

Developing the SSBD Ontology for International Interoperability of Bioimaging Data

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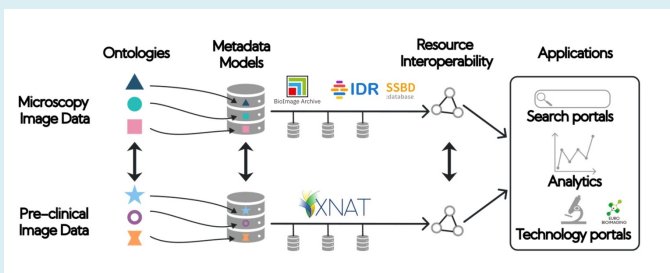
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BACKGROUND

- Bioimaging repositories (BioImage Archive, IDR, SSBD) differ in target organisms, research aims and imaging modalities.
- Their terms, concepts and description granularity therefore differ — a barrier to reuse and cross-resource integration.
- To develop the SSBD Ontology as the reference ontology for SSBD metadata, and to contribute to international data harmonization through the foundingGIDE project

Role of ontology for metadata

- Provides a controlled vocabulary and schema shared across datasets and repositories.
- Normalizes one concept written in many ways (mouse / Mus musculus / NCBITaxon:10090).
- Compares definitions, granularity and relations



- Repository**: Minimal metadata for rapid publication
 - SSBD: repository, BioImage Archive
- Added-Value DB**: Rich metadata for enhanced data value.
 - SSBD: database, IDR

foundingGIDE: Lessons for Interoperability

- Repositories describe different scientific worlds**
BIA, IDR and SSBD differ in target organisms, research aims, experimental contexts and imaging modalities.
- Differences go beyond terminology**
Concepts may differ in definition, granularity, relationships and use of external ontologies.
- Interoperability does not require one unified ontology**
We need to distinguish common concepts, resource-specific concepts, and make their mappings explicit.

Interoperability means connecting different semantic models, not forcing them into one model.

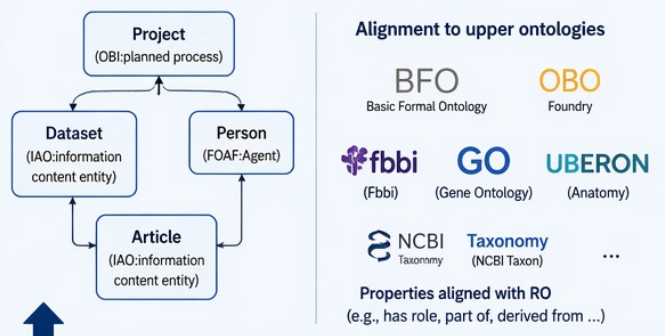
How the SSBD Ontology Works

- Core Layer (OWL) — minimal, semantically strong classes aligned to BFO / OBO, reusing FBbi, GO, CL, UBERON and NCBITaxon.
- Instance Layer (RDF) — over 500 SSBD datasets linked to image pixels via OME-NGFF.

APPROACH: TWO-LAYER SSBD ONTOLOGY

1. CORE LAYER (OWL)

Minimal yet semantically strong



2. INSTANCE LAYER

Real-world metadata



Link from articles, to biology, to image pixels (OME-NGFF).

Separating class definitions from data description, and identifying both by URIs, lets knowledge be traversed from articles, to biology, to image pixels (OME-NGFF).

CONCLUSION & NEXT STEPS

- ✓ Contribution to foundingGIDE
 - Compared vocabularies, and ontologies used across international bioimaging data resources.
 - Contributed to the alignment of common metadata elements following REMBI and their reference ontologies.
 - These efforts help connect heterogeneous semantic models and establish a semantic foundation for a global bioimaging data ecosystem. <https://founding-gide.eurobioimaging.eu/biological-imaging-gide-stack/>
- ✓ Next steps
 - Connect the SSBD Ontology with the RO-Crate framework for portable, interoperable study-level representation.
 - Extend the SSBD Ontology to accommodate emerging bioimaging metadata and use cases.
 - Explore LLM-assisted ontology extension and annotation, with expert curation and validation.



GitHub



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