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**Course:** Semantic Web (CENG685-Assignment-2)

**Domain:** Vaccine Ontology

**Q1:** Find the total number of classes in the Vaccine Ontology.

**SPARQL:**

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>

PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>

prefix owl: <http://www.w3.org/2002/07/owl#>

prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#>

SELECT ( COUNT(?class ) AS ?TotalClasses)

WHERE {

?class a owl:Class.

}

**RESULT:**

| **TotalClasses** |
| --- |
| 5501 |

**Q2:** Find the different descriptions and their types of FluMist vaccine in the Ontology

**SPARQL:**

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>

PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>

prefix owl: <http://www.w3.org/2002/07/owl#>

prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#>

SELECT ?subject ?vaccineName ?description ?type WHERE {

?subject rdf:type ?type.

?subject rdfs:comment ?description.

?subject rdfs:label ?vaccineName.

FILTER ( ?vaccineName = "FluMist").

}

**RESULT:**

|  | **subject** | **vaccineName** | **description** | **object** |
| --- | --- | --- | --- | --- |
| 1 | [<http://purl.obolibrary.org/obo/VO\_0000044>](http://purl.obolibrary.org/obo/VO_0000044) | "FluMist" | "Product Name: Influenza Virus Vaccine, Live, Intranasal" | [owl:Class](http://www.w3.org/2002/07/owl#Class) |
| 2 | [<http://purl.obolibrary.org/obo/VO\_0000044>](http://purl.obolibrary.org/obo/VO_0000044) | "FluMist" | "Trade Name: FluMist" | [owl:Class](http://www.w3.org/2002/07/owl#Class) |

**Q3)** Find the first 10 classes, their label names and their desiptions in the vaccine Ontology.

**SPARQL:**

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>

PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>

prefix owl: <http://www.w3.org/2002/07/owl#>

prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#>

SELECT DISTINCT ?class ?label ?description

WHERE {

?class a owl:Class.

?class rdfs:label ?label .

?class rdfs:comment ?description

}

LIMIT 10

**RESULT:**

|  | **class** | **label** | **description** |
| --- | --- | --- | --- |
| 1 | [<http://purl.obolibrary.org/obo/VO\_0000003>](http://purl.obolibrary.org/obo/VO_0000003) | "ACAM2000" | "Smallpox (Vaccinia) Vaccine, Live" |
| 2 | [<http://purl.obolibrary.org/obo/VO\_0000003>](http://purl.obolibrary.org/obo/VO_0000003) | "ACAM2000" | "Trade Name: ACAM2000" |
| 3 | [<http://purl.obolibrary.org/obo/VO\_0000433>](http://purl.obolibrary.org/obo/VO_0000433) | "vaccinia virus vaccine" | "Vaccinia virus is well known for its role as a vaccine that helped eradicate the smallpox disease, making it the first human disease to be successfully eradicated by science." |
| 4 | [<http://purl.obolibrary.org/obo/VO\_0000004>](http://purl.obolibrary.org/obo/VO_0000004) | "ActHIB" | "Product Name: Haemophilus b Conjugate Vaccine (Tetanus Toxoid Conjugate)" |
| 5 | [<http://purl.obolibrary.org/obo/VO\_0000004>](http://purl.obolibrary.org/obo/VO_0000004) | "ActHIB" | "Trade Name: ActHIB" |
| 6 | [<http://purl.obolibrary.org/obo/VO\_0000005>](http://purl.obolibrary.org/obo/VO_0000005) | "Adacel" | "Product Name: Tetanus Toxoid, Reduced Diphtheria Toxoid and Acellular Pertussis Vaccine, Adsorbed" |
| 7 | [<http://purl.obolibrary.org/obo/VO\_0000005>](http://purl.obolibrary.org/obo/VO_0000005) | "Adacel" | "Trade Name: Adacel" |
| 8 | [<http://purl.obolibrary.org/obo/VO\_0000006>](http://purl.obolibrary.org/obo/VO_0000006) | "Afluria" | "Product Name: Influenza Virus Vaccine" |
| 9 | [<http://purl.obolibrary.org/obo/VO\_0000006>](http://purl.obolibrary.org/obo/VO_0000006) | "Afluria" | "Trade Name: Afluria" |
| 10 | [<http://purl.obolibrary.org/obo/VO\_0000642>](http://purl.obolibrary.org/obo/VO_0000642) | "Influenza virus vaccine" | "There is no single 'influenza virus' in NCBI\_Taxon. We usually use: ('unidentified influenza virus' or 'Influenzavirus A' or 'Influenzavirus B' or 'Influenzavirus C') However, even this may not be comprehensive. " |

**Q4)** Find all the total number of classes, the hierarchies associated/connected within the Vaccine Ontology.

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>

PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>

prefix owl: <http://www.w3.org/2002/07/owl#>

prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#>

SELECT DISTINCT ( COUNT(?term) AS ?TotalClassesHierarchy)

WHERE {

{

OPTIONAL {?term rdfs:label ?label} .

OPTIONAL {?subTerm rdfs:subClassOf ?term}

} UNION {

?term owl:equivalentClass ?s1 .

OPTIONAL {?term rdfs:label ?label} .

OPTIONAL {?subTerm rdfs:subClassOf ?term}

}

}

**RESULT:**

| **TotalClassesHierarchy** |
| --- |
| 1 | "10076"^^xsd:integer |

**Q5)** Find the number of all class (or object, annotation, or datatype property) terms that started with “VO\_000000…” of an ontology

**SPARQL:**

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>

PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>

PREFIX owl: <http://www.w3.org/2002/07/owl#>

SELECT ?s

WHERE

{

?s rdf:type owl:Class .

?s rdfs:label ?label .

FILTER regex( ?s, "VO\_000000", "i" )

}

**RESULT:**

| **s** |
| --- |
| [http://purl.obolibrary.org/obo/VO\_0000006](http://www.violinet.org/vaccineontology/sparql/index.php) |
| [http://purl.obolibrary.org/obo/VO\_0000001](http://www.violinet.org/vaccineontology/sparql/index.php) |
| [http://purl.obolibrary.org/obo/VO\_0000002](http://www.violinet.org/vaccineontology/sparql/index.php) |
| [http://purl.obolibrary.org/obo/VO\_0000007](http://www.violinet.org/vaccineontology/sparql/index.php) |
| [http://purl.obolibrary.org/obo/VO\_0000008](http://www.violinet.org/vaccineontology/sparql/index.php) |
| [http://purl.obolibrary.org/obo/VO\_0000009](http://www.violinet.org/vaccineontology/sparql/index.php) |
| [http://purl.obolibrary.org/obo/VO\_0000000](http://www.violinet.org/vaccineontology/sparql/index.php) |
| [http://purl.obolibrary.org/obo/VO\_0000003](http://www.violinet.org/vaccineontology/sparql/index.php) |
| [http://purl.obolibrary.org/obo/VO\_0000004](http://www.violinet.org/vaccineontology/sparql/index.php) |
| [http://purl.obolibrary.org/obo/VO\_0000005](http://www.violinet.org/vaccineontology/sparql/index.php) |

**Q6:** Find or retrieve definition and authors of all classes in an ontology

**SPARQL:**

PREFIX obo-term: <http://purl.obolibrary.org/obo/>

SELECT ?s ?label ?definition ?author

FROM <http://purl.obolibrary.org/obo/merged/VO>

WHERE

{

?s a owl:Class .

?s rdfs:label ?label .

?s obo-term:IAO\_0000115 ?definition .

?s obo-term:IAO\_0000117 ?author . }

**Result:**

| **s** | **label** | **definition** | **author** |
| --- | --- | --- | --- |
| [http://purl.obolibrary.org/obo/OAE\_0000004](http://www.violinet.org/vaccineontology/sparql/index.php) | vaccine adverse event | an adverse event that occurs after a vaccination. | YH |
| [http://purl.obolibrary.org/obo/OAE\_0000097](http://www.violinet.org/vaccineontology/sparql/index.php) | vaccine-induced adverse event | an adverse event that is induced by a vaccination. | YH |
| [http://purl.obolibrary.org/obo/VO\_0000609](http://www.violinet.org/vaccineontology/sparql/index.php) | viral vaccine | A vaccine that targets against a viral disease. | YH |
| [http://purl.obolibrary.org/obo/VO\_0000642](http://www.violinet.org/vaccineontology/sparql/index.php) | Influenza virus vaccine | A viral vaccine that protects against infection with influenza virus. | YH |
| [http://purl.obolibrary.org/obo/VO\_0001382](http://www.violinet.org/vaccineontology/sparql/index.php) | rabbit hemorrhagic disease virus vaccine | A viral vaccine that protects against infection with Rabbit hemorrhagic disease virus | YH, RS, NF |
| [http://purl.obolibrary.org/obo/VO\_0001455](http://www.violinet.org/vaccineontology/sparql/index.php) | rinderpest virus vaccine | A viral vaccine that protects against infection with Rinderpest virus | YH, RS, NF |
| [http://purl.obolibrary.org/obo/VO\_0001480](http://www.violinet.org/vaccineontology/sparql/index.php) | African horse sickness virus vaccine | A viral vaccine that protects against infection with African horse sickness virus | YH, RS, NF |
| [http://purl.obolibrary.org/obo/VO\_0001483](http://www.violinet.org/vaccineontology/sparql/index.php) | Borna disease virus vaccine | A viral vaccine that protects against infection with Borna disease virus | YH, RS, NF |
| [http://purl.obolibrary.org/obo/VO\_0001484](http://www.violinet.org/vaccineontology/sparql/index.php) | Caprine herpesvirus 1 vaccine | A viral vaccine that protects against infection with Caprine herpesvirus 1 | YH, RS, NF |
| [http://purl.obolibrary.org/obo/VO\_0001519](http://www.violinet.org/vaccineontology/sparql/index.php) | Mycobacterium bovis vaccine | A vaccine that protects against infection with Mycobacterium bovis | YH, RS, NF |

**Q7:** Find vaccines containing egg protein allergen

**SPARQL:**

PREFIX has\_vaccine\_allergen: <http://purl.obolibrary.org/obo/VO\_0000531>

PREFIX chicken\_egg\_protein\_allergen: <http://purl.obolibrary.org/obo/VO\_0000912>

SELECT distinct ?vaccine\_label ?vaccine

WHERE {

?vaccine rdfs:label ?vaccine\_label .

?vaccine rdfs:subClassOf ?vaccine\_restriction .

?vaccine\_restriction owl:onProperty has\_vaccine\_allergen:; owl:someValuesFrom chicken\_egg\_protein\_allergen: .

}

**RESULT:**

| **vaccine\_label** | **vaccine** |
| --- | --- |
| Afluria | [http://purl.obolibrary.org/obo/VO\_0000006](http://www.violinet.org/vaccineontology/sparql/index.php) |
| FluLaval | [http://purl.obolibrary.org/obo/VO\_0000043](http://www.violinet.org/vaccineontology/sparql/index.php) |
| FluMist | [http://purl.obolibrary.org/obo/VO\_0000044](http://www.violinet.org/vaccineontology/sparql/index.php) |
| FluLaval Quadrivalent | [http://purl.obolibrary.org/obo/VO\_0003071](http://www.violinet.org/vaccineontology/sparql/index.php) |
| FluLaval Tetra | [http://purl.obolibrary.org/obo/VO\_0003072](http://www.violinet.org/vaccineontology/sparql/index.php) |
| Fluzone Quadrivalent | [http://purl.obolibrary.org/obo/VO\_0003073](http://www.violinet.org/vaccineontology/sparql/index.php) |
| Fluzone Quadrivalent - Southern Hemisphere Formulation | [http://purl.obolibrary.org/obo/VO\_0003074](http://www.violinet.org/vaccineontology/sparql/index.php) |
| Influenza A (H5N1) Virus Monovalent Vaccine, Adjuvanted by GSK | [http://purl.obolibrary.org/obo/VO\_0003083](http://www.violinet.org/vaccineontology/sparql/index.php) |
| Influenza A (H1N1) 2009 Monovalent Vaccine (GlaxoSmithKline) | [http://purl.obolibrary.org/obo/VO\_0003084](http://www.violinet.org/vaccineontology/sparql/index.php) |
| Afluria Quadrivalent | [http://purl.obolibrary.org/obo/VO\_0001817](http://www.violinet.org/vaccineontology/sparql/index.php) |

**Q8:** Query the number of Helicobacter pylori vaccine (VO\_0012181)

**SPARQL:**

PREFIX obo-term: <http://purl.obolibrary.org/obo/>

PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>

PREFIX owl: <http://www.w3.org/2002/07/owl#>

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>

SELECT count(DISTINCT ?x) as ?count

WHERE {

?x rdfs:subClassOf obo-term:VO\_0012181 .

?x a owl:Class .}

**RESULT:**

| **count** |
| --- |
| "12"^^xsd:integer |

**Q9)** Is vaccines containing egg protein allergen?

**SPARQL:**

PREFIX owl: <http://www.w3.org/2002/07/owl#>

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>

PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>

PREFIX has\_vaccine\_allergen: <http://purl.obolibrary.org/obo/VO\_0000531>

PREFIX chicken\_egg\_protein\_allergen: <http://purl.obolibrary.org/obo/VO\_0000912>

ASK

WHERE

{ ?vaccine rdfs:label ?vaccine\_label .

?vaccine rdfs:subClassOf ?vaccine\_restriction .

?vaccine\_restriction owl:onProperty has\_vaccine\_allergen:; owl:someValuesFrom chicken\_egg\_protein\_allergen: .

}

**RESULT:**

1. true

**Q10)** Find the ("creator", "description"s, etc.) annotations in the Vaccine Ontolodgy

**SPARQL:**

PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>

PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>

PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>

PREFIX owl: <http://www.w3.org/2002/07/owl#>

SELECT DISTINCT ?x ?detail

WHERE{

?s a owl:Ontology .

?s ?x ?detail .}

**RESULT:**

|  | **x** | **detail** |
| --- | --- | --- |
| 1 | [<http://protege.stanford.edu/plugins/owl/protege#defaultLanguage>](http://protege.stanford.edu/plugins/owl/protege#defaultLanguage) | "en" |
| 2 | [<http://purl.org/dc/elements/1.1/contributor>](http://purl.org/dc/elements/1.1/contributor) | "Erica Marcos" |
| 3 | [<http://purl.org/dc/elements/1.1/contributor>](http://purl.org/dc/elements/1.1/contributor) | "Chris mungall" |
| 4 | [<http://purl.org/dc/elements/1.1/contributor>](http://purl.org/dc/elements/1.1/contributor) | "Ningxian Fan" |
| 5 | [<http://purl.org/dc/elements/1.1/contributor>](http://purl.org/dc/elements/1.1/contributor) | "Ryan R. Brinkman" |
| 6 | [<http://purl.org/dc/elements/1.1/contributor>](http://purl.org/dc/elements/1.1/contributor) | "Shunzhou Deng"@en |
| 7 | [<http://purl.org/dc/elements/1.1/creator>](http://purl.org/dc/elements/1.1/creator) | "Alexander D. Diehl" |
| 8 | [<http://purl.org/dc/elements/1.1/creator>](http://purl.org/dc/elements/1.1/creator) | "Bjoern Peters" |
| 9 | [<http://purl.org/dc/elements/1.1/creator>](http://purl.org/dc/elements/1.1/creator) | "Alan Ruttenburg" |
| 10 | [<http://purl.org/dc/elements/1.1/creator>](http://purl.org/dc/elements/1.1/creator) | "Thomas Todd" |
| 11 | [<http://purl.org/dc/elements/1.1/creator>](http://purl.org/dc/elements/1.1/creator) | "Barry Smith" |
| 12 | [<http://purl.org/dc/elements/1.1/creator>](http://purl.org/dc/elements/1.1/creator) | "Lindsay Cowell" |
| 13 | [<http://purl.org/dc/elements/1.1/creator>](http://purl.org/dc/elements/1.1/creator) | "Ningxian Fan"@en |
| 14 | [<http://purl.org/dc/elements/1.1/creator>](http://purl.org/dc/elements/1.1/creator) | "Rebecca Racz" |
| 15 | [<http://purl.org/dc/elements/1.1/creator>](http://purl.org/dc/elements/1.1/creator) | "Richard H. Scheuermann" |
| 16 | [<http://purl.org/dc/elements/1.1/creator>](http://purl.org/dc/elements/1.1/creator) | "Ronak Sutariya"@en |
| 17 | [<http://purl.org/dc/elements/1.1/creator>](http://purl.org/dc/elements/1.1/creator) | "Samantha G. Sayers (SGS)" |
| 18 | [<http://purl.org/dc/elements/1.1/creator>](http://purl.org/dc/elements/1.1/creator) | "Melanie Courtot" |
| 19 | [<http://purl.org/dc/elements/1.1/creator>](http://purl.org/dc/elements/1.1/creator) | "Omar Tibi" |
| 20 | [<http://purl.org/dc/elements/1.1/creator>](http://purl.org/dc/elements/1.1/creator) | "Yongqun "Oliver" He (YH)"@en |
| 21 | [<http://purl.org/dc/elements/1.1/creator>](http://purl.org/dc/elements/1.1/creator) | "Yu Lin (YL)"@en |
| 22 | [<http://purl.org/dc/elements/1.1/creator>](http://purl.org/dc/elements/1.1/creator) | "Zuoshuang "Allen" Xiang"@en |
| 23 | [<http://purl.org/dc/elements/1.1/date>](http://purl.org/dc/elements/1.1/date) | "May 26, 2017"@en |
| 24 | [<http://purl.org/dc/elements/1.1/description>](http://purl.org/dc/elements/1.1/description) | "The Vaccine Ontology (VO) is a biomedical ontology in the domain of vaccine and vaccination. VO aims to standardize vaccine annotation, integrate various vaccine data, and support computer-assisted reasoning. VO supports basic vaccine R&D and clincal vaccine usage. VO is initiated and primarily developed by Dr. Yongqun "Oliver" He at the University of Michigan Medical School. VO is being developed as a community-based ontology with support and collaborations from the vaccine and bio-ontology communities."@en |
| 25 | [<http://purl.org/dc/elements/1.1/format>](http://purl.org/dc/elements/1.1/format) | "OWL-DL"@en |
| 26 | [<http://purl.org/dc/elements/1.1/license>](http://purl.org/dc/elements/1.1/license) | [<http://creativecommons.org/licenses/by/3.0/>](http://creativecommons.org/licenses/by/3.0/) |
| 27 | [<http://purl.org/dc/elements/1.1/subject>](http://purl.org/dc/elements/1.1/subject) | "An ontology in the domain of vaccine and vaccination"@en |
| 28 | [<http://purl.org/dc/elements/1.1/title>](http://purl.org/dc/elements/1.1/title) | "Vaccine Ontology"@en |
| 29 | [<http://xmlns.com/foaf/0.1/homepage>](http://xmlns.com/foaf/0.1/homepage) | [<http://code.google.com/p/bfo/>](http://code.google.com/p/bfo/) |
| 30 | [<http://xmlns.com/foaf/0.1/homepage>](http://xmlns.com/foaf/0.1/homepage) | [<http://ifomis.org/bfo>](http://ifomis.org/bfo) |
| 31 | [<http://xmlns.com/foaf/0.1/mbox>](http://xmlns.com/foaf/0.1/mbox) | [<mailto:bfo-owl-devel@googlegroups.com>](mailto:bfo-owl-devel@googlegroups.com) |
| 32 | [owl:imports](http://www.w3.org/2002/07/owl#imports) | [<http://purl.obolibrary.org/obo/bfo.owl>](http://purl.obolibrary.org/obo/bfo.owl) |
| 33 | [owl:imports](http://www.w3.org/2002/07/owl#imports) | [<http://purl.obolibrary.org/obo/obcs/2017-04-29/obcs.owl>](http://purl.obolibrary.org/obo/obcs/2017-04-29/obcs.owl) |
| 34 | [owl:imports](http://www.w3.org/2002/07/owl#imports) | [<http://purl.obolibrary.org/obo/vo/external/CARO\_import.owl>](http://purl.obolibrary.org/obo/vo/external/CARO_import.owl) |
| 35 | [owl:imports](http://www.w3.org/2002/07/owl#imports) | [<http://purl.obolibrary.org/obo/vo/external/CHEBI\_import.owl>](http://purl.obolibrary.org/obo/vo/external/CHEBI_import.owl) |
| 36 | [owl:imports](http://www.w3.org/2002/07/owl#imports) | [<http://purl.obolibrary.org/obo/vo/external/DOID\_import.owl>](http://purl.obolibrary.org/obo/vo/external/DOID_import.owl) |
| 37 | [owl:imports](http://www.w3.org/2002/07/owl#imports) | [<http://purl.obolibrary.org/obo/vo/external/FMA\_import.owl>](http://purl.obolibrary.org/obo/vo/external/FMA_import.owl) |
| 38 | [owl:imports](http://www.w3.org/2002/07/owl#imports) | [<http://purl.obolibrary.org/obo/vo/external/GO\_import.owl>](http://purl.obolibrary.org/obo/vo/external/GO_import.owl) |
| 39 | [owl:imports](http://www.w3.org/2002/07/owl#imports) | [<http://purl.obolibrary.org/obo/vo/external/IAO\_import.owl>](http://purl.obolibrary.org/obo/vo/external/IAO_import.owl) |
| 40 | [owl:imports](http://www.w3.org/2002/07/owl#imports) | [<http://purl.obolibrary.org/obo/vo/external/IDO\_import.owl>](http://purl.obolibrary.org/obo/vo/external/IDO_import.owl) |
| 41 | [owl:imports](http://www.w3.org/2002/07/owl#imports) | [<http://purl.obolibrary.org/obo/vo/external/NCBITaxon\_import.owl>](http://purl.obolibrary.org/obo/vo/external/NCBITaxon_import.owl) |
| 42 | [owl:imports](http://www.w3.org/2002/07/owl#imports) | [<http://purl.obolibrary.org/obo/vo/external/OAE\_import.owl>](http://purl.obolibrary.org/obo/vo/external/OAE_import.owl) |
| 43 | [owl:imports](http://www.w3.org/2002/07/owl#imports) | [<http://purl.obolibrary.org/obo/vo/external/OBI\_import.owl>](http://purl.obolibrary.org/obo/vo/external/OBI_import.owl) |
| 44 | [owl:imports](http://www.w3.org/2002/07/owl#imports) | [<http://purl.obolibrary.org/obo/vo/external/OGG\_import.owl>](http://purl.obolibrary.org/obo/vo/external/OGG_import.owl) |
| 45 | [owl:imports](http://www.w3.org/2002/07/owl#imports) | [<http://purl.obolibrary.org/obo/vo/external/OGMS\_import.owl>](http://purl.obolibrary.org/obo/vo/external/OGMS_import.owl) |
| 46 | [owl:imports](http://www.w3.org/2002/07/owl#imports) | [<http://purl.obolibrary.org/obo/vo/external/PATO\_import.owl>](http://purl.obolibrary.org/obo/vo/external/PATO_import.owl) |
| 47 | [owl:imports](http://www.w3.org/2002/07/owl#imports) | [<http://purl.obolibrary.org/obo/vo/external/PRO\_import.owl>](http://purl.obolibrary.org/obo/vo/external/PRO_import.owl) |
| 48 | [owl:imports](http://www.w3.org/2002/07/owl#imports) | [<http://purl.obolibrary.org/obo/vo/external/RO\_import.owl>](http://purl.obolibrary.org/obo/vo/external/RO_import.owl) |
| 49 | [owl:imports](http://www.w3.org/2002/07/owl#imports) | [<http://purl.obolibrary.org/obo/vo/external/UBERON\_import.owl>](http://purl.obolibrary.org/obo/vo/external/UBERON_import.owl) |
| 50 | [owl:imports](http://www.w3.org/2002/07/owl#imports) | [<http://purl.obolibrary.org/obo/vo/external/UO\_import.owl>](http://purl.obolibrary.org/obo/vo/external/UO_import.owl) |
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