**CEDAR: Web-Based Tools for Accelerating the Creation of Standardized Metadata**

Mark A. Musen¹, John Graybeal³, Martin J. O’Connor³, Marcos Martínez-Romero¹, Attila L. Egyedi¹, Debra Willrett⁴, S. Ahmad Chan Bukhari², Steven H. Kleinstein², Kei-Hoi Cheung², Elizabeth Thomson³, Alejandra Gonzalez-Beltran⁴, Phillippe Rocca-Serra⁴, and Susanna-Assunta Sansone⁴

¹Stanford University; ²Yale University; ³Northrop Grumman, Inc.; ⁴Oxford University

**cedar.metadatadcenter.org**

CEDAR lets users create complete and comprehensive metadata for any scientific domain using standard ontologies and data structures.

1. **EXPLORE METADATA**
   - Template authors / Scientists
   - search, browse, and share metadata

2. **DESIGN TEMPLATE**
   - Template authors
   - create templates

3. **FILL IN METADATA**
   - Metadata authors
   - create metadata

4. **SUBMIT METADATA**
   - Publish your templates, elements and metadata.

**WORKSPACE**

- **Folders**
  - CEDAR provides you a workspace to store your templates, elements and metadata. Organize your project into folders and manage your metadata over time.

- **Share**
  - Collaborate with your team using groups. Share documents and folders in CEDAR with your team members. Publish your templates to the community by making them public.

**TEMPLATES**

- **Templates**
  - Building templates involves composing forms of fields, each with a name and description.

```
<table>
<thead>
<tr>
<th>Field Type</th>
<th>Title</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Name</td>
<td>BioSample</td>
<td>Enter the name of your sample.</td>
</tr>
</tbody>
</table>
```

- **Basic field types**
  - include short and long text, numbers, email, and more.

```
<table>
<thead>
<tr>
<th>Field Type</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>Date</td>
</tr>
<tr>
<td>Email</td>
<td>Email</td>
</tr>
<tr>
<td>Number</td>
<td>Number</td>
</tr>
<tr>
<td>Image</td>
<td>Image</td>
</tr>
<tr>
<td>Phone</td>
<td>Phone</td>
</tr>
<tr>
<td>Tissue</td>
<td>Tissue</td>
</tr>
<tr>
<td>Isolate</td>
<td>Isolate</td>
</tr>
<tr>
<td>Age</td>
<td>Age</td>
</tr>
</tbody>
</table>
```

**META DATA**

- **Metadata**
  - CEDAR supports features that allow easy and rapid entry of metadata. Computer-assisted intelligent authoring provides suggestions for both fields and values.

- **Validation**
  - Automatic validation is done on the fly to give immediate feedback of errors. The validator framework wraps other existing validation services, e.g., the BioSample Validator.

```
BioSample validation errors:
- Empty attribute value for attribute 'tissue'.
- Sample has missing mandatory attribute(s). If you do not have information for the required field(s), please provide value as either 'not collected', 'not applicable' or 'missing'.
```

**REST APIs**

- **Create, read, update and delete with CEDAR**
  - Send metadata to REST API microservices. Send metadata to your repository or app, or publish to CEDAR!

```
POST /folders/{id}/details
DELETE /folders/{id}/details
GET /folders/{id}
GET /folders/{id}/details
```

**ADOPTION AND EVALUATION**

- **Adoption and Evaluation**
  - Services, e.g., the BioSample Validator.

```
ADOPTION AND EVALUATION
```

**ANNOTATION**

- **Annotation**
  - Elements are reusable groups of fields and other elements. Elements can be shared on CEDAR and nested to any level. Using elements enables templates to be composed of community-defined building blocks to meet common specifications or needs.

```
<table>
<thead>
<tr>
<th>Study</th>
<th>Principal Investigator</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Name</td>
<td>Last Name</td>
</tr>
<tr>
<td>Address</td>
<td></td>
</tr>
<tr>
<td>Publication</td>
<td>Date</td>
</tr>
</tbody>
</table>
```

**JSON-LD**

- **Templates and metadata are represented as JSON-LD, a machine-readable and widely accepted interchange format on the Web**.

```
"_name": "Organism",
"_type": "http://data.bioontology.org/ontologies/NCBITAXON/classes/NCBITAXON/9606",
"_id": "http://purl.obolibrary.org/NCBITAXON/9606"
```

**JSON-LD**

- **JSON-LD**
  - Templates and metadata are represented as JSON-LD, a machine-readable and widely accepted interchange format on the Web.

```
"_name": "Organism",
"_type": "http://data.bioontology.org/ontologies/NCBITAXON/classes/NCBITAXON/9606",
"_id": "http://purl.obolibrary.org/NCBITAXON/9606"
```

https://metadatadcenter.org