

# ROH Ontology Classes, Object Properties and DataType Properties

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## 1. Abstract

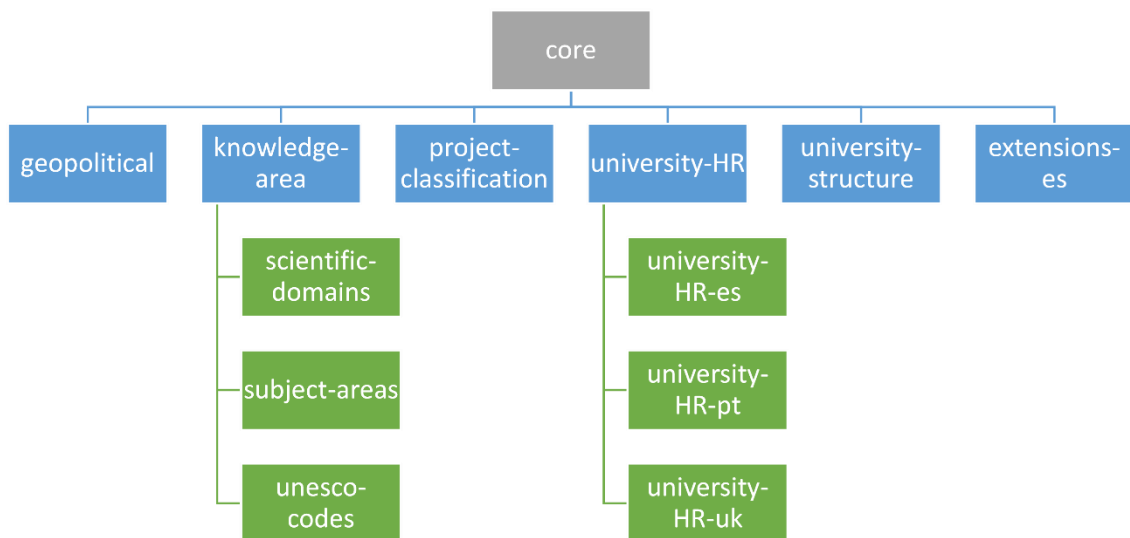
The aim of this document is to provide a bird's eye view on the entities modelled within ROH. The document includes an overview in tabular form for each of the core entities of the network of ontologies ROH, giving details on the object and data properties supported by each of them. This document is meant to be useful when instances of ROH want to be created, since it clearly explains what entity types a given entity type relates with through an object property and what data properties are supported by a given entity type, including details about its associated object types.

This document should be read as a complement to the [ROH Tutorial document](#) which describes more verbosely the purpose of the core entities of ROH and their relationships with other entities in the ontology.

## 2. Ontologies used

The following table lists all ontologies created, which combine entities defined specifically in our core ontology under prefix `roh` with those reused from other well-known and extensively adopted ontologies. Notice that ROH network of ontologies is divided into 2 main parts as depicted in the following figure:

- The generic ontology, **core module**, contains the most important entities and properties to model information in the academic domain. It contains the central part of the network of ontologies. It covers the academic domain, being agnostic to the country or the research organization whose information wants to be modelled with.
- A set of **vertical modules** which include, on one hand, specializations of some academic concepts for a given country domain. For instance, the figure Associate Professor in the Spanish academic domain would be encountered in the vertical module `university-HR-es` and is assigned the URI `http://purl.org/roh/university-hr/es#ProfesorTitularDeUniversidad`. On the other hand, these vertical modules, include controlled vocabularies, according to SKOS ontology, for different important areas in the academic domain, namely, geographical locations (geopolitical) , knowledge areas (including concepts for `scientific-domains`, `subject-areas` or `unesco-codes`), classification of project types (`project-classification`), resource positions in universities (`university-HR` for Spain, UK or Portugal), controlled vocabulary with all universities in Spain (`university-structure`) or some extensions for the Spanish university system (`extensions-es`).



The following table illustrates the name spaces of the ontologies used within ROH:

| Prefix  | Ontology name   | Ontology namespace  | Ontology website  |
|---------|---|---|---|
| bibo    | Bibliographic Ontology                                      | <a href="http://purl.org/roh/mirror/bibo#">http://purl.org/roh/mirror/bibo#</a>                       | <a href="http://bibilontology.com/">http://bibilontology.com/</a>   |
| cito    | CITO, the Citation Typing Ontology                          | <a href="http://purl.org/spar/cito#">http://purl.org/spar/cito#</a>                                   | <a href="https://sparontologies.github.io/cito/current/cito.html">https://sparontologies.github.io/cito/current/cito.html</a>   |
| foaf    | FOAF: Friend of a Friend Ontology                           | <a href="http://purl.org/roh/mirror/foaf#">http://purl.org/roh/mirror/foaf#</a>                       | <a href="http://xmlns.com/foaf/spec/">http://xmlns.com/foaf/spec/</a>   |
| gn      | GeoNames Ontology   | <a href="http://purl.org/roh/mirror/geonames#">http://purl.org/roh/mirror/geonames#</a>               | <a href="http://www.geonames.org/ontology/documentation.html">http://www.geonames.org/ontology/documentation.html</a>   |
| obo-bfo | OBO Foundry, Basic Formal Ontology                          | <a href="http://purl.org/roh/mirror/obo/bfo#">http://purl.org/roh/mirror/obo/bfo#</a>                 | <a href="http://www.obofoundry.org/ontology/bfo.html">http://www.obofoundry.org/ontology/bfo.html</a>   |
| obo-ero | OBO Foundry, eagle-i Research Resource Ontology (ERO)       | <a href="http://purl.org/roh/mirror/obo/ero#">http://purl.org/roh/mirror/obo/ero#</a>                 | <a href="https://open.library.ubc.ca/erodoc/ontology/ontology">https://open.library.ubc.ca/erodoc/ontology/ontology</a>   |
| obo-iao | OBO Foundry, Information Artifact Ontology                  | <a href="http://purl.org/roh/mirror/obo/iao#">http://purl.org/roh/mirror/obo/iao#</a>                 | <a href="https://github.com/Information-Artifact-Ontology/iao">https://github.com/Information-Artifact-Ontology/iao</a>   |
| obo-ro  | OBO Foundry, Relations Ontology                             | <a href="http://purl.org/roh/mirror/obo/ro#">http://purl.org/roh/mirror/obo/ro#</a>                   | <a href="http://www.obofoundry.org/ontology/ro.html">http://www.obofoundry.org/ontology/ro.html</a>   |
| owl     | OWL Web Ontology Language                                   | <a href="http://www.w3.org/2002/07/owl#">http://www.w3.org/2002/07/owl#</a>                           | <a href="https://www.w3.org/TR/owl-features/">https://www.w3.org/TR/owl-features/</a>   |
| rdf     | The RDF Concepts Vocabulary (RDF)                           | <a href="http://www.w3.org/1999/02/22-rdf-syntax-ns#">http://www.w3.org/1999/02/22-rdf-syntax-ns#</a> | <a href="https://www.w3.org/TR/rdf-concepts/">https://www.w3.org/TR/rdf-concepts/</a>   |
| rdfs    | RDF Schema 1.1  | <a href="http://www.w3.org/2000/01/rdf-schema#">http://www.w3.org/2000/01/rdf-schema#</a>             | <a href="https://www.w3.org/TR/rdf-schema/">https://www.w3.org/TR/rdf-schema/</a>   |
| roh     | Red de Ontologías Hércules / Hercules Network of Ontologies | <a href="http://purl.org/roh#">http://purl.org/roh#</a>   | <a href="https://github.com/HerculesCRUE/ROH/tree/main/sigmaaie/modules/core/doc">https://github.com/HerculesCRUE/ROH/tree/main/sigmaaie/modules/core/doc</a>                   |
| roh-es  | Extensions of ROH for Spanish academic system               | <a href="http://purl.org/roh/es#">http://purl.org/roh/es#</a>   | <a href="https://github.com/HerculesCRUE/ROH/tree/main/sigmaaie/modules/extensions-es/doc">https://github.com/HerculesCRUE/ROH/tree/main/sigmaaie/modules/extensions-es/doc</a> |
| skos    | SKOS Simple Knowledge Organization System                   | <a href="http://www.w3.org/2004/02/skos/core#">http://www.w3.org/2004/02/skos/core#</a>               | <a href="https://www.w3.org/TR/2008/WD-skos-reference-20080829/skos.html">https://www.w3.org/TR/2008/WD-skos-reference-20080829/skos.html</a>                                   |
| terms   | DCMI Metadata Terms   | <a href="http://purl.org/dc/terms">http://purl.org/dc/terms</a>                                       | <a href="https://www.dublincore.org/specifications/dublin-core/dcmi-terms/">https://www.dublincore.org/specifications/dublin-core/dcmi-terms/</a>                               |
| vcad    | vCard Ontology - for describing People and Organizations    | <a href="http://purl.org/roh/mirror/vcard#">http://purl.org/roh/mirror/vcard#</a>                     | <a href="https://www.w3.org/TR/vcard-rdf/">https://www.w3.org/TR/vcard-rdf/</a>   |
| vivo    | VIVO core ontology  | <a href="http://purl.org/roh/mirror/vivo#">http://purl.org/roh/mirror/vivo#</a>                       | <a href="https://wiki.lyrasis.org/display/VIVO/The+core+ontology+and+its+annotations">https://wiki.lyrasis.org/display/VIVO/The+core+ontology+and+its+annotations</a>           |
| oa      | The Web Annotation Data Model                               |   | <a href="https://www.w3.org/ns/oa">https://www.w3.org/ns/oa</a>   |

### 3. Concepts modelled.

#### 3.1. vivo:AcademicDegree

| Prefix | Class           | Prefix | Object property (bold indicates explicit Domain, otherwise a Restriction) | Range Class | Prefix | Datatype Property (bold indicates explicit domain; otherwise a restriction) | Range Datatype (if typed) | Range values |
|--------|-----------------|--------|---|-------------|--------|---|---------------------------|--------------|
| vivo   | AcademicDegree  |        |   |             | vivo   | abbreviation  | rdfs:Literal              |              |
|        |                 |        |   |             | roh    | title   | xsd:string                |              |
| roh    | BachelorsDegree |        |   |             |        |   |                           |              |

|  |     |                |  |  |  |  |  |  |
|--|-----|----------------|--|--|--|--|--|--|
|  | roh | DoctoralDegree |  |  |  |  |  |  |
|  | roh | MastersDegree  |  |  |  |  |  |  |

### 3.2. roh:Accreditation

| Prefix | Class         |                       | Prefix              | Object property (bold indicates explicit Domain, otherwise a Restriction) | Range Class             | Prefix                | Datatype Property (bold indicates explicit domain; otherwise a restriction) | Range Datatype (if typed) | Range values                         |
|--------|---------------|-----------------------|---------------------|---|-------------------------|-----------------------|---|---------------------------|--------------------------------------|
| roh    | Accreditation |                       | vivo                | hasGoverningActivity  | foaf:Organization       | roh                   | title   | xsd:string                |                                      |
|        |               |                       | vivo                | hasSubjectArea  | skos:Concept            | vivo                  | description   | xsd:string                |                                      |
|        |               |                       | roh                 | accreditationOf   | foaf:Agent              |                       |   |                           |                                      |
|        |               |                       | roh                 | issuedBy  | roh:AccreditationIssuer |                       |   |                           |                                      |
|        |               |                       | vivo                | dateIssued  | vivo:DateTimeValue      |                       |   |                           |                                      |
|        | roh           | AcademicAccreditation |                     |   |                         | roh                   | title   | xsd:string                |                                      |
|        | vivo          | Certificate           |                     |   |                         | roh                   | title   | xsd:string                |                                      |
|        |               | roh                   | Award               |   |                         |                       |   |                           |                                      |
|        |               | roh                   | CourseCertificate   |   |                         |                       |   |                           |                                      |
|        |               | roh                   | LanguageCertificate |   |                         | roh                   | language  | xsd:string                |                                      |
|        |               |                       |                     |   |                         | roh                   | listeningSkill  | xsd:string                | ["A1", "A2", "B1", "B2", "C1", "C2"] |
|        |               |                       |                     |   |                         | roh                   | readingSkill  | xsd:string                | ["A1", "A2", "B1", "B2", "C1", "C2"] |
|        |               |                       |                     |   |                         | roh                   | speakingSkill   | xsd:string                | ["A1", "A2", "B1", "B2", "C1", "C2"] |
|        |               |                       |                     |   |                         | roh                   | spokenInteractionSkill  | xsd:string                | ["A1", "A2", "B1", "B2", "C1", "C2"] |
|        |               |                       |                     |   |                         | roh                   | writingSkill  | xsd:string                | ["A1", "A2", "B1", "B2", "C1", "C2"] |
|        | roh           | DegreeHomologation    | vivo                | relates   | vivo:AwardedDegree      |                       |   |                           |                                      |
|        | vivo          | License               |                     |   |                         |                       |   |                           |                                      |
|        | roh           | ResearchAccreditation |                     |   |                         |                       |   |                           |                                      |
|        |               | roh-es                | Sexennial           | vivo  | dateTimeInterval        | vivo:DateTimeInterval |   |                           |                                      |
|        | roh           | SealOfQuality         |                     |   |                         |                       |   |                           |                                      |

### 3.3. roh:Activity

| Prefix | Class    |             | Prefix | Object property (bold indicates explicit Domain, otherwise a Restriction) | Range Class                           | Prefix | Datatype Property (bold indicates explicit domain; otherwise a restriction) | Range Datatype (if typed) | Range values |
|--------|----------|-------------|--------|---|---------------------------------------|--------|---|---------------------------|--------------|
| roh    | Activity |             | roh    | hasContactInfo  | vcard:Kind                            | vivo   | identifier  | xsd:string                |              |
|        |          |             | vivo   | hasKnowledgeArea  | skos:Concept                          | vivo   | description   | xsd:string                |              |
|        |          |             | roh    | participatedBy  | foaf:Agent or vivo:Project            | vivo   | freeTextKeyword   | xsd:string                |              |
|        |          |             | bibo   | presents  | bibo:Document                         | roh    | title   | xsd:string                |              |
|        |          |             | vivo   | relates   | roh:Expense or obo-bfo:0000023 (Role) |        |   |                           |              |
|        |          |             | vivo   | dateTimeInterval  | vivo:DateTimeInterval                 |        |   |                           |              |
|        |          |             | gn     | locatedIn   | gn:Feature                            |        |   |                           |              |
|        | vivo     | Competition |        |   |                                       |        |   |                           |              |
|        | bibo     | Conference  |        |   |                                       | vivo   | abbreviation  | rdfs:Literal              |              |
|        | vivo     | Course      | obo-ro | partOf  | vivo:AcademicDegree                   | vivo   | courseCredits   | xsd:int                   |              |

|  |      |              |  |  |  |      |             |            |  |
|--|------|--------------|--|--|--|------|-------------|------------|--|
|  |      |              |  |  |  | vivo | courseHours | xsd:string |  |
|  | vivo | Exhibit      |  |  |  |      |             |            |  |
|  | bibo | Hearing      |  |  |  |      |             |            |  |
|  | vivo | Internship   |  |  |  |      |             |            |  |
|  | vivo | Interview    |  |  |  |      |             |            |  |
|  | vivo | Meeting      |  |  |  |      |             |            |  |
|  | bibo | Performance  |  |  |  |      |             |            |  |
|  | vivo | Presentation |  |  |  |      |             |            |  |
|  | vivo | InvitedTalk  |  |  |  |      |             |            |  |
|  | roh  | PanelTalk    |  |  |  |      |             |            |  |
|  | roh  | ThesisViva   |  |  |  |      |             |            |  |
|  | bibo | Workshop     |  |  |  |      |             |            |  |

### 3.4. foaf:Agent

| Prefix | Class                                | Prefix | Object property (bold indicates explicit Domain, otherwise a Restriction) | Range Class   | Prefix | Datatype Property (bold indicates explicit domain; otherwise a restriction) | Range Datatype (if typed) | Range values |
|--------|--------------------------------------|--------|---|---|--------|---|---------------------------|--------------|
| foaf   | Agent                                | roh    | hasContactInfo  | vcad:Kind   | vivo   | freeTextKeyword   | xsd:string                |              |
|        |                                      | roh    | <b>hasAccreditation</b>   | roh:Accreditation   |        |   |                           |              |
|        |                                      | roh    | <b>hasRole</b>  | obo-bfo:BFO_0000023 (Role)                                |        |   |                           |              |
|        |                                      | foaf   | mBox  | owl:Thing   |        |   |                           |              |
|        |                                      | vivo   | relatedBy   | vivo:Relationship   |        |   |                           |              |
|        |                                      | roh    | <b>hasReservable</b>  | roh:Reservable  |        |   |                           |              |
|        | foaf Group                           |        |   |   |        |   |                           |              |
|        | foaf Organization                    | roh    | hasKnowledgeArea  | (skos:Concept and (skos:inScheme some roh:KnowledgeArea)) | vivo   | identifier  | xsd:string                |              |
|        |                                      | vivo   | <b>affiliatedOrganization</b>   | foaf:Organization   | vivo   | abbreviation  | rdfs:Literal              |              |
|        |                                      | roh    | correspondingOrganizationOf   | roh:ResearchObject  |        |   |                           |              |
|        |                                      | roh    | <b>foundationDate</b>   | vivo:DateTimeValue  | vivo   | description   | xsd:string                |              |
|        |                                      | vivo   | <b>hasSuccessorOrganization</b>   | foaf:Organization   | roh    | title   | xsd:string                |              |
|        |                                      | vivo   | <b>hasPredecessorOrganization</b>   | foaf:Organization   |        |   |                           |              |
|        |                                      | obo-ro | BFO_0000051 (hasPart)   | foaf:Organization   |        |   |                           |              |
|        |                                      | roh    | hasReservable   | roh:Reservable  |        |   |                           |              |
|        |                                      | roh    | hasSpinOff  | vivo:Company  |        |   |                           |              |
|        |                                      | foaf   | homePage  | bibo:Document   |        |   |                           |              |
|        |                                      | roh    | <b>ownerOrganizationOf</b>  | roh:PatentApplication or bibo:Patent                      |        |   |                           |              |
|        |                                      | roh    | participates  | roh:Activity  |        |   |                           |              |
|        |                                      | roh    | produces  | roh:ResearchObject  |        |   |                           |              |
|        |                                      | roh    | <b>provides</b>   | obo-ero:ERO_0000005 (Service)                             |        |   |                           |              |
|        |                                      | roh    | grantedBy   | roh:FundingAmount   |        |   |                           |              |
|        |                                      | vivo   | <b>dateTimeInterval</b>   | vivo:DateTimeInterval                                     |        |   |                           |              |
|        |                                      | gn     | locatedIn   | gn:Feature  |        |   |                           |              |
|        | roh AccreditationIssuer <sup>1</sup> | roh    | <b>issues</b>   | roh:Accreditation   |        |   |                           |              |
|        | vivo Center                          |        |   |   |        |   |                           |              |

<sup>1</sup> Defined class attending the following restriction Organization and (issues some Accreditation) and (issues only Accreditation)

|  |      |        |                      |      |                          |   |      |                 |             |                      |
|--|------|--------|----------------------|------|--------------------------|---|------|-----------------|-------------|----------------------|
|  |      | vivo   | Company              | roh  | hasCompanyClassification | (skos:Concept and (skos:inScheme some roh:KnowledgeArea)) | roh  | isStartup       | xsd:boolean |                      |
|  |      |        |                      | roh  | isSpinoffOf              | foaf:Organization   | roh  | publicCompany   | xsd:boolean |                      |
|  |      |        | roh LargeEnterprise  |      |                          |   |      |                 |             |                      |
|  |      |        | roh MediumEnterprise |      |                          |   |      |                 |             |                      |
|  |      |        | roh MicroEnterprise  |      |                          |   |      |                 |             |                      |
|  |      |        | roh SmallEnterprise  |      |                          |   |      |                 |             |                      |
|  |      | vivo   | Consortium           |      |                          |   |      |                 |             |                      |
|  |      | vivo   | Department           |      |                          |   |      |                 |             |                      |
|  |      | roh    | EthicsCommittee      | roh  | produces                 | roh:EthicalReport   |      |                 |             |                      |
|  |      | vivo   | Foundation           |      |                          |   |      |                 |             |                      |
|  |      | roh    | FundingOrganization  | roh  | promotes                 | roh:FundingProgram or roh:FundingSource                   |      |                 |             |                      |
|  |      | vivo   | GovernmentAgency     |      |                          |   |      |                 |             |                      |
|  |      | vivo   | Institute            |      |                          |   |      |                 |             |                      |
|  |      | roh    | ManagementInstitute  |      |                          |   |      |                 |             |                      |
|  |      | roh    | ResearchGroup        |      |                          |   | roh  | excellenceLabel | xsd:boolean |                      |
|  |      | vivo   | University           | roh  | awards                   | vivo:AwardedDegree  |      |                 |             |                      |
|  |      | roh    | Company              | roh  | hasCompanyCategorization | roh:CompanyClassification                                 | roh  | isStartup       | xsd:boolean |                      |
|  |      |        |                      |      |                          |   | roh  | publicCompany   | xsd:boolean |                      |
|  | foaf | Person |                      | roh  | hasKnowledgeArea         | (skos:Concept and (skos:inScheme some roh:KnowledgeArea)) | vivo | identifier      | xsd:string  |                      |
|  |      |        |                      | vivo | relates                  | vivo:AwardedDegree  | vivo | researcherId    |             |                      |
|  |      |        |                      | roh  | spends                   | roh:PersonExpense   | roh  | birthdate       | xsd:string  |                      |
|  |      |        |                      | roh  | hasContract              | roh:PersonContract  | vivo | eRACommonsId    |             |                      |
|  |      |        |                      | roh  | hasCV                    | roh:CurriculumVitae                                       | vivo | description     | xsd:string  |                      |
|  |      |        |                      | roh  | hasPosition              | vivo:Position   | roh  | firstName       | xsd:string  |                      |
|  |      |        |                      | roh  | participates             | roh:Activity  | roh  | gender          | xsd:string  |                      |
|  |      |        |                      | roh  | hasMetric                | roh:AuthorMetric  | roh  | researchLine    | xsd:string  |                      |
|  |      |        |                      | foaf | homePage                 | foaf:Document   | foaf | surname         | xsd:string  |                      |
|  |      |        |                      | foaf | image                    | foaf:Image  | foaf | name            | xsd:string  |                      |
|  |      |        |                      | roh  | correspondingAuthorOf    |   | foaf | nickname        | xsd:string  |                      |
|  |      |        |                      | roh  | supervisorOf             | bibo:Thesis   | roh  | taxID           | xsd:string  |                      |
|  |      |        |                      | roh  | teaches                  | roh:AcademicSubject                                       | roh  | title           | xsd:string  |                      |
|  |      |        |                      | roh  | reviews                  | bibo:Document   | roh  | ORCID           | xsd:string  |                      |
|  |      |        |                      |      |                          |   | vivo | scopusId        |             |                      |
|  |      |        |                      |      |                          |   | roh  | dedication      | xsd:string  | ["PARTIAL", "TOTAL"] |

### 3.5. skos:Concept & skos:ConceptScheme

| Prefix | Class                      | Prefix | Object property (bold indicates explicit Domain, otherwise a Restriction) | Range Class  | Prefix | Datatype Property (bold indicates explicit domain; otherwise a restriction) | Range Datatype (if typed) | Range values |
|--------|----------------------------|--------|---|--------------|--------|---|---------------------------|--------------|
| skos   | Concept                    | roh    | <b>codeOf</b>   | skos:Concept |        |   |                           |              |
|        |                            | roh    | <b>hasCode</b>  | skos:Concept |        |   |                           |              |
|        |                            | roh    | <b>hasKnowledgeArea</b>   |              |        |   |                           |              |
| skos   | ConceptScheme              |        |   |              |        |   |                           |              |
|        | roh AcademicSubject        |        |   |              |        |   |                           |              |
|        | roh BachelorsDegreeSubject |        |   |              |        |   |                           |              |
|        | roh MastersDegreeSubject   |        |   |              |        |   |                           |              |

|     |                              |  |  |  |  |  |  |  |
|-----|------------------------------|--|--|--|--|--|--|--|
| roh | AdministrativeEntity         |  |  |  |  |  |  |  |
| roh | CompanyClassification        |  |  |  |  |  |  |  |
| roh | Country                      |  |  |  |  |  |  |  |
| roh | ExpenseClassification        |  |  |  |  |  |  |  |
| roh | FundingProgramClassification |  |  |  |  |  |  |  |
| roh | HRClassification             |  |  |  |  |  |  |  |
| roh | KnowledgeArea                |  |  |  |  |  |  |  |
| roh | ProjectClassification        |  |  |  |  |  |  |  |
| roh | PropertyClassification       |  |  |  |  |  |  |  |
| roh | ResearchProblem              |  |  |  |  |  |  |  |

### 3.6. roh:CurriculumVitae

| Prefix | Class           | Prefix | Object property (bold indicates explicit Domain, otherwise a Restriction) | Range Class | Prefix | Datatype Property (bold indicates explicit domain; otherwise a restriction) | Range Datatype (if typed) | Range values |
|--------|-----------------|--------|---|-------------|--------|---|---------------------------|--------------|
| roh    | CurriculumVitae | roh    | <b>CVOF</b>   | foaf:Person | roh    | <b>cites</b>  | xsd:string                |              |
|        |                 |        |   |             | roh    | <b>factorH</b>  | xsd:string                |              |
|        |                 |        |   |             | roh    | <b>summary</b>  | xsd:string                |              |

### 3.7. roh:Expense

| Prefix | Class   | Prefix | Object property (bold indicates explicit Domain, otherwise a Restriction) | Range Class   | Prefix | Datatype Property (bold indicates explicit domain; otherwise a restriction) | Range Datatype (if typed) | Range values |
|--------|---------|--------|---|---|--------|---|---------------------------|--------------|
| roh    | Expense | vivo   | <b>dateTimeValue</b>  | vivo:DateTimeValue  | roh    | <b>currency</b>   | xsd:string                |              |
|        |         | roh    | <b>hasExpenseClassification</b>   | (skos:Concept and (skos:inScheme some roh:ExpenseClassification)) | vivo   | <b>description</b>  | xsd:string                |              |
|        |         | roh    | <b>spentBy</b>  |   | roh    | <b>expenseModality</b>  | xsd:string                |              |
|        |         |        |   |   | roh    | <b>monetaryAmount</b>   | xsd:float                 |              |
|        |         |        |   |   | roh    | <b>title</b>  | xsd:string                |              |
|        | roh     |        | PatentExpense   |   |        |   |                           |              |
|        | roh     |        | PersonExpense   |   |        |   |                           |              |
|        | roh     |        | ProjectExpense  |   |        |   |                           |              |
|        | roh     |        | ResearchObjectExpense   |   |        |   |                           |              |

### 3.8. gn:Feature

| Prefix | Class   | Prefix | Object property (bold indicates explicit Domain, otherwise a Restriction) | Range Class    | Prefix | Datatype Property (bold indicates explicit domain; otherwise a restriction) | Range Datatype (if typed) | Range values |
|--------|---------|--------|---|----------------|--------|---|---------------------------|--------------|
| gn     | Feature | gn     | <b>featureClass</b>   |                | gn     | <b>geonamesID</b>   | rdfs:Literal              |              |
|        |         | gn     | <b>featureCode</b>  | gn:Code        | gn     | <b>countryCode</b>  | rdfs:Literal              |              |
|        |         | gn     | <b>parentAMD1</b>   | gn:featureCode | gn     | <b>name</b>   | xsd:string                |              |
|        |         | gn     | <b>parentAMD2</b>   | gn:featureCode | gn     | <b>population</b>   | xsd:integer               |              |
|        |         | gn     | <b>parentAMD3</b>   | gn:featureCode |        |   |                           |              |
|        |         | gn     | <b>parentAMD4</b>   | gn:featureCode |        |   |                           |              |

### 3.9. roh:Funding, roh:FundingAmount, roh:FundingProgram & roh:FundingSource

| Prefix | Class          |                   | Prefix | Object property (bold indicates explicit Domain, otherwise a Restriction) | Range Class  | Prefix | Datatype Property (bold indicates explicit domain; otherwise a restriction) | Range Datatype (if typed) | Range values |
|--------|----------------|-------------------|--------|---|--|--------|---|---------------------------|--------------|
| roh    | Funding        |                   | obo-ro | <b>BFO_0000051 (has part)</b>   | roh:FundingAmount  | vivo   | identifier  | xsd:string                |              |
|        |                |                   | vivo   | dateTimeInterval  | vivo:DateTimeInterval  | vivo   | description   |                           |              |
|        |                |                   | roh    | <b>fundedBy</b>   | roh:FundingProgram   | vivo   | freeTextKeyword   |                           |              |
|        |                |                   | roh    | hasContract   | vivo:Contract  | roh    | <b>publicFunding</b>  | xsd:boolean               |              |
|        |                |                   | roh    | hasKnowledgeArea  | (skos:Concept and (skos:inScheme some roh:KnowledgeArea))                |        |   |                           |              |
|        |                |                   | roh    | <b>supports</b>   | roh:PersonContract or roh:Project  |        |   |                           |              |
|        | roh            | Grant             |        |   |  |        |   |                           |              |
|        | roh            | Loan              |        |   |  |        |   |                           |              |
|        | roh            | Outsourcing       |        |   |  |        |   |                           |              |
|        | roh            | RefundableAdvance |        |   |  |        |   |                           |              |
| roh    | FundingAmount  |                   | obo-ro | <b>BFO_0000050 (part of)</b>  | roh:Funding  | roh    | currency  | xsd:string                |              |
|        |                |                   | vivo   | dateTimeInterval  | vivo:DateTimeInterval  | roh    | monetaryAmount  | xsd:float                 |              |
|        |                |                   | roh    | <b>grants</b>   | foaf:Organization  |        |   |                           |              |
| roh    | FundingProgram |                   | obo-ro | <b>BFO_0000051 (has part)</b>   | roh:FundingProgram   | vivo   | description   | xsd:string                |              |
|        |                |                   | vivo   | dateTimeInterval  | vivo:DateTimeInterval  | vivo   | identifier  | xsd:string                |              |
|        |                |                   | roh    | hasFundingProgramClassification   | (skos:Concept and (skos:inScheme some roh:FundingProgramClassification)) | roh    | <b>title</b>  | xsd:string                |              |
|        |                |                   | gn     | locatedIn   | gn:Feature   |        |   |                           |              |
|        |                |                   | roh    | <b>promotedBy</b>   | vivo:FundingOrganization   |        |   |                           |              |
|        |                |                   | roh    | <b>funds</b>  | roh:Funding  |        |   |                           |              |
|        |                |                   | vivo   | <b>relatedBy</b>  | roh:Dossier  |        |   |                           |              |
| roh    | FundingSource  |                   | roh    | <b>funds</b>  | roh:FundingProgram   |        |   |                           |              |
|        |                |                   | roh    | <b>promotedBy</b>   | vivo:FundingOrganization   |        |   |                           |              |

### 3.10. vcard:Kind

| Prefix | Class |              | Prefix | Object property (bold indicates explicit Domain, otherwise a Restriction) | Range Class | Prefix | Datatype Property (bold indicates explicit domain; otherwise a restriction) | Range Datatype (if typed) | Range values |
|--------|-------|--------------|--------|---|-------------|--------|---|---------------------------|--------------|
| vcad   | Kind  |              | roh    | <b>contactInfoOf</b>  | foaf:Agent  |        |   |                           |              |
|        | vcad  | Group        |        |   |             |        |   |                           |              |
|        | vcad  | Individual   |        |   |             |        |   |                           |              |
|        | vcad  | Location     |        |   |             |        |   |                           |              |
|        | vcad  | Organization |        |   |             |        |   |                           |              |

### 3.11. roh:Invention

| Prefix | Class     |  | Prefix | Object property (bold indicates explicit Domain, otherwise a Restriction) | Range Class   | Prefix | Datatype Property (bold indicates explicit domain; otherwise a restriction) | Range Datatype (if typed) | Range values |
|--------|-----------|--|--------|---|---|--------|---|---------------------------|--------------|
| roh    | Invention |  | roh    | <b>fundedBy</b>   | roh:FundingProgram  | vivo   | abbreviation  | rdfs:Literal              |              |
|        |           |  | roh    | hasKnowledgeArea  | (skos:Concept and (skos:inScheme some roh:KnowledgeArea)) | vivo   | description   | xsd:string                |              |
|        |           |  | obo-ro | <b>BFO_0000051 (hasPart)</b>  | roh:PatentApplication                                     | vivo   | freeTextKeyword   | xsd:string                |              |



|  |     |                   |                           |  |   |            |              |  |
|--|-----|-------------------|---------------------------|--|---|------------|--------------|--|
|  |     | roh               | <b>hasPatent</b>          | bibo:Patent  | vivo  | identifier | rdfs:Literal |  |
|  |     | roh               | hasPropertyClassification | (skos:Concept and (skos:inScheme some roh:PropertyClassification)) | roh   | title      | xsd:string   |  |
|  |     | roh               | isSupportedBy             | roh:Funding  |   |            |              |  |
|  |     | geonames          | locatedIn                 | geonames:Feature   |   |            |              |  |
|  |     | roh               | patentStatus              | roh:Submitted or roh:Accepted or roh:Rejected                      |   |            |              |  |
|  |     | roh               | produces                  | roh:ResearchObject   |   |            |              |  |
|  |     | vivo              | relatedBy                 | roh:Dossier  |   |            |              |  |
|  |     | vivo              | relates                   | obo-bfo:BFO_0000023 (Role)   |   |            |              |  |
|  |     | roh               | spends                    | roh:PatentExpense  |   |            |              |  |
|  | roh | PatentApplication | roh                       | ownerOrganization  | foaf:Organization                             |            |              |  |
|  |     |                   | roh                       | patentStatus   | roh:Submitted or roh:Accepted or roh:Rejected |            |              |  |

### 3.12. roh:Metric

| Prefix | Class         | Prefix              | Object property (bold indicates explicit Domain, otherwise a Restriction) | Range Class        | Prefix | Datatype Property (bold indicates explicit domain; otherwise a restriction) | Range Datatype (if typed) | Range values             |
|--------|---------------|---------------------|---|--------------------|--------|---|---------------------------|--------------------------|
| roh    | <b>Metric</b> | vivo                | <b>dateTimeValue</b>  | vivo:DateTimeValue | roh    | <b>metricName</b>   | xsd:string                |                          |
|        |               | roh                 | <b>metricOf</b>   |                    |        |   |                           |                          |
|        | roh           | AuthorMetric        | <b>metricOf</b>   | foaf:Agent         | roh    | <b>citationCount</b>  | xsd:integer               |                          |
|        |               |                     |   |                    | roh    | <b>h-index</b>  | xsd:integer               |                          |
|        | roh           | DegreeMetric        |   |                    |        |   |                           |                          |
|        | roh           | ThesisMetric        |   |                    | roh    | <b>cumLaude</b>   | xsd:boolean               |                          |
|        |               |                     |   |                    | roh    | <b>mark</b>   | xsd:string                |                          |
|        |               | roh                 | PhDThesisMetric   |                    |        |   |                           |                          |
|        | roh           | PublicationMetric   |   |                    | roh    | <b>citationCount</b>  | xsd:integer               |                          |
|        |               |                     |   |                    | roh    | <b>impactFactor</b>   | xsd:float                 |                          |
|        |               |                     |   |                    | roh    | <b>quartile</b>   | xsd:string                | {"Q1", "Q2", "Q3", "Q4"} |
|        |               |                     |   |                    | roh    | <b>ranking</b>  | xsd:string                |                          |
|        | roh           | ResearchGroupMetric |   |                    |        |   |                           |                          |

### 3.13. roh:Product

| Prefix | Class          | Prefix    | Object property (bold indicates explicit Domain, otherwise a Restriction) | Range Class | Prefix | Datatype Property (bold indicates explicit domain; otherwise a restriction) | Range Datatype (if typed) | Range values |
|--------|----------------|-----------|---|-------------|--------|---|---------------------------|--------------|
| roh    | <b>Product</b> |           |   |             | roh    | <b>hasTRL</b>   | xsd:integer               |              |
|        | roh            | Prototype |   |             |        |   |                           |              |

### 3.14. vivo:Project

| Prefix | Class | Prefix | Object property (bold indicates explicit Domain, otherwise a Restriction) | Range Class | Prefix | Datatype Property (bold indicates explicit domain; otherwise a restriction) | Range Datatype (if typed) | Range values |
|--------|-------|--------|---|-------------|--------|---|---------------------------|--------------|
|--------|-------|--------|---|-------------|--------|---|---------------------------|--------------|

|      |         |        |                           |  |      |                        |              |  |
|------|---------|--------|---------------------------|--|------|------------------------|--------------|--|
| vivo | Project | roh    | hasKnowledgeArea          | skos:Concept and (skos:inScheme some roh:KnowledgeArea)                      | roh  | identifier             | xsd:string   |  |
|      |         | vivo   | relates                   | obo-bfo:BFO_0000023 (Role)   | vivo | abbreviation           | rdfs:Literal |  |
|      |         | roh    | hasContract               | vivo:ProjectContract   | vivo | description            | rdfs:Literal |  |
|      |         | obo-ro | BFO_0000051 (hasPart)     | vivo:Project   | roh  | title                  | xsd:string   |  |
|      |         | vivo   | participates              | roh:Activity   | vivo | freeTextKeyword        | xsd:string   |  |
|      |         | roh    | spends                    | roh:ProjectExpense   | roh  | modality               | xsd:string   |  |
|      |         | roh    | produces                  | roh:ResearchObject   | roh  | needsEthicalValidation | xsd:boolean  |  |
|      |         | vivo   | relatedBy                 | roh:Dossier or roh:Justification or obo-bfo:BFO_0000023 (Role)               | roh  | isCompetitive          | xsd:boolean  |  |
|      |         | roh    | isSupportedBy             | roh:Funding  | roh: | projectObjective       | xsd:string   |  |
|      |         | gn     | locatedIn                 | gn:Feature   |      |                        |              |  |
|      |         | vivo   | dateTimeInterval          | vivo:DateTimeInterval  |      |                        |              |  |
|      |         | roh    | hasProjectCategorization  | (skos:Concept and (skos:inScheme some roh:ProjectClassification))            |      |                        |              |  |
|      |         | roh    | hasHRCClassification      | (skos:Concept and (skos:inScheme some roh:HRCClassification))                |      |                        |              |  |
|      |         | roh    | projectStatus             | roh:Status (roh:Closed or roh:Open or roh:ProposalSubmitted or roh:Rejected) |      |                        |              |  |
|      |         | roh    | coordinatedBy             | foaf:Agent   |      |                        |              |  |
|      |         | roh    | foreseenJustificationDate | vivo:DateTimeValue   |      |                        |              |  |

### 3.15. vivo:Relationship

| Prefix | Class        |                      | Prefix                              | Object property (bold indicates explicit Domain, otherwise a Restriction) | Range Class  | Prefix | Datatype Property (bold indicates explicit domain; otherwise a restriction) | Range Datatype (if typed) | Range values |
|--------|--------------|----------------------|-------------------------------------|---|--|--------|---|---------------------------|--------------|
| vivo   | Relationship |                      |                                     |   |  |        |   |                           |              |
|        | vivo         | AdvisingRelationship | vivo                                | dateTimeInterval  | vivo:DateTimeInterval  |        |   |                           |              |
|        |              |                      | vivo                                | degreeCandidacy   | vivo:AcademicDegree  |        |   |                           |              |
|        |              |                      | vivo                                | hasSubjectArea  | skos:Concept   |        |   |                           |              |
|        |              |                      | vivo                                | relates   | vivo:AdvisorRole or vivo:AdviseeRole or foaf:Person                    |        |   |                           |              |
|        |              | vivo                 | FacultyMentoringRelationship        |   |  |        |   |                           |              |
|        |              | vivo                 | GraduateAdvisingRelationship        |   |  |        |   |                           |              |
|        |              | vivo                 | PostdocOrFellowAdvisingRelationship |   |  |        |   |                           |              |
|        |              | vivo                 | UndergraduateAdvisingRelationship   |   |  |        |   |                           |              |
|        | vivo         | AuditingRelationship | vivo                                | dateTimeInterval  | vivo:DateTimeInterval  |        |   |                           |              |
|        |              |                      | vivo                                | dateTimeValue   | vivo:DateTimeValue   |        |   |                           |              |
|        |              |                      | vivo                                | relates   | roh:AuditeeRole or vivo:AuditorRole or foaf:Agent                      |        |   |                           |              |
|        | vivo         | AwardedDegree        | roh                                 | awardedBy   | vivo:University  |        |   |                           |              |
|        |              |                      | vivo                                | dateTimeValue   | vivo:DateTimeValue   |        |   |                           |              |
|        |              |                      | vivo                                | relates   | foaf:Person or roh:AcademicDegree                                      |        |   |                           |              |
|        | vivo         | Contract             | vivo                                | assignedBy  | foaf:Organization  | bibo   | abstract  | xsd:string                |              |
|        |              |                      | roh                                 | attachment  | owl:Thing  |        |   |                           |              |
|        |              |                      | roh                                 | contractSigningDate   | vivo:DateTimeValue   |        |   |                           |              |
|        |              |                      | vivo                                | dateTimeInterval  | vivo:DateTimeInterval  |        |   |                           |              |
|        |              |                      | vivo                                | hasSubjectArea  | skos:Concept   |        |   |                           |              |
|        |              |                      | vivo                                | relates   | roh:Funding or bibo:Patent or foaf:Agent or obo-bfo:BFO_0000023 (Role) |        |   |                           |              |
|        |              |                      |                                     |   |  |        |   |                           |              |

|  |      |                         |                                  |      |                              |   |      |            |         |  |
|--|------|-------------------------|----------------------------------|------|------------------------------|---|------|------------|---------|--|
|  |      |                         |                                  | vivo | supportedInformationResource | obo-lao: IAO_0000030<br>(InformationContentEntity)            |      |            |         |  |
|  |      | roh                     | PatentContract                   |      |                              |   |      |            |         |  |
|  |      | roh                     | PersonContract                   |      |                              |   |      |            |         |  |
|  |      | roh                     | ProjectContract                  |      |                              |   |      |            |         |  |
|  |      | roh                     | ServiceContract                  |      |                              |   |      |            |         |  |
|  | vivo | Position                |                                  | vivo | dateTimeInterval             | vivo:DateTimeInterval   | vivo | rank       | xsd:int |  |
|  |      |                         |                                  | roh  | positionOf                   | foaf:Person   | vivo | hrJobTitle |         |  |
|  |      |                         |                                  | vivo | relates                      | foaf:Organization   |      |            |         |  |
|  |      |                         |                                  | vivo | relates                      | foaf:Person   |      |            |         |  |
|  |      | vivo                    | FacultyAdministrativePosition    |      |                              |   |      |            |         |  |
|  |      | vivo                    | FacultyPosition                  |      |                              |   |      |            |         |  |
|  |      | vivo                    | LibrarianPosition                |      |                              |   |      |            |         |  |
|  |      | vivo                    | NonAcademicPosition              |      |                              |   |      |            |         |  |
|  |      | vivo                    | NonFacultyAcademicPosition       |      |                              |   |      |            |         |  |
|  |      | vivo                    | PostdocPosition                  |      |                              |   |      |            |         |  |
|  |      | vivo                    | PrimaryPosition                  |      |                              |   |      |            |         |  |
|  |      | roh                     | ResearcherPosition               |      |                              |   |      |            |         |  |
|  | roh  | ReservationRelationship |                                  | vivo | dateTimeInterval             | vivo:DateTimeInterval   |      |            |         |  |
|  |      |                         |                                  | vivo | hasSubjectArea               | skos:Concept  |      |            |         |  |
|  |      |                         |                                  | vivo | relates                      | roh:ReservableConsumerRole                                    |      |            |         |  |
|  | roh  | SupervisingRelationship |                                  | vivo | dateTimeInterval             | vivo:DateTimeInterval   |      |            |         |  |
|  |      |                         |                                  | roh  | produces                     | bibo:Thesis   |      |            |         |  |
|  |      |                         |                                  | vivo | relates                      | roh:SupervisorRole or<br>roh:SuperviseeRole or<br>foaf:Person |      |            |         |  |
|  |      | roh                     | BachelorsSupervisingRelationship | roh  | produces                     | roh:DegreeThesis  |      |            |         |  |
|  |      | roh                     | MastersSupervisingRelationship   | roh  | produces                     | roh:MasterThesis  |      |            |         |  |
|  |      | roh                     | PhDSupervisingRelationship       | roh  | produces                     | roh:PhDThesis   |      |            |         |  |

Notice that in vertical modules you can find human resource positions associated to different countries.

### 3.16. roh:ResearchResult

| Prefix | Class          | Prefix                      | Object property (bold indicates explicit Domain, otherwise a Restriction) | Range Class  | Prefix | Datatype Property (bold indicates explicit domain; otherwise a restriction) | Range Datatype (if typed) | Range values |
|--------|----------------|-----------------------------|---|--|--------|---|---------------------------|--------------|
| roh    | ResearchResult | roh                         | hasKnowledgeArea  | skos:Concept and (skos:inScheme some roh:KnowledgeArea)  | roh    | identifier  | xsd:string                |              |
|        |                | roh                         | researchResultHasPart   | roh:ExperimentalProtocol or roh:Repository or bibo:Document or ero:ERO_0000071 or vivo:Project | roh    | title   | xsd:string                |              |
|        |                | roh                         | seqOfAuthors  | rdf:Seq  | vivo   | abbreviation  | rdfs:Literal              |              |
|        |                | roh                         | hasSucessor   | roh:ResearchResult   | vivo   | description   | rdfs:Literal              |              |
|        |                | roh                         | correspondingAuthor   | foaf:Person  | vivo   | freeTextKeyword   | xsd:string                |              |
|        |                | vivo                        | dateTimeInterval  | vivo:DateTimeInterval  | roh    | <b>needsEthicalValidation</b>   | xsd:boolean               |              |
|        | roh            | ResearchObject <sup>2</sup> | correspondingOrganization   | foaf:Organization  | roh    | language  | xsd:string                |              |
|        |                | roh                         | hasPartOfResearchResult   | roh:ResearchResult   |        |   |                           |              |
|        |                | roh                         | <b>producedBy</b>   | roh:Project  |        |   |                           |              |

| Prefix      | Class                                    | Prefix              | Object property (bold indicates explicit Domain, otherwise a Restriction) | Range Class  | Prefix   | Datatype Property (bold indicates explicit domain; otherwise a restriction) | Range Datatype (if typed) | Range values |
|-------------|--|---------------------|---|--|--|---|---------------------------|--------------|
| obo<br>-iao | IAO_0000030 (Information Content Entity) | roh                 | correspondingOrganization   | foaf:Organization  | roh  | language  | xsd:string                |              |
|             | roh                                      | Repository          | correspondingAuthor   | foaf:Person  | roh  | title   | xsd:string                |              |
|             |  | roh                 | hasKnowledgeArea  | (skos:Concept and (skos:inScheme some roh:KnowledgeArea))                      | vivo   | description   | xsd:string                |              |
|             |  | roh                 | hasReadme   | roh:README   | bibo   | abstract  | xsd:string                |              |
|             |  | cito                | cites   | roh:ExperimentalProtocol or ero:ERO_0000071 or roh:Repository or bibo:Document | vivo   | freeTextKeyword   | xsd:string                |              |
|             |  | roh                 | repositoryHasPart   | ExperimentalProtocol or bibo:Document or ero:ERO_0000071                       |  |   |                           |              |
|             |  | roh                 | hasPredecessor  | roh:Repository   |  |   |                           |              |
|             |  | roh                 | seqOfAuthors  | rdf:Seq  |  |   |                           |              |
|             |  | roh                 | hasLicense  | vivo:License   |  |   |                           |              |
|             |  | roh                 | repositoryStatus  | roh:Closed or roh:Open   |  |   |                           |              |
|             |  | vivo                | dateTimeValue   | vivo:DateTimeValue   |  |   |                           |              |
|             |  | foaf                | homePage  | bibo:Webpage   |  |   |                           |              |
|             | roh                                      | BitBucketRepository | hasPredecessor  | roh:BitBucketRepository  |  |   |                           |              |
|             | roh                                      | GitHubRepository    | hasPredecessor  | roh:GitHubRepository   |  |   |                           |              |
|             | roh                                      | ZenodoRepository    | hasPredecessor  | roh:ZenodoRepository   | bibo   | doi   | xsd:integer               |              |
|             |  |                     |   |  | vivo   | identifier  | xsd:integer               |              |
|             | bibo                                     | Collection          |   |  | bibo   | oclcnum   | rdfs:Literal              |              |
|             | roh                                      | Dossier             | vivo  | dateTimeInterval   | vivo   | description   | rdfs:Literal              |              |
|             |  |                     | vivo  | relates  | roh:FundingProgram or roh:ProjectContract or bibo:Report or vivo:Project | vivo  | identifier                | xsd:string   |
|             |  |                     |   |  | roh  | title   | xsd:string                |              |
|             | bibo                                     | Periodical          | vivo  | publisher  | foaf:Organization  | bibo  | eissn                     | rdfs:Literal |
|             |  |                     |   |  | bibo   | issn  | rdfs:Literal              |              |
|             |  | bibo                | Journal   |  | vivo   | abbreviation  | rdfs:Literal              |              |
|             |  | bibo                | Magazine  |  |  |   |                           |              |
|             | bibo                                     | Document            | bibo  | authorList   | rdf:Seq  | bibo  | abstract                  | xsd:string   |

<sup>2</sup> Notice that roh:ResearchObject is a defined class, which follows these restrictions: Research or ('part of research result' some 'Research Result') or ('produced by' only vivo:Project)  
This is, an instance in ROH belongs to class roh:ResearchObject if it meets these restrictions.

|  |  |      |                                      |                           |  |                                   |                    |                    |              |
|--|--|------|--------------------------------------|---------------------------|--|-----------------------------------|--------------------|--------------------|--------------|
|  |  |      | roh                                  | correspondingAuthor       | foaf:Person  | bibo                              | doi                | xsd:string         |              |
|  |  |      | roh                                  | correspondingOrganization | foaf:Organization  |                                   |                    |                    |              |
|  |  |      | roh                                  | partOfRepository          | roh:Repository   | roh                               | title              | xsd:string         |              |
|  |  |      | roh                                  | partOfResearchResult      | roh:ResearchResult   |                                   |                    |                    |              |
|  |  |      | vivo                                 | dateTimeValue             | vivo:DateTimeValue   | vivo                              | freeTextKeyword    | xsd:string         |              |
|  |  |      | bibo                                 | editorList                | rdf:Seq  | bibo                              | pageStart          | rdfs:Literal       |              |
|  |  |      | vivo                                 | hasPublicationVenue       | bibo:Collection or bibo:Book   | bibo                              | pageEnd            | rdfs:Literal       |              |
|  |  |      | vivo                                 | publisher                 | foaf:Agent   |                                   |                    |                    |              |
|  |  |      | cito                                 | cites                     | roh:ExperimentalProtocol or ero:ERO_0000071 or roh:Repository or bibo:Document |                                   |                    |                    |              |
|  |  |      | roh                                  | documentStatus            | roh:Accepted or roh:Rejected   |                                   |                    |                    |              |
|  |  | roh  | README                               | roh                       | readmeOf   | roh:Repository or ero:ERO_0000071 |                    |                    |              |
|  |  | roh  | ExperimentalProtocolResult           |                           |  |                                   |                    |                    |              |
|  |  | vivo | Abstract                             |                           |  |                                   |                    |                    |              |
|  |  | bibo | Article                              |                           |  | bibo                              | issue              |                    |              |
|  |  | bibo | Academic Article                     | vivo                      | hasPublicationVenue  | bibo:Journal                      | bibo               | eanucc13           | rdfs:Literal |
|  |  |      | obo-lao:IAO_0000013 (JournalArticle) | vivo                      | dateTimeValue  | vivo:DateTimeValue                |                    |                    |              |
|  |  |      |                                      | roh                       | hasMetric  | roh:PublicationMetric             |                    |                    |              |
|  |  |      | roh:PeerReviewedArticle              |                           |  |                                   |                    |                    |              |
|  |  | roh  | BlogPost                             |                           |  |                                   |                    |                    |              |
|  |  | vivo | ConferencePaper                      | bibo                      | presentedAt  | bibo:Conference                   |                    |                    |              |
|  |  |      | roh:WorkshopPaper                    |                           |  |                                   |                    |                    |              |
|  |  | vivo | EditorialArticle                     |                           |  |                                   |                    |                    |              |
|  |  | roh  | PeerReviewedArticle                  |                           |  |                                   |                    |                    |              |
|  |  | roh  | PressArticle                         |                           |  |                                   |                    |                    |              |
|  |  | bibo | AudioVisualDocument                  |                           |  |                                   |                    |                    |              |
|  |  | roh  | RadioProgram                         |                           |  |                                   |                    |                    |              |
|  |  | roh  | TvProgram                            |                           |  |                                   |                    |                    |              |
|  |  | bibo | Book                                 | vivo                      | publisher  | foaf:Organization                 | bibo               | edition            | rdfs:Literal |
|  |  |      |                                      |                           |  | bibo                              | isbn               | rdfs:Literal       |              |
|  |  |      |                                      |                           |  | bibo                              | iccn               | rdfs:Literal       |              |
|  |  |      |                                      |                           |  | vivo                              | placeOfPublication | rdfs:Literal       |              |
|  |  | bibo | Proceedings                          |                           |  |                                   |                    |                    |              |
|  |  | roh  | CaseStudy                            |                           |  |                                   |                    |                    |              |
|  |  | roh  | Catalog                              |                           |  |                                   |                    |                    |              |
|  |  | bibo | CollectedDocument                    |                           |  |                                   |                    |                    |              |
|  |  | roh  | Database                             |                           |  |                                   |                    |                    |              |
|  |  | bibo | EditedBook                           |                           |  |                                   |                    |                    |              |
|  |  | bibo | Issue                                | obo-ro                    | BFO_0000051 (hasPart)  | bibo:Article                      | bibo               | issue              | rdfs:Literal |
|  |  | vivo | ConferencePoster                     |                           |  |                                   |                    |                    |              |
|  |  | roh  | CurriculumVitae                      | roh                       | CVOF   | foaf:Person                       | roh                | summary            | xsd:string   |
|  |  | vivo | Dataset                              | cito                      | isCitedAsDataSourceBy  | bibo:Document                     |                    |                    |              |
|  |  | bibo | DocumentPart                         | vivo                      | publisher  | foaf:Organization                 | vivo               | placeOfPublication | rdfs:Literal |
|  |  | bibo | BookSection                          |                           |  |                                   | bibo               | edition            | rdfs:Literal |

|  |  |      |     |                       |      |                   |  |      |                    |              |  |
|--|--|------|-----|-----------------------|------|-------------------|--|------|--------------------|--------------|--|
|  |  |      |     | bibo:Chapter          |      |                   |  |      |                    |              |  |
|  |  | roh  |     | EditedPublication     |      |                   |  |      |                    |              |  |
|  |  | foaf |     | Image                 |      |                   |  |      |                    |              |  |
|  |  | roh  |     | Invoice               |      |                   |  |      |                    |              |  |
|  |  |      | roh | Proforma Invoice      |      |                   |  |      |                    |              |  |
|  |  | bibo |     | Manual                |      |                   |  |      |                    |              |  |
|  |  | bibo |     | Patent                | vivo | assignee          | foaf:Organization  | vivo | identifier         | xsd:string   |  |
|  |  |      |     |                       | vivo | dateIssued        | vivo:DateTimeValue   | roh  | modality           | xsd:string   |  |
|  |  |      |     |                       | roh  | expirationDate    | vivo:DateTimeValue   |      |                    |              |  |
|  |  |      |     |                       | roh  | hasKnowledgeArea  | (skos:Concept and (skos:inScheme some roh:KnowledgeArea))                        |      |                    |              |  |
|  |  |      |     |                       | gn   | locatedIn         | gn:Feature   |      |                    |              |  |
|  |  |      |     |                       | roh  | ownerOrganization | foaf:Organization  |      |                    |              |  |
|  |  |      |     |                       | roh  | patentCountry     | (skos:Concept and (skos:inScheme some roh:Country))                              |      |                    |              |  |
|  |  |      |     |                       | roh  | patentInventor    | foaf:Person  |      |                    |              |  |
|  |  | bibo |     | Report                | bibo | distributor       | foaf:Organization  |      |                    |              |  |
|  |  |      |     |                       | vivo | publisher         | foaf:Organization  |      |                    |              |  |
|  |  | roh  |     | EthicalReport         |      |                   |  |      |                    |              |  |
|  |  |      |     | roh:EthicalAudit      |      |                   |  |      |                    |              |  |
|  |  |      |     | roh:EthicalValidation |      |                   |  |      |                    |              |  |
|  |  | roh  |     | EvaluationSummary     | roh  | evaluationStatus  | roh:Final or roh:Provisional   |      |                    |              |  |
|  |  | roh  |     | Justification         | vivo | relates           | roh:Project  |      |                    |              |  |
|  |  | vivo |     | ResearchProposal      | vivo | relates           | roh:Justification or roh:ProjectContract or roh:Project or vivo:ResearchProposal |      |                    |              |  |
|  |  | roh  |     | Technical Report      |      |                   |  |      |                    |              |  |
|  |  | bibo |     | Thesis                | roh  | supervisedBy      | foaf:Person  | vivo | abbreviation       | rdfs:Literal |  |
|  |  |      |     |                       |      |                   |  | vivo | placeOfPublication | rdfs:Literal |  |
|  |  | roh  |     | BachelorsThesis       |      |                   |  |      |                    |              |  |
|  |  | roh  |     | MastersThesis         |      |                   |  |      |                    |              |  |
|  |  | roh  |     | PhDThesis             |      |                   |  |      |                    |              |  |
|  |  | bibo |     | Webpage               |      |                   |  |      |                    |              |  |

### 3.17. roh:Reservable

| Prefix | Class      | Prefix | Object property (bold indicates explicit Domain, otherwise a Restriction) | Range Class           | Prefix | Datatype Property (bold indicates explicit domain; otherwise a restriction) | Range Datatype (if typed) | Range values |
|--------|------------|--------|---|-----------------------|--------|---|---------------------------|--------------|
| roh    | Reservable | vivo   | <b>dateTimeInterval</b>   | vivo:DateTimeInterval | vivo   | <b>description</b>  | xsd:string                |              |
|        |            | roh    | <b>reservableOf</b>   | foaf:Agent            | vivo   | <b>freetextKeyword</b>  | xsd:string                |              |
|        |            |        |   |                       | roh    | <b>title</b>  | xsd:string                |              |
|        | roh        |        | ReservableSoftware  |                       |        |   |                           |              |
|        | vivo       |        | Equipment   |                       |        |   |                           |              |
|        | vivo       | pbo-ro | BFO_0000051 (hasPart)   | roh:Facility          |        |   |                           |              |

### 3.18. obo-bfo:BFO\_0000023 (Role)

| Prefix  | Class                                 | Prefix                     | Object property (bold indicates explicit Domain, otherwise a Restriction) | Range Class  | Prefix | Datatype Property (bold indicates explicit domain; otherwise a restriction) | Range Datatype (if typed) | Range values         |
|---------|---------------------------------------|----------------------------|---|--|--------|---|---------------------------|----------------------|
| obo-bfo | <b>BFO_0000023 (Role)<sup>3</sup></b> | vivo                       | dateTimeInterval  | vivo:DateTimeInterval                                      | roh    | <b>dedication</b>   | xsd:string                | ["PARTIAL", "TOTAL"] |
|         |                                       | roh                        | RO_0000052 (inheresIn)  | foaf:Agent   | vivo   | dedicationPercentage  | xsd:float                 |                      |
|         |                                       |                            |   |  | vivo   | description   | xsd:string                |                      |
|         |                                       | roh                        | hasKnowledgeArea  | (skos:Concept and (skos:inScheme some roh:KnowledgeArea))  | roh    | referencedLaw   | xsd:string                |                      |
|         |                                       | vivo                       | relatedBy   | roh:PatentApplication or vivo:Project or vivo:Relationship |        |   |                           |                      |
|         |                                       | obo-bfo                    | realizedIn  | roh:Activity   |        |   |                           |                      |
|         |                                       | roh                        | <b>roleOf</b>   | foaf:Agent   |        |   |                           |                      |
|         | vivo                                  | AdministratorRole          |   |  |        |   |                           |                      |
|         | vivo                                  | AdviseeRole                |   |  |        |   |                           |                      |
|         | vivo                                  | AdvisorRole                |   |  |        |   |                           |                      |
|         | vivo                                  | AttendeeRole               |   |  |        |   |                           |                      |
|         | vivo                                  | AuditeeRole                |   |  |        |   |                           |                      |
|         | vivo                                  | AuditorRole                |   |  |        |   |                           |                      |
|         | vivo                                  | EditorRole                 |   |  |        |   |                           |                      |
|         | obo-ero                               | ERO_0000225 (EducatorRole) |   |  |        |   |                           |                      |
|         | obo-ero                               | ERO_0000787 (EmployeeRole) |   |  |        |   |                           |                      |
|         | roh                                   | ExternalMemberRole         |   |  |        |   |                           |                      |
|         | obo-ero                               | ERO_0000224 (FundingRole)  |   |  |        |   |                           |                      |
|         | vivo                                  | LeaderRole                 |   |  |        |   |                           |                      |
|         | vivo                                  | MemberRole                 |   |  |        |   |                           |                      |
|         | vivo                                  | OrganizerRole              |   |  |        |   |                           |                      |
|         | vivo                                  | PresenterRole              |   |  |        |   |                           |                      |
|         | vivo                                  | ResearcherRole             |   |  |        |   |                           |                      |
|         | roh                                   | ReservableConsumerRole     |   |  |        |   |                           |                      |
|         | roh                                   | ReservableProviderRole     |   |  |        |   |                           |                      |
|         | vivo                                  | ReviewerRole               |   |  |        |   |                           |                      |
|         | obo-ero                               | ERO_0000783 (StudentRole)  |   |  |        |   |                           |                      |
|         | roh                                   | SuperviseeRole             |   |  |        |   |                           |                      |
|         | roh                                   | SupervisorRole             |   |  |        |   |                           |                      |
|         | vivo                                  | TeacherRole                |   |  |        |   |                           |                      |
|         | roh                                   | TechnicalSupport           |   |  |        |   |                           |                      |
|         | roh                                   | ThirdPartyContractorRole   |   |  |        |   |                           |                      |

### 3.19. obo-ero:ERO\_0000005 (Service)<sup>4</sup>

| Prefix  | Class                        | Prefix | Object property (bold indicates explicit Domain, otherwise a Restriction) | Range Class       | Prefix | Datatype Property (bold indicates explicit domain; otherwise a restriction) | Range Datatype (if typed) | Range values |
|---------|------------------------------|--------|---|-------------------|--------|---|---------------------------|--------------|
| obo-ero | <b>ERO_0000005 (Service)</b> | roh    | isProvidedBy  | foaf:Organization | vivo   | description   | xsd:string                |              |
|         |                              |        |   |                   | vivo   | identifier  | xsd:string                |              |
|         |                              |        |   |                   | roh    | title   | xsd:string                |              |

<sup>3</sup> Notice that the actual name of this class is opaque, i.e. BFO\_0000023, its associated URI is [http://purl.org/roh/obo/bfo#BFO\\_0000023](http://purl.org/roh/obo/bfo#BFO_0000023)

<sup>4</sup> Associated to IRI [http://purl.org/roh/mirror/obo/ero#ERO\\_0000005](http://purl.org/roh/mirror/obo/ero#ERO_0000005). These classes from obo-ero use opaque IDs, for their instantiation the alphanumeric IDs declared under parenthesis should be used.

|  |         |   |  |  |  |  |  |  |  |
|--|---------|---|--|--|--|--|--|--|--|
|  | obo-ero | ERO_0000391 (AccessService)               |  |  |  |  |  |  |  |
|  | obo-ero | ERO_0001261 (AnalysisService)             |  |  |  |  |  |  |  |
|  | obo-ero | ERO_0001262 (DataAnalysisService)         |  |  |  |  |  |  |  |
|  | obo-ero | ERO_0000395 (MaterialAnalysisService)     |  |  |  |  |  |  |  |
|  | obo-ero | ERO_0001261 (AnalysisService)             |  |  |  |  |  |  |  |
|  | obo-ero | ERO_0001262 (DataAnalysisService)         |  |  |  |  |  |  |  |
|  | obo-ero | ERO_0000395 (MaterialMaintenanceService)  |  |  |  |  |  |  |  |
|  | obo-ero | ERO_0001258 (MaintenanceService)          |  |  |  |  |  |  |  |
|  | obo-ero | ERO_0001260 (DataMaintenanceService)      |  |  |  |  |  |  |  |
|  | obo-ero | ERO_0001259 (MaterialMaintenanceService)  |  |  |  |  |  |  |  |
|  | obo-ero | ERO_0000394 (MaterialProcessingService)   |  |  |  |  |  |  |  |
|  | obo-ero | ERO_0001263 (MaterialModificationService) |  |  |  |  |  |  |  |
|  | obo-ero | ERO_0000396 (MaterialProductionService)   |  |  |  |  |  |  |  |
|  | obo-ero | ERO_0000392 (StorageService)              |  |  |  |  |  |  |  |
|  | obo-ero | ERO_0001257 (DataStorageService)          |  |  |  |  |  |  |  |
|  | obo-ero | ERO_0001256 (MaterialStorageService)      |  |  |  |  |  |  |  |
|  | obo-ero | ERO_0001255 (SupportService)              |  |  |  |  |  |  |  |
|  | obo-ero | ERO_0000393 (TrainingService)             |  |  |  |  |  |  |  |
|  | obo-ero | ERO_0001254 (TransportService)            |  |  |  |  |  |  |  |

### 3.20. roh:Status

| Prefix | Class         |                   | Prefix | Object property (bold indicates explicit Domain, otherwise a Restriction) | Range Class                  | Prefix | Datatype Property (bold indicates explicit domain; otherwise a restriction) | Range Datatype (if typed) | Range values |
|--------|---------------|-------------------|--------|---|------------------------------|--------|---|---------------------------|--------------|
| roh    | <b>Status</b> |                   | vivo   | <b>dateTimeInterval</b>   | <b>vivo:DateTimeInterval</b> |        |   |                           |              |
|        | roh           | Accepted          |        |   |                              |        |   |                           |              |
|        | roh           | Cancelled         |        |   |                              |        |   |                           |              |
|        | roh           | Closed            |        |   |                              |        |   |                           |              |
|        | roh           | Final             |        |   |                              |        |   |                           |              |
|        | roh           | Funded            |        |   |                              |        |   |                           |              |
|        | roh           | Open              |        |   |                              |        |   |                           |              |
|        | roh           | ProposalSubmitted |        |   |                              |        |   |                           |              |
|        | roh           | Provisional       |        |   |                              |        |   |                           |              |
|        | roh           | Rejected          |        |   |                              |        |   |                           |              |
|        | roh           | Signed            |        |   |                              |        |   |                           |              |
|        | roh           | Submitted         |        |   |                              |        |   |                           |              |
|        | roh           | Terminated        |        |   |                              |        |   |                           |              |
|        | roh           | Unfunded          |        |   |                              |        |   |                           |              |



### 3.21. obo-bfo:TemporalRegion<sup>5</sup>

| Prefix  | Class  | Prefix           | Object property (bold indicates explicit Domain, otherwise a Restriction) | Range Class        | Prefix | Datatype Property (bold indicates explicit domain; otherwise a restriction) | Range Datatype (if typed) | Range values |
|---------|--|------------------|---|--------------------|--------|---|---------------------------|--------------|
| obo-bfo | BFO_0000008 (TemporalRegion)                       |                  |   |                    |        |   |                           |              |
|         | obo-bfo BFO_0000038 (OneDimensionalTemporalRegion) |                  |   |                    |        |   |                           |              |
|         | vivo   | DateTimeInterval | vivo start  | vivo:DateTimeValue |        |   |                           |              |
|         |  |                  | vivo end  | vivo:DateTimeValue |        |   |                           |              |
|         | obo-bfo BFO_0000158 (ZeroDimensionTemporalRegion)  |                  |   |                    |        |   |                           |              |
|         | vivo   | DateTimeValue    |   |                    | vivo   | dateTime  | xsd:dateTime              |              |

### 3.22. roh: ExperimentalProtocol

| Prefix | Class                | Prefix | Object property (bold indicates explicit Domain, otherwise a Restriction) | Range Class  | Prefix | Datatype Property (bold indicates explicit domain; otherwise a restriction) | Range Datatype (if typed) | Range values |
|--------|----------------------|--------|---|--|--------|---|---------------------------|--------------|
| Roh    | ExperimentalProtocol | roh    | correspondingAuthor   | foaf:Person  | roh    | language  | xsd:string                |              |
|        |                      | roh    | hasKnowledgeArea  | (skos:Concept and (skos:inScheme some roh:KnowledgeArea))                      | vivo   | description   | xsd:string                |              |
|        |                      | roh    | produces  | roh:ExperimentalProtocolResult   | bibo   | abstract  | xsd:string                |              |
|        |                      | cito   | cites   | roh:ExperimentalProtocol or ero:ERO_0000071 or roh:Repository or bibo:Document | vivo   | freeTextKeyword   | xsd:string                |              |
|        |                      | roh    | partOfResearchResult  | roh:ResearchResult   | roh    | title   | xsd:string                |              |
|        |                      | rog    | partOfRepository  | roh:Repository   |        |   |                           |              |
|        |                      | roh    | hasPredecessor  | roh:ExperimentalProtocol   |        |   |                           |              |
|        |                      | roh    | seqOfAuthors  | rdf:Seq  |        |   |                           |              |
|        |                      | roh    | hasLicense  | vivo:License   |        |   |                           |              |
|        |                      | vivo   | dateTimeValue   | vivo:DateTimeValue   |        |   |                           |              |
|        |                      | foaf   | homePage  | vivo:Webpage   |        |   |                           |              |

### 3.23. obo-ero:Software

| Prefix | Class       | Prefix | Object property (bold indicates explicit Domain, otherwise a Restriction) | Range Class  | Prefix | Datatype Property (bold indicates explicit domain; otherwise a restriction) | Range Datatype (if typed) | Range values |
|--------|-------------|--------|---|--|--------|---|---------------------------|--------------|
| ero    | ERO_0000071 | roh    | correspondingAuthor   | foaf:Person  | roh    | language  | xsd:string                |              |
|        |             | roh    | hasKnowledgeArea  | (skos:Concept and (skos:inScheme some roh:KnowledgeArea))                      | vivo   | description   | xsd:string                |              |
|        |             | roh    | hasReadme   | roh:README   | bibo   | abstract  | xsd:string                |              |
|        |             | cito   | cites   | roh:ExperimentalProtocol or ero:ERO_0000071 or roh:Repository or bibo:Document | vivo   | freeTextKeyword   | xsd:string                |              |
|        |             | roh    | partOfResearchResult  | roh:ResearchResult   | roh    | title   | xsd:string                |              |
|        |             | roh    | partOfRepository  | roh:Repository   |        |   |                           |              |
|        |             | roh    | hasPredecessor  | ero:ERO_0000071  | roh    | programmingLanguage   | xsd:string                |              |
|        |             | roh    | seqOfAuthors  | rdf:Seq  |        |   |                           |              |
|        |             | roh    | hasLicense  | vivo:License   |        |   |                           |              |
|        |             | roh    | softwareStatus  | roh:Final or roh:Provisional   |        |   |                           |              |

<sup>5</sup> The actual URI associated to this concept is: [http://purl.org/roh/mirror/obo/bfo#BFO\\_0000008](http://purl.org/roh/mirror/obo/bfo#BFO_0000008)

|  |     |                    |               |                    |  |  |  |  |
|--|-----|--------------------|---------------|--------------------|--|--|--|--|
|  |     | vivo               | dateTimeValue | vivo:DateTimeValue |  |  |  |  |
|  |     | foaf               | homePage      | vivo:Webpage       |  |  |  |  |
|  | roh | ReservableSoftware |               |                    |  |  |  |  |