The ISA-model

Speakers: Korbinian Bösl (UiB)

16 June 2022

Learning Objectives

In this talk, we will learn:

- The structure of ISA (Investigation, Study, Assay)

Session Take-Away

After completing this session, you will be:

- Able to understand the concept of ISA (Investigation, Study, Assay) Model
- Identify metadata schema with similar underlying concepts

Investigation Study Assay structure

Investigation Study Assay structure

Hierarchical

"Overall goals and means"

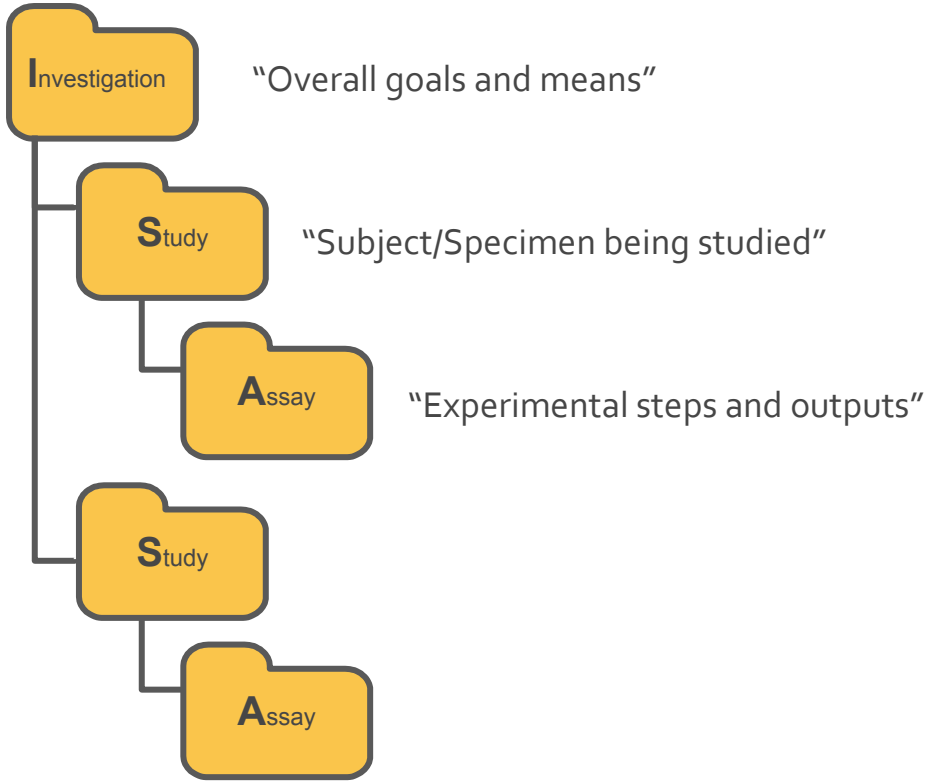
"Subject/Specimen being studied"

"Experimental steps and outputs"

Investigation Study Assay structure

Hierarchical

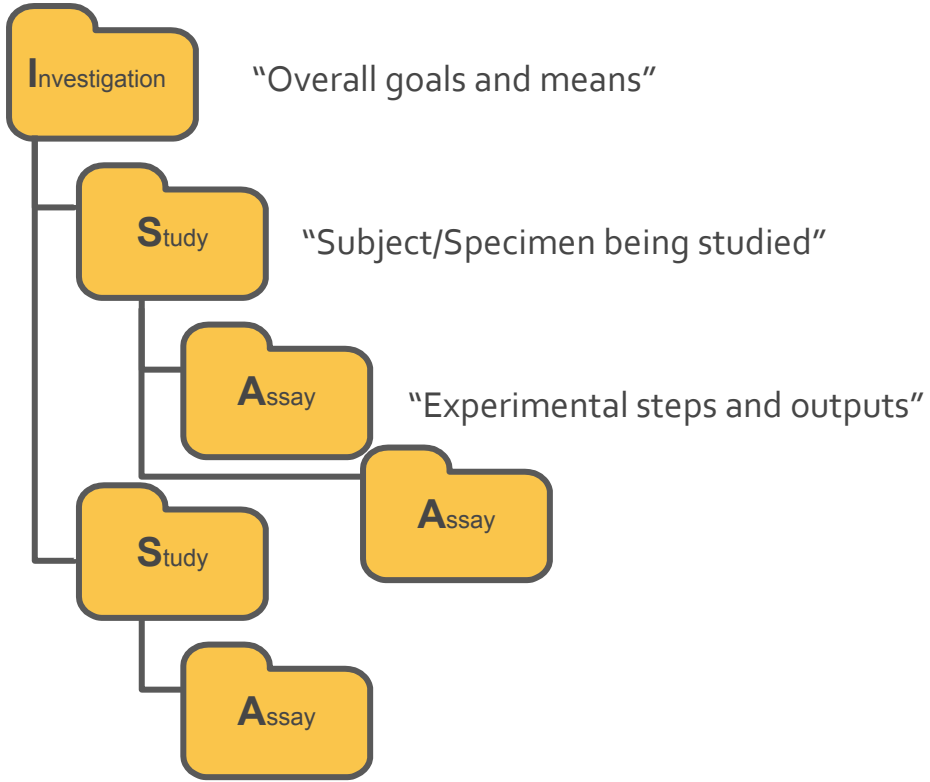
Extendable



Investigation Study Assay structure

Hierarchical

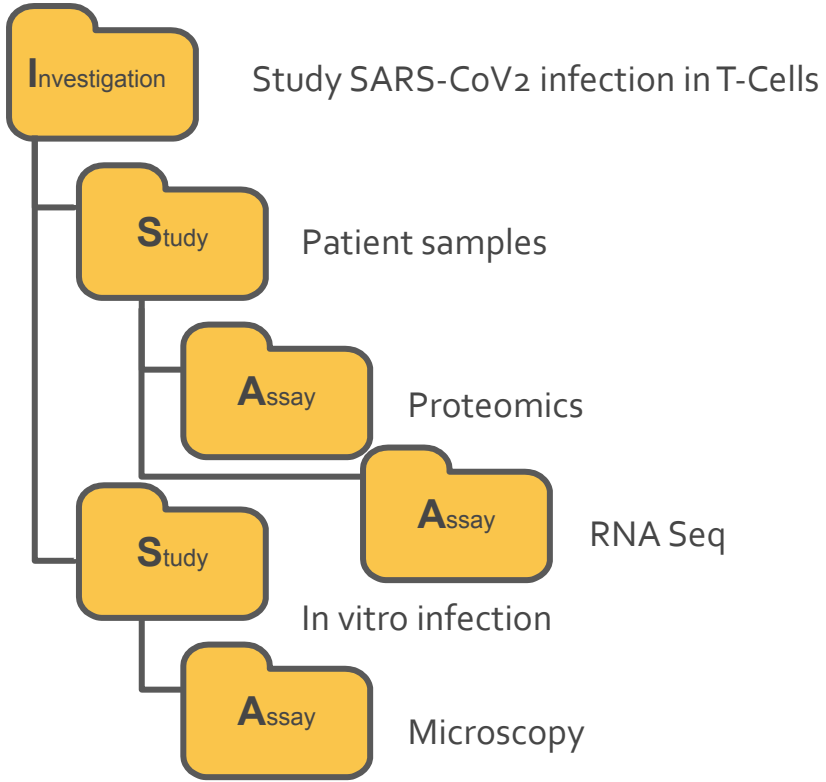
Extendable



Investigation Study Assay structure

Hierarchical

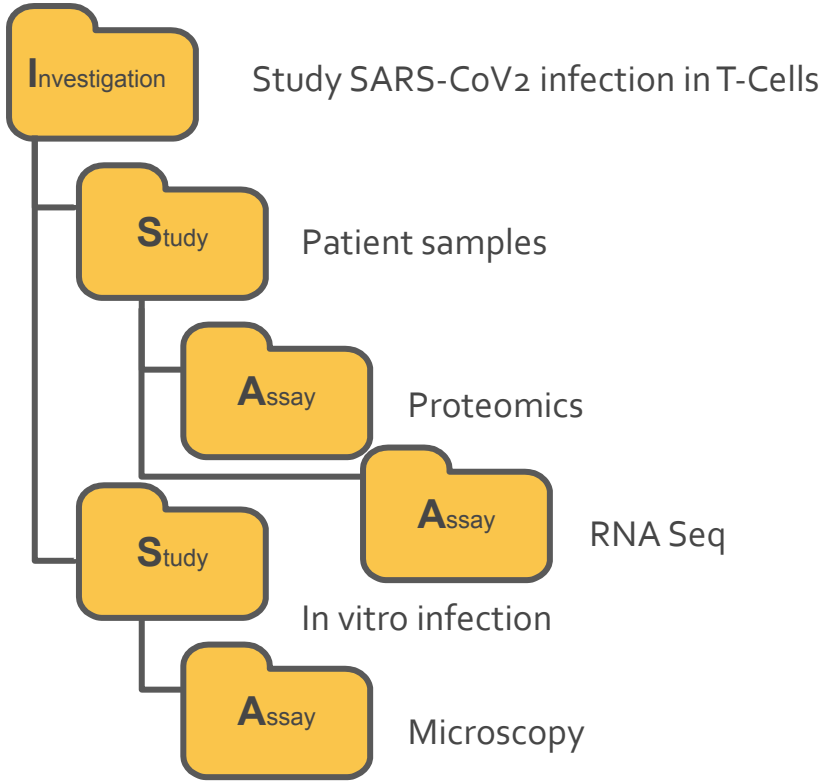
Extendable



Background

Hierarchical

Extendable



OMICS: A Journal of Integrative Biology > Vol. 12, No. 2 > ORIGINAL PAPERS

Open Access

The First RSBI (ISA-TAB) Workshop: "Can a Simple Format Work for Complex Studies?"

Susanna-Assunta Sansone, Philippe Rocca-Serra, Marco Brandizi, Alvis Brazma, Dawn Field, Jennifer Fostel, Andrew G. Garrow, Jack Gilbert, Federico Goodsaid, Nigel Hardy, Phil Jones, Allyson Lister, Michael Miller, Norman Morrison, Tim Rayner, Nataliya Sklyar, Chris Taylor, Weida Tong, Guy Warner, Stefan Wiemann, and and Members of the RSBI Working Group

Published Online: 19 Jun 2008 | https://doi.org/10.1089/omi.2008.0019

"(...) a simple format that can easily be created, viewed, and edited by researchers with little or no bioinformatics support (...)"

(...) a general purpose framework with which to collect and communicate complex metadata (i.e. sample characteristics, technologies used, type of measurements made) from 'omics-based' experiments (...)

DCC
Because good research needs good data

https://www.dcc.ac.uk/resources/metadata-standards/isa-tab

https://doi.org/10.1089/omi.2008.0019

Related models

MAGE-TAB

MINSEQE

MIAPE

MIAPPE

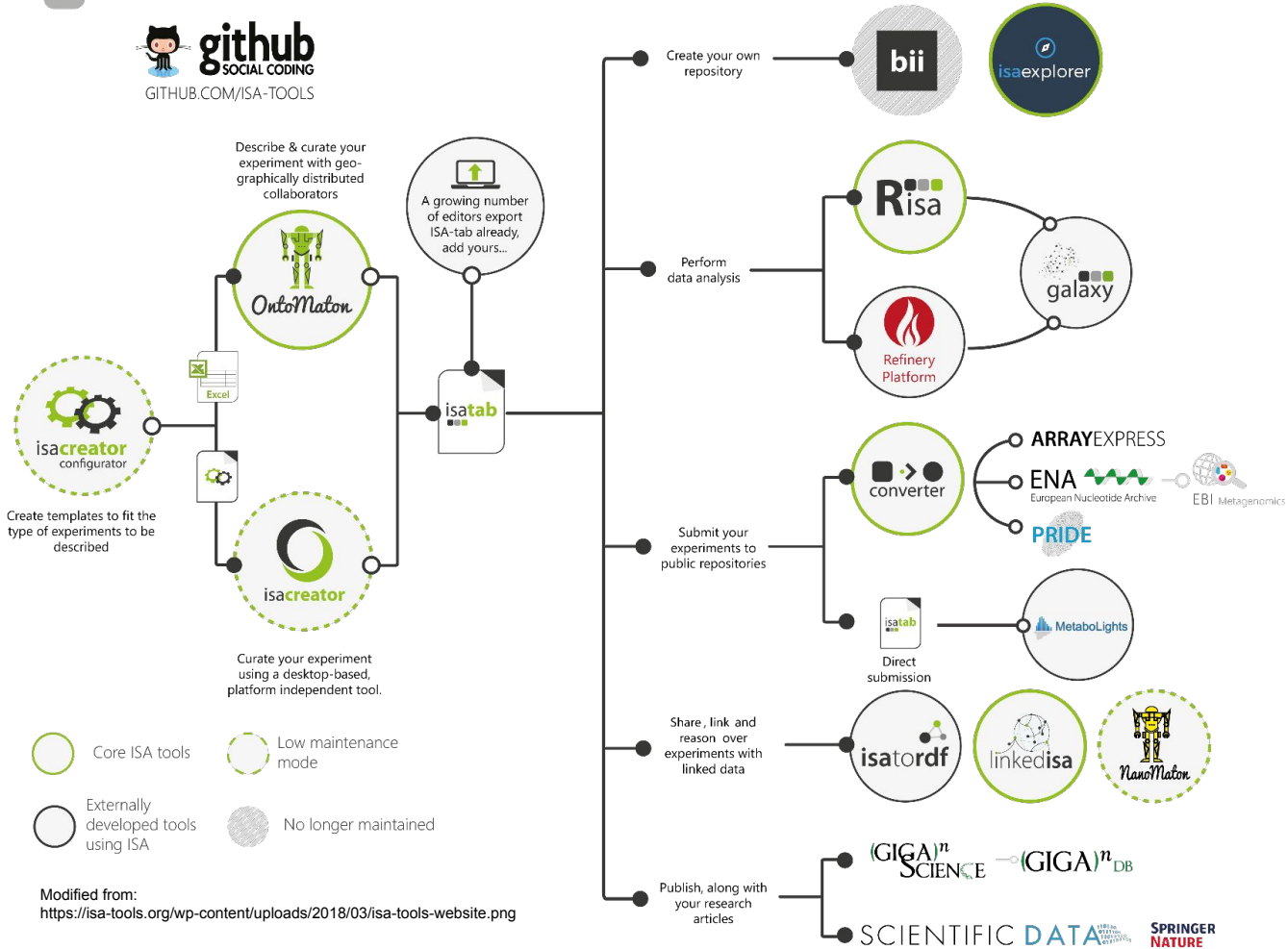
PAGE

ISA

isa-tools.org

Curate, store, analyse, share and publish your bioscience experiment

github SOCIAL CODING
GITHUB.COM/ISA-TOOLS



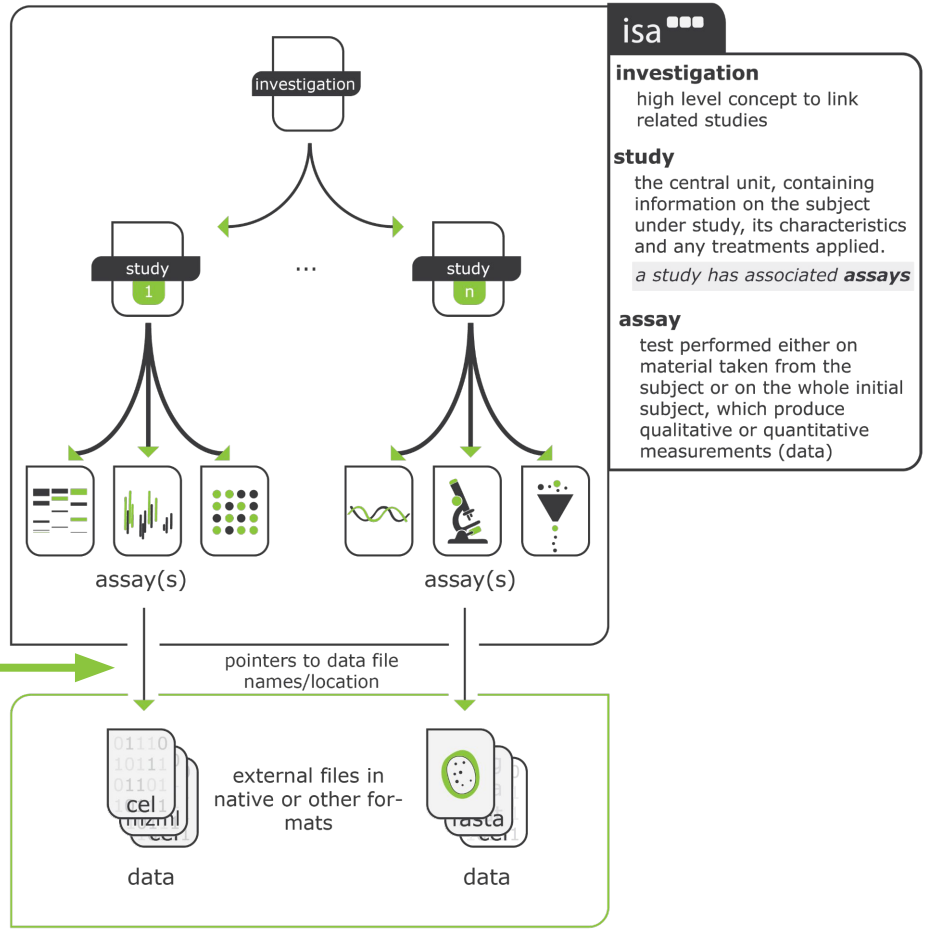
Modified from:
https://isa-tools.org/wp-content/uploads/2018/03/isa-tools-website.png

isacommons

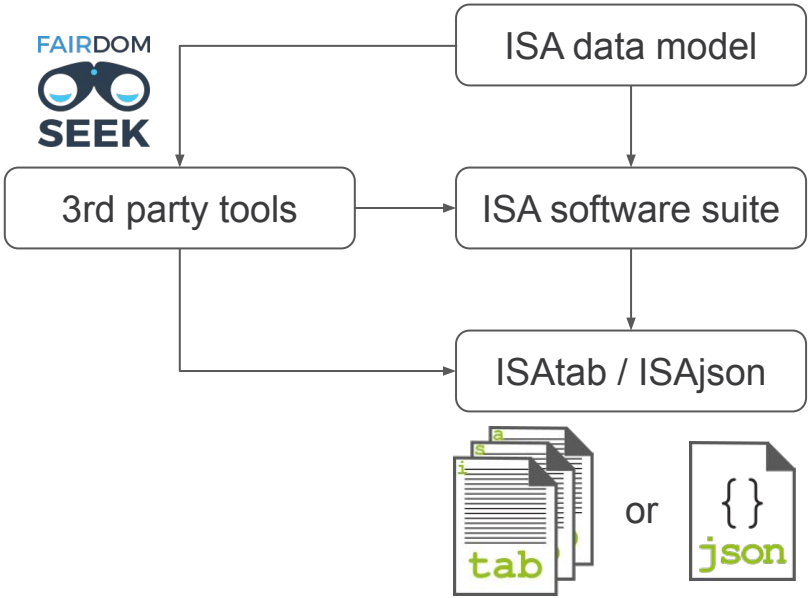
ISA data model

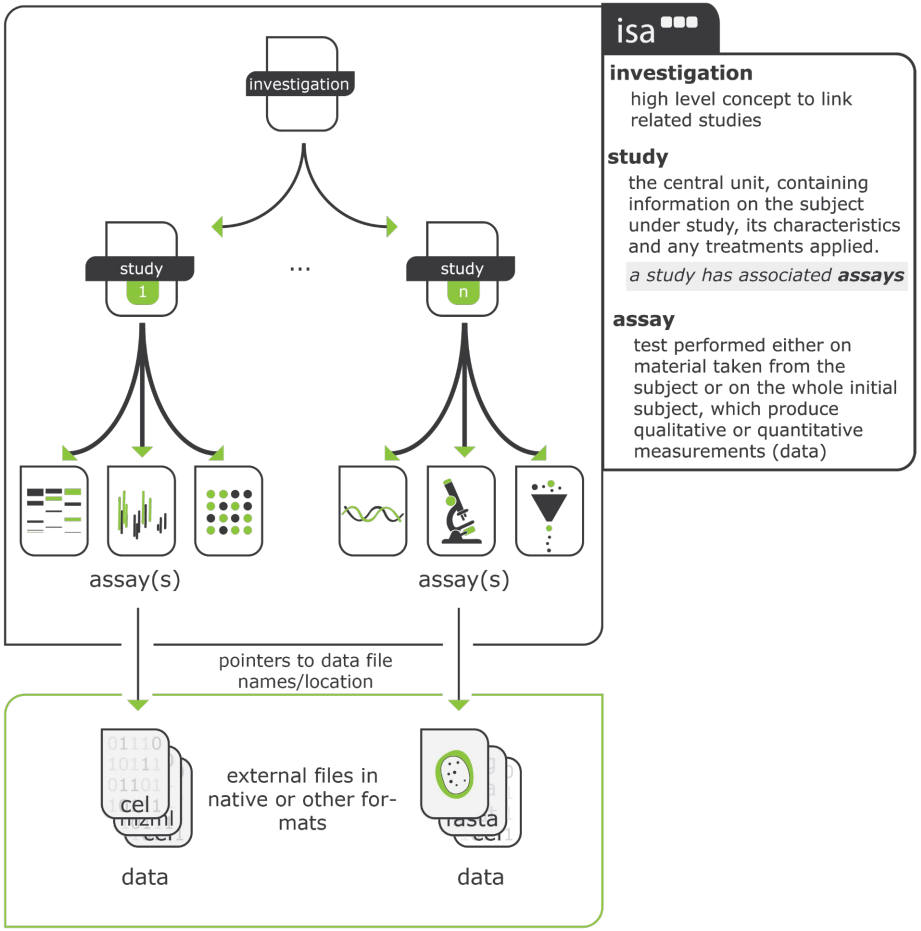
ISA software

Access to files not necessary



https://isa-tools.org/wp-content/uploads/2015/12/ISAmodel-structure.png





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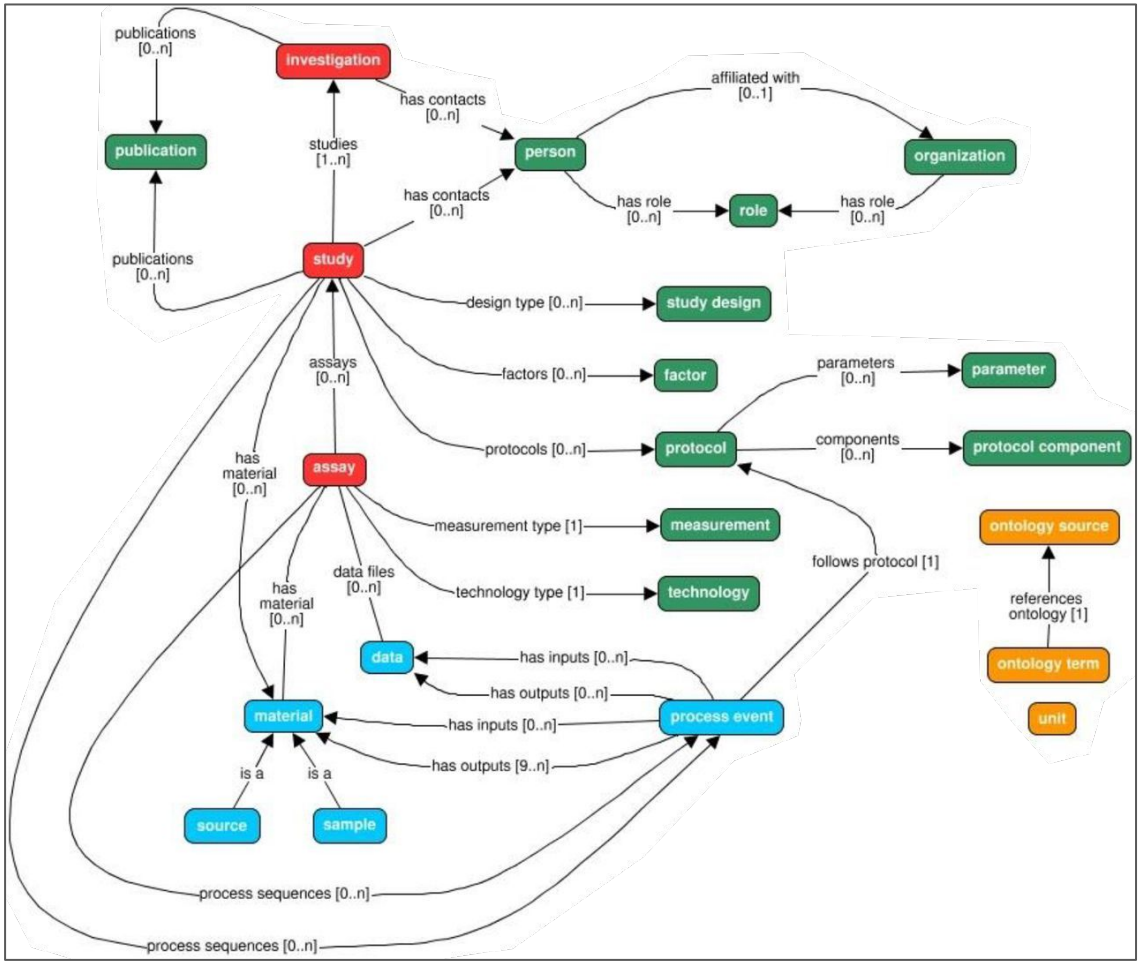
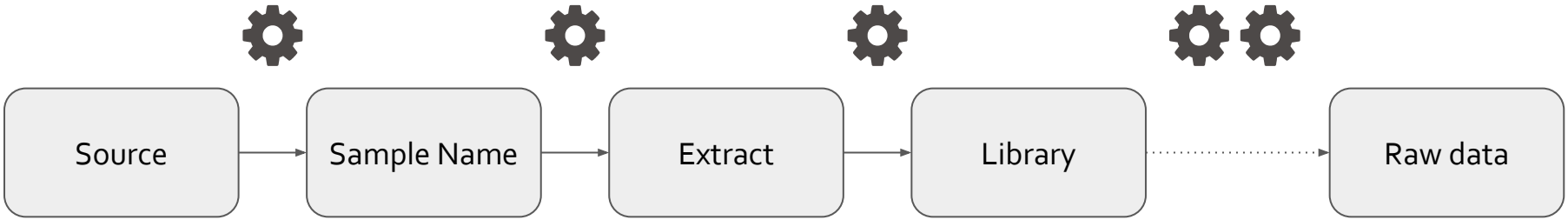
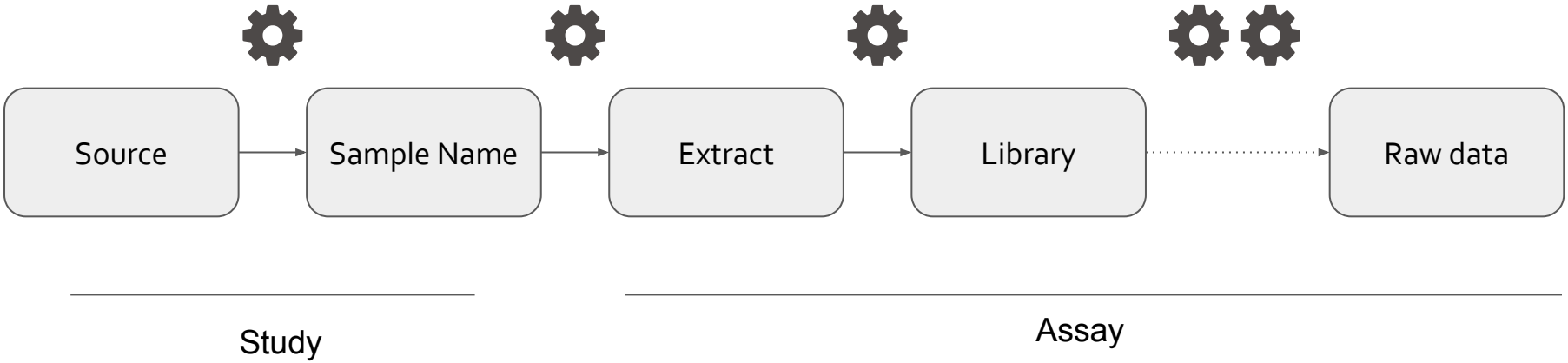
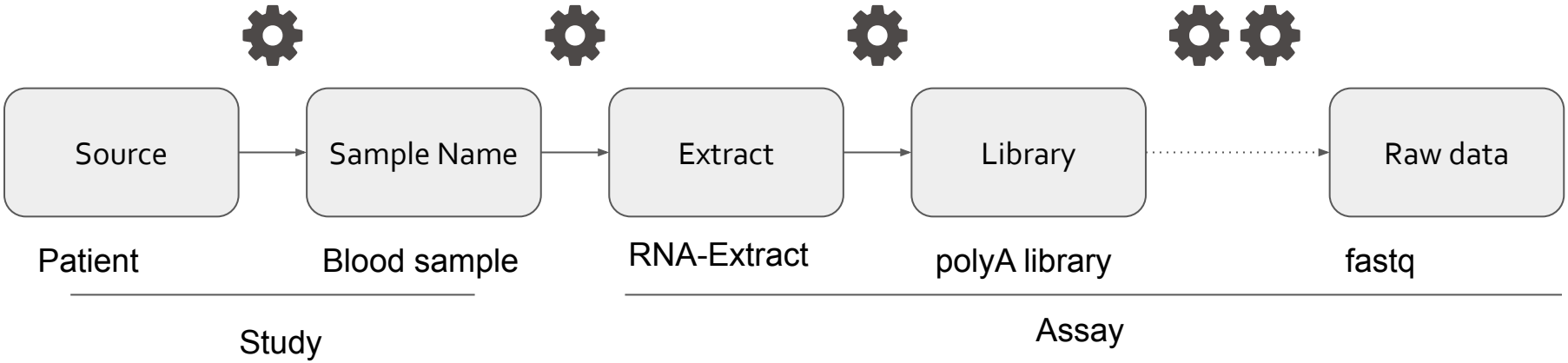


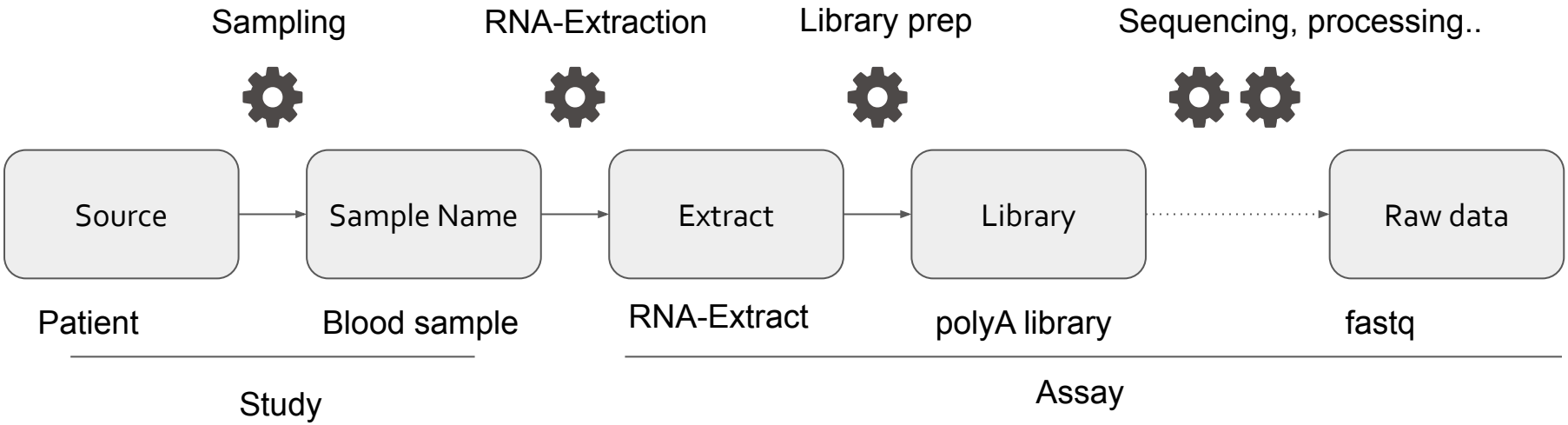
https://doi.org/10.1101/2020.11.13.382119



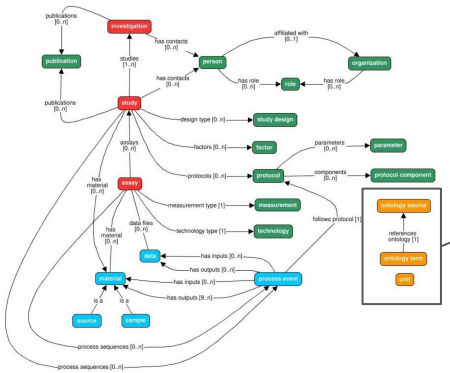
Modified from Rafael Buono

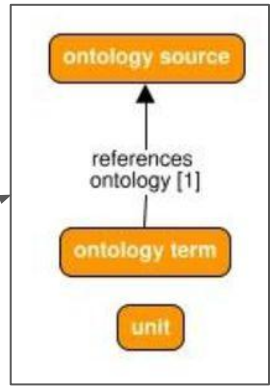

Source
Sample Name
Extract
Library
Raw data
Study
Assay


Source
Sample Name
Extract
Library
Raw data
Patient
Blood sample
RNA-Extract
polyA library
fastq
Study
Assay


Sampling
RNA-Extraction
Library prep
Sequencing, processing..
Source
Sample Name
Extract
Library
Raw data
Patient
Blood sample
RNA-Extract
polyA library
fastq
Study
Assay

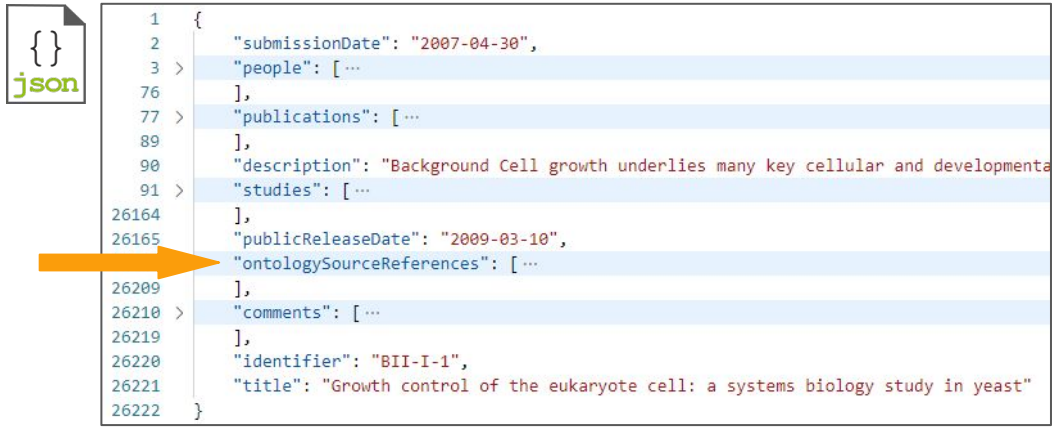
Ontologies





"ISA Data Model objects can be qualified with ontology terms (Ontology Annotations) that are linked to a declared description of the source of the terms (Ontology Sources)"

https://doi.org/10.1101/2020.11.13.382119



Based on: https://github.com/ISA-tools/ISAdatasets/tree/master/json/BII-I-1

Modified from Rafael Buono

Ontologies

"ISA Data Model objects can be qualified with ontology terms (Ontology Annotations) that are linked to a declared description of the source of the terms (Ontology Sources)"

https://doi.org/10.1101/2020.11.13.382119

Items qualifiable with Ontology in ISA-JSON:

1. People's roles
2. Status of Publication
3. Study Design Descriptors
4. Units
5. Measurement Type
6. Technology Type
7. Factor (Attribute title)
8. Factor Value (Input value)
9. Characteristic (Attribute title)
10. Characteristics value (Input value)
11. Parameter Value (Attribute title)
12. Parameter Value value (Input value)
13. Protocol Type
14. Component Type (of Protocol)

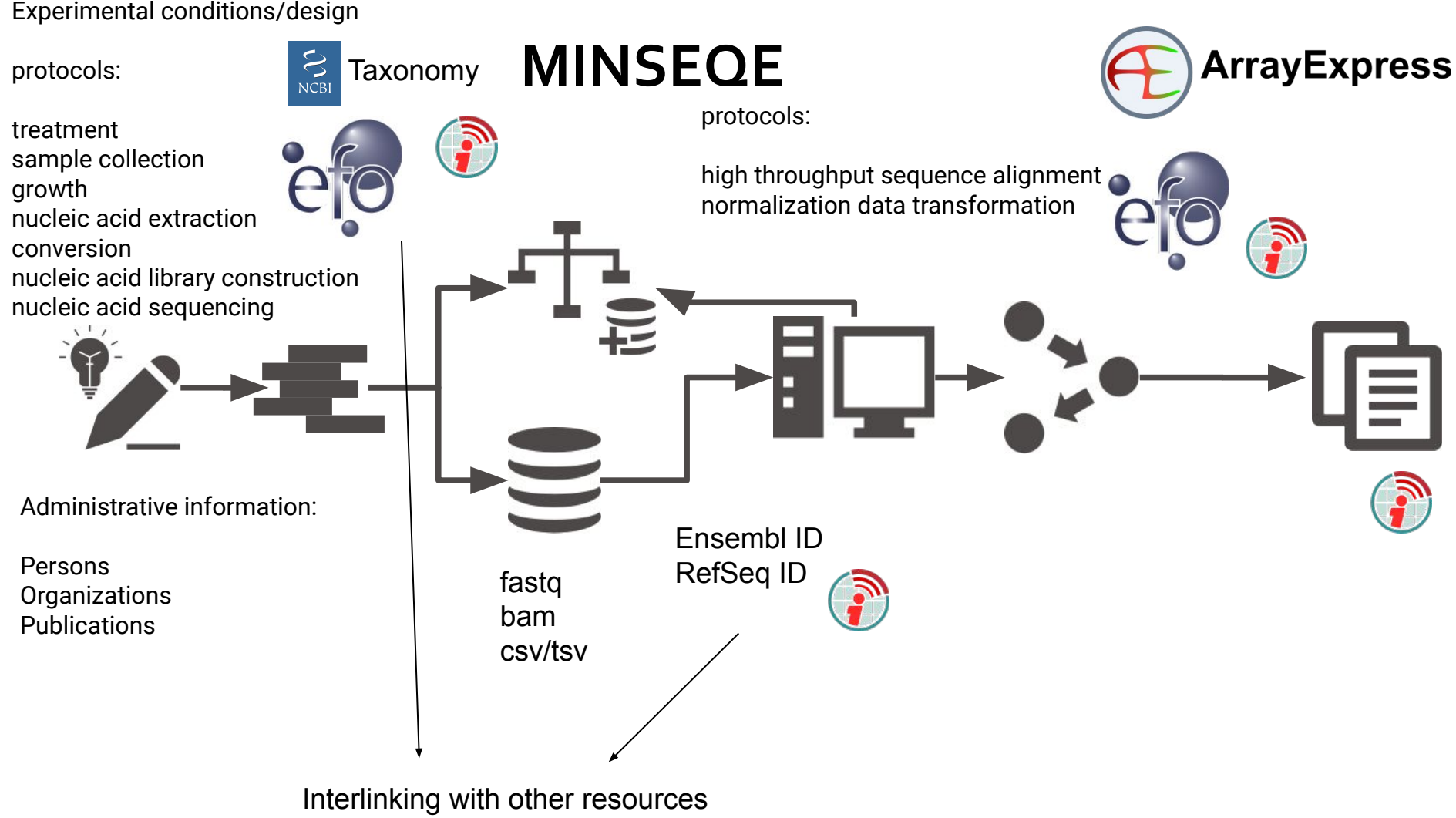
Ontology Sources

```
"ontologySourceReferences": [
  {
   "file": "https://bioportal.bioontology.org/ontologies/UO",
   "description": "Units of Measurement Ontology",
   "name": "UO",
   "version": "2020-03-10"
  },
```

Ontology Annotations (example for a Unit)

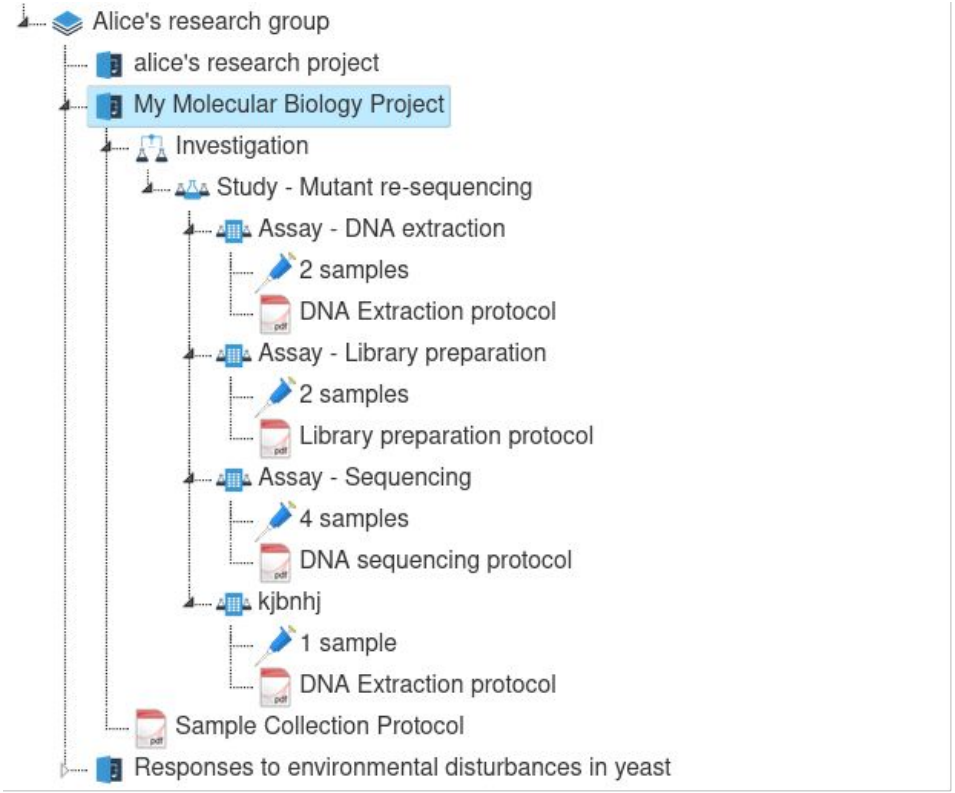
```
{
"@id": "#Unit/hour",
"termAccession": "http://purl.obolibrary.org/obo/UO_0000032",
"annotationValue": "hour",
"termSource": "UO"
}
```

Modified from Rafael Buono


Experimental conditions/design
protocols:
NCBI
Taxonomy
MINSEQE
ArrayExpress
protocols:
treatment
sample collection
growth
nucleic acid extraction
conversion
nucleic acid library construction
nucleic acid sequencing
efo
high throughput sequence alignment
normalization data transformation
efo
Administrative information:
Persons
Organizations
Publications
fastq
bam
csv/tsv
Ensembl ID
RefSeq ID
Interlinking with other resources

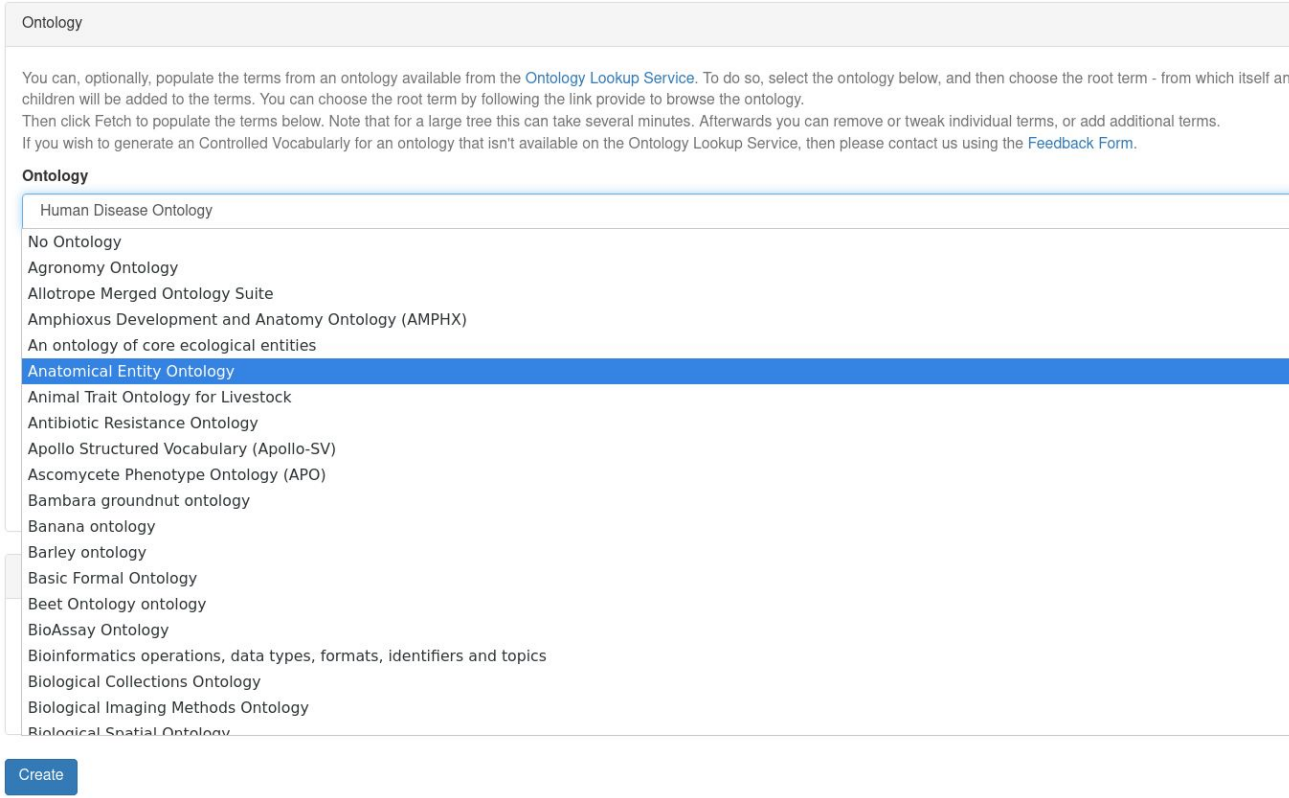
SEEK

FAIRDOM SEEK



SEEK

FAIRDOM SEEK



Our ambition:

Follow up from
Staff exchange
DE UK **BE NO**