------------|--|----------|---|
| 2.3.3 Date             | 2001-06-20                             | R        | Date when it was developed or (in practical terms) the date it was contributed to the library (if no date included will be autogenerated as date received at BEN) |
| <b>3 Meta-metadata</b> |  |          |   |
| 3.1 Identifier         |  | Not Used |   |
| 3.2 Catalog Entry      |  |          |   |
| 3.2.1 Catalog          | ASM MicrobeLibrary                     |          |   |
| 3.2.2 Entry            | En, 00001                              |          |   |
| 3.3 Contribute         |  |          |   |
| 3.3.1 Role             | creator                                | R        | IEEE Vocabulary (creator; validator). One instance of creator is required.  |
| 3.3.2 Entity           | Susan Musante, ASM, Education Division | R        | Use Vcard format.   |
| 3.3.3 Date             | 2001-08-28                             | R        |   |
| 3.3.1 Role             | validator                              | O        | There can be multiple instances of validator.   |
| 3.3.2 Entity           | ASM                                    | O        |   |
| 3.3.3 Date             | 2001-08-28                             | O        |   |
| 3.4 Metadata Scheme    | LOM-6.1                                | R        |   |
| 3.4 Metadata Scheme    | BEN-1.0                                | R        |   |
| 3.5 Language           | English                                | R        | Default language is English.  |
| <b>4 Technical</b>     |  |          |   |
| 4.1 Format             | mpeg                                   | R        | May be automated but may require input from validator or author; resource may have multiple formats   |
| 4.2 Size               | 232,134 bytes                          | O        | May be automatically generated but may need input from validator for zipped files in particular. (doesn't make sense for web pages)                               |
| 4.3 Location           | www./microbelibrary.org/pageid.asp     | R        |   |
| 4.4 Requirements       |  | O        |   |
| 4.4.1 Type             | Operating system                       | O        | IEEE defined vocabulary.  |
| 4.4.2 Name             | Multi-OS                               | O        | IEEE defined vocabulary.  |
| 4.4.3 Minimum Version  | <blank>                                | O        |   |

|                                      |  |   |  |
|--------------------------------------|--|---|--|
| 4.4.4 Maximum Version                | <blank>                                | O |  |
| 4.5 Installation remarks             | <blank>                                | O |  |
| 4.6 Other Platform Requirements      | <blank>                                | O |  |
| 4.7 Duration                         | 7 minutes                              | O |  |
|                                      |  |   |  |
| <b>5 Educational</b>                 |  |   |  |
| 5.1 Interactivity Type               | expositive                             | O | IEEE defined Vocabulary.   |
| 5.2 Learning Resource Type           | video                                  | R | BEN defined Learning Resource Type Vocabulary  |
| 5.3 Interactivity Level              | very low                               | O | IEEE defined Vocabulary.   |
| 5.4 Semantic Density                 | very high                              | O | IEEE defined Vocabulary.   |
| 5.5 Intended End User Role           | learner                                | R | IEEE defined Vocabulary. Can have multiple instances.  |
| 5.6 Context                          | Lower Division High School (9-10)      | R | BEN Defined Context Vocabulary. Can have multiple instances.   |
| 5.6 Context                          | Upper Division High School (11-12)     | R |  |
| 5.6 Context                          | Lower Division Undergraduate (13-14)   | R |  |
| 5.7 Typical Age Range                | <blank>                                | O |  |
| 5.8 Difficulty                       | medium                                 | O | IEEE defined Vocabulary.   |
| 5.9 Typical Learning Time            | PT 14M                                 | O |  |
| 5.10 Description                     | This video can be used in a unit on... | O | Open text on context issues such as how the resource can be used. Could include some issues on accessibility (visual, auditory, physical/motor). |
| 5.11 Language                        | English                                | R | Can be used in conjunction with field 1.4 for resources targeted for language learning settings.   |
|                                      |  |   |  |
| <b>6.0 Rights</b>                    |  |   |  |
| 6.1 Cost                             | yes                                    | R | Yes or no  |
| 6.2 Copyright and Other Restrictions | yes                                    | R | Yes or no  |

|                       |  |          |   |
|-----------------------|--|----------|---|
| 6.3 Description       | ASM copyright and use policy                               | R        | Open text with society or collection owner policy for the resource. |
| <b>7 Relation</b>     |  |          |   |
| 7.1 Kind              | IsVersionOf  | O        | IEEE defined Vocabulary.  |
| 7.2 Resource          | Phagocytosis   | O        |   |
| 7.2.1 Identifier      |  | Not used |   |
| 7.2.2 Description     | This video is an edited version of a 30 minute video.      | O        |   |
| 7.2.3 Catalog Entry   |  | O        |   |
| 7.2.3.1 Catalog       | ASM MicrobeLibrary   | O        |   |
| 7.2.3.2 Entry         | En, 00002  | O        |   |
| <b>8 Annotation</b>   |  |          |   |
| 8.1 Person            | Marsha Matyas, APS, Education Division                     | O        | Use Vcard.  |
| 8.2 Date              | 2001-08-30   | O        |   |
| 8.3 Description       | This video is a fine addition to any teacher's collection. | O        |   |
| <b>Classification</b> |  |          |   |
| 9.1 Purpose           | Discipline   | R        |   |
| 9.2 Taxon Path        |  | R        |   |
| 9.2.1 Source          | BEN Subject/Discipline Taxonomy                            | R        | BEN defined Discipline Vocabulary                                   |
| 9.2.2 Taxon           |  | R        | (can have multiple instances)                                       |
| 9.2.2.1 ID            | 36   | R        |   |
| 9.2.2.2 Entry         | microbiology   | R        |   |
| 9.2.2 Taxon           |  |          |   |
| 9.2.2.1 ID            | 13   |          |   |
| 9.2.2.2 Entry         | Cell biology   |          |   |
| 9.3 Description       | This is a life sciences video.                             | O        |   |
| 9.4 Keywords          | life science   | R        | Free text   |
| 9.4 Keywords          | biology  | R        |   |
|                       |  |          |   |

|                 |  |   |   |
|-----------------|--|---|---|
| 9.1 Purpose     | Content/curriculum standards                         | O | A learning resource can be referenced to more than one standard |
| 9.2 Taxon Path  |  |   |   |
| 9.2.1 Source    | ASM Curriculum Guidelines for Microbiology Majors    |   |   |
| 9.2.2 Taxon     |  |   |   |
| 9.2.2.1 ID      | Men  |   |   |
| 9.2.2.2 Entry   | Microorganisms and Environment                       |   |   |
| 9.3 Description | Illustrates microorganisms impact on the environment | O | Free text   |
| 9.4 Keywords    | Microbes   |   | Free text   |
|                 |  |   |   |
| 9.1 Purpose     | Pedagogical Use                                      | O |   |
| 9.2 Taxon Path  |  |   |   |
| 9.2.1 Source    | BEN Pedagogical Use Taxonomy                         |   |   |
| 9.2.2 Taxon     |  |   |   |
| 9.2.2.1 ID      | 2  |   |   |
| 9.2.2.2 Entry   | Learn  |   | BEN defined Vocabulary: Assess, learn, research, plan, teach    |
| 9.3 Description | This video can be used in a unit on...               | O | Free text   |
| 9.4 Keywords    | Visual   |   | Free text   |