Managing Your Data Flows: Architecture and Data Provenance For Your Institution

> John Fereira Cornell University

#### **Outline:**

- Examine your data
- Clean your data

V V (

- Create local ontology extensions (optional)
- Model your data
- Load your data



#### Examine your data

### Accommodate within existing ontologies most of your data

Opt for local extensions if necessary

- Local unique identifiers (people & organizations)
- Specific needs (publication types; non-traditional scholarly outputs ...)



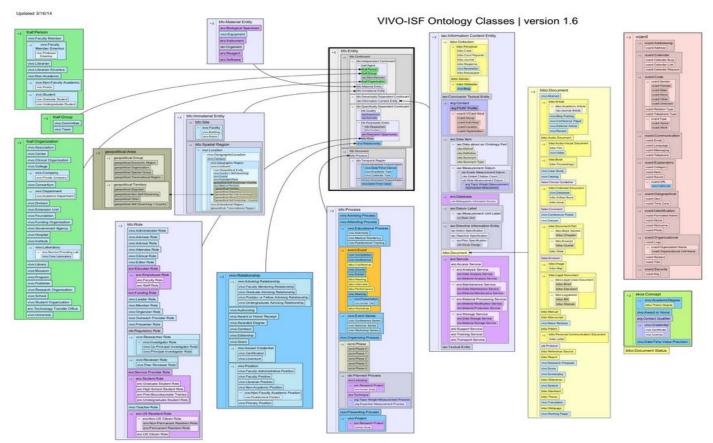
#### **Clean your data**

Utilizing local resources and skills

- polyglot programing skills (Python, Perl, XSLT, SAS, R, OpenRefine)

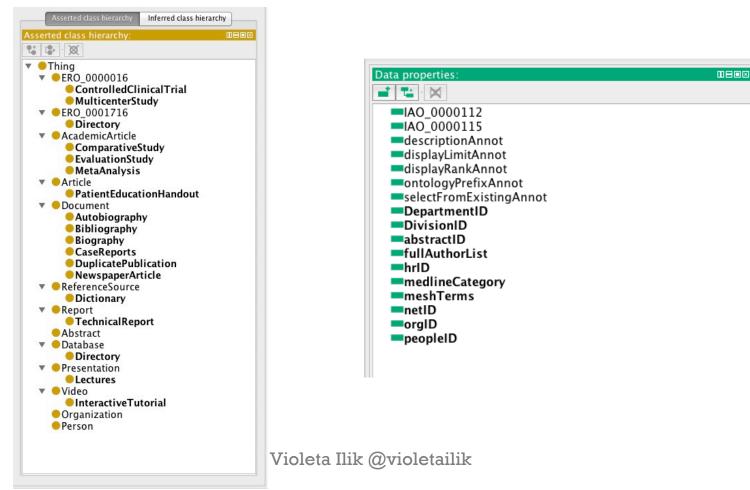
#### **Ontology: VIVO-ISF**

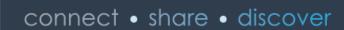
VV





#### **Ontology: local extensions**





#### Karma enables integration of:

- CSV/TSV files
- XML

VVO

- JSON
- Databases
- KML
- Web APIs



#### The modeling consists of four steps:

1.Assign Semantic Types

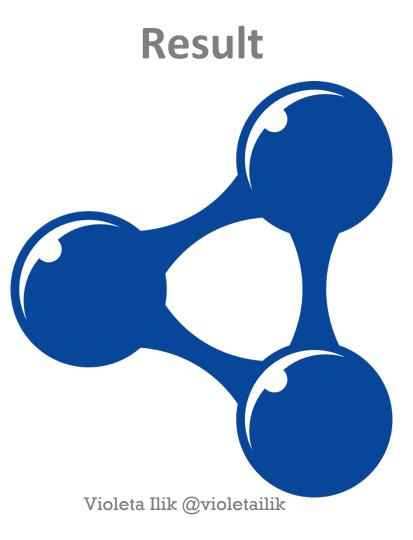
VVO

2.Constructing the Graph

3.Refine Source Model

4. Generate Formal Specification









Karma v2.033	Import -	Manage Models	Reset
Comman Import CSV File: persor	Database Using SQL From Serv From File	person	n - person.ts : person - p
Set Worksheet Properti		positio	ons - positio

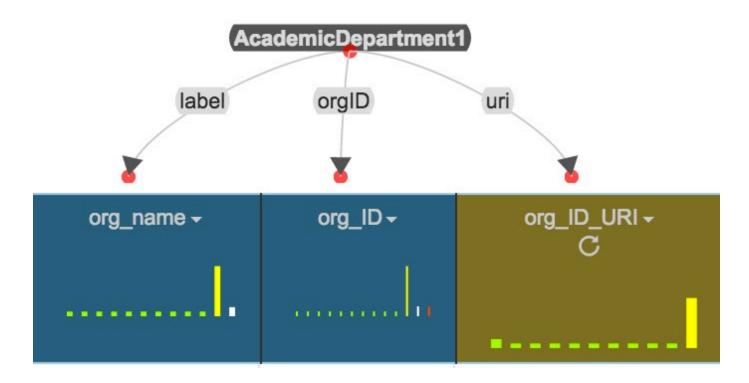


#### **Importing CSV/TSV files**

org_name <del>-</del>	org_ID <del>+</del>	org_lDuri <del>↓</del> C
<mark> </mark>	l.	I
Accounting	8b9df681	http://vivo.northwester
Aerospace Engineering	e5c84f0a	http://vivo.northwester
Agriculture Leadership Education and Communication	2d953da5	http://vivo.northwester



# Modeling organizations/units data



VVO

#### R2RML - RDB to RDF Mapping Language

"R2RML, a language for expressing customized mappings from relational databases to RDF datasets. Such mappings provide the ability to view existing relational data in the RDF data model, expressed in a structure and target vocabulary of the mapping author's choice. R2RML mappings are themselves RDF graphs and written down in Turtle syntax. R2RML enables different types of mapping implementations. Processors could, for example, offer a virtual SPARQL endpoint over the mapped relational data, or generate RDF dumps, or offer a Linked Data interface." <u>http://www.w3.org/TR/r2rml/</u>

#### **R2RML**

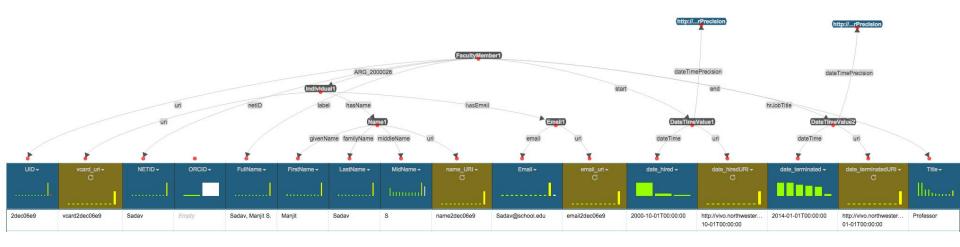
```
:node19s213a13x1 a km-dev:R2RMLMapping ;
             km-dev:sourceName "organisations - organisations.tsv" ;
             km-dev:modelPublicationTime "1438882310179"^^xsd:long;
             km-dev:modelVersion "1.7";
             km-dev:hasInputColumns "[[{\"columnName\":\"org_name\"}],[{\"columnName\":\"org_ID\"}]]";
             km-dev:hasOutputColumns "[[{\"columnName\":\"org name\"}],[{\"columnName\":\"org IDuri\"}],[{\"columnName\":\"org ID\"}]";
             km-dev:hasModelLabel "organisations - organisations.tsv";
             km-dev:hasBaseURI "http://localhost:8080/source/";
             km-dev:hasWorksheetHistory """[
\"commandName\": \"SetSemanticTypeCommand\",
\"inputParameters\": [
  {
    \"name\": \"hNodeld\",
    \"type\": \"hNodeld\",
    \"value\": [{\"columnName\": \"org name\"}]
  },
  {
    \"name\": \"worksheetId\",
    \"type\": \"worksheetId\",
    \"value\": \"W\"
  },
  {
    \"name\": \"selectionName\",
    \"type\": \"other\",
    \"value\": \"DEFAULT TEST\"
  },
    \"name\": \"SemanticTypesArray\",
    \"type\": \"other\",
    \"value\": [{
      \"DomainUri\": \"http://vivoweb.org/ontology/core#AcademicDepartment\",
      \"DomainId\": \"http://vivoweb.org/ontology/core#AcademicDepartment1\".
      \"isPrimary\": true,
                                                                   Violeta Ilik @violetailik
      \"FullType\": \"http://www.w3.org/2000/01/rdf-schema#label\",
      \"DomainLabel\": \"vivo:AcademicDepartment1 (add)\"
```

#### Workbench: organizations/units N-Triples

Subject	Predicate	Object	Context
<http: n8b9df681="" vivo.northwestern.edu=""></http:>	<http: 02="" 1999="" 22-rdf-syntax-ns#type="" www.w3.org=""></http:>	<http: core#academicdepartment="" ontology="" vivoweb.org=""></http:>	<http: -="" localhost.com="" organisations="" organisations_tsv="" vivo15="" worksheets=""></http:>
<http: n8b9df681="" vivo.northwestern.edu=""></http:>	<http: 01="" 2000="" rdf-schema#label="" www.w3.org=""></http:>	"Accounting"	<http: -="" localhost.com="" organisations="" organisations_tsv="" vivo15="" worksheets=""></http:>
<http: n8b9df681="" vivo.northwestern.edu=""></http:>	<http: ontology="" vivo.northwestern.edu="" vlocal#orgid=""></http:>	"8b9df681"	<http: -="" localhost.com="" organisations="" organisations_tsv="" vivo15="" worksheets=""></http:>
<http: ne5c84f0a="" vivo.northwestern.edu=""></http:>	<http: 02="" 1999="" 22-rdf-syntax-ns#type="" www.w3.org=""></http:>	<http: core#academicdepartment="" ontology="" vivoweb.org=""></http:>	<http: -="" localhost.com="" organisations="" organisations_tsv="" vivo15="" worksheets=""></http:>
<http: ne5c84f0a="" vivo.northwestern.edu=""></http:>	<http: 01="" 2000="" rdf-schema#label="" www.w3.org=""></http:>	"Aerospace Engineering"	<http: -="" _tsv="" localhost.com="" organisations="" vivo15="" worksheets=""></http:>
<http: ne5c84foa="" vivo.northwestern.edu=""></http:>	<http: ontology="" vivo.northwestern.edu="" vlocal#orgid=""></http:>	<u>"e5c84foa"</u>	<http: -="" _tsv="" localhost.com="" organisations="" vivo15="" worksheets=""></http:>
<http: n2d953da5="" vivo.northwestern.edu=""></http:>	<a href="http://www.w3.org/1999/02/22-rdf-syntax-ns#type">http://www.w3.org/1999/02/22-rdf-syntax-ns#type</a>	<http: core#academicdepartment="" ontology="" vivoweb.org=""></http:>	<http: -="" localhost.com="" organisations="" organisations_tsv="" vivo15="" worksheets=""></http:>
<http: n2d953da5="" vivo.northwestern.edu=""></http:>	<http: 01="" 2000="" rdf-schema#label="" www.w3.org=""></http:>	"Agriculture Leadership Education and Communication"	<http: -="" localhost.com="" organisations="" organisations_tsv="" vivo15="" worksheets=""></http:>
<http: n2d953da5="" vivo.northwestern.edu=""></http:>	<http: ontology="" vivo.northwestern.edu="" vlocal#orgid=""></http:>	<u>"2d953da5"</u>	<http: -="" localhost.com="" organisations="" organisations_tsv="" vivo15="" worksheets=""></http:>
<http: n2735b399="" vivo.northwestern.edu=""></http:>	<pre><http: 02="" 1999="" 22-rdf-syntax-ns#type="" www.w3.org=""></http:></pre>	<http: core#academicdepartment="" ontology="" vivoweb.org=""></http:>	<http: -="" _tsv="" localhost.com="" organisations="" vivo15="" worksheets=""></http:>
<http: n2735b399="" vivo.northwestern.edu=""></http:>	<http: 01="" 2000="" rdf-schema#label="" www.w3.org=""></http:>	"Animal Science"	<http: -="" _tsv="" localhost.com="" organisations="" vivo15="" worksheets=""></http:>
<http: n2735b399="" vivo.northwestern.edu=""></http:>	<http: ontology="" vivo.northwestern.edu="" vlocal#orgid=""></http:>	<u>"2735b399"</u>	<http: -="" localhost.com="" organisations="" organisations_tsv="" vivo15="" worksheets=""></http:>
<http: n26ddd99c="" vivo.northwestern.edu=""></http:>	<pre><http: 02="" 1999="" 22-rdf-syntax-ns#type="" www.w3.org=""></http:></pre>	<http: core#academicdepartment="" ontology="" vivoweb.org=""></http:>	<http: -="" _tsv="" localhost.com="" organisations="" vivo15="" worksheets=""></http:>
<http: n26ddd99c="" vivo.northwestern.edu=""></http:>	<http: 01="" 2000="" rdf-schema#label="" www.w3.org=""></http:>	"Anthropology"	<http: -="" _tsv="" localhost.com="" organisations="" vivo15="" worksheets=""></http:>
<http: n26ddd99c="" vivo.northwestern.edu=""></http:>	<http: ontology="" vivo.northwestern.edu="" vlocal#orgid=""></http:>	"26ddd99c"	<http: -="" localhost.com="" organisations="" organisations_tsv="" vivo15="" worksheets=""></http:>
<http: n3c372a44="" vivo.northwestern.edu=""></http:>	<http: 02="" 1999="" 22-rdf-syntax-ns#type="" www.w3.org=""></http:>	<http: core#academicdepartment="" ontology="" vivoweb.org=""></http:>	<http: -="" localhost.com="" organisations="" organisations_tsv="" vivo15="" worksheets=""></http:>
<http: n3c372a44="" vivo.northwestern.edu=""></http:>	<http: 01="" 2000="" rdf-schema#label="" www.w3.org=""></http:>	"Architecture"	<http: -="" localhost.com="" organisations="" organisations_tsv="" vivo15="" worksheets=""></http:>
<http: n3c372a44="" vivo.northwestern.edu=""></http:>	<http: ontology="" vivo.northwestern.edu="" vlocal#orgid=""></http:>	"30372844"	<http: -="" localhost.com="" organisations="" tsv="" vivo15="" worksheets=""></http:>



#### **Modeling the person file**





#### **Incoming-Outgoing links: Individual**

Incominç	-Outgoing Links for: Individual1				×
Incoming	Links:				
from	vivo:FacultyMember1	via	obo:ARG_2000028	Delete	Edit
-					
Outgoing I	Links:				
to	vcard:Email1	via	vcard:hasEmail	Delete	Edit
to	vcard:Name1	via	vcard:hasName	Delete	Edit

Add Incoming Link	Add Outgoing Link	Cancel	Save

#### **Workbench: person N-Triples**

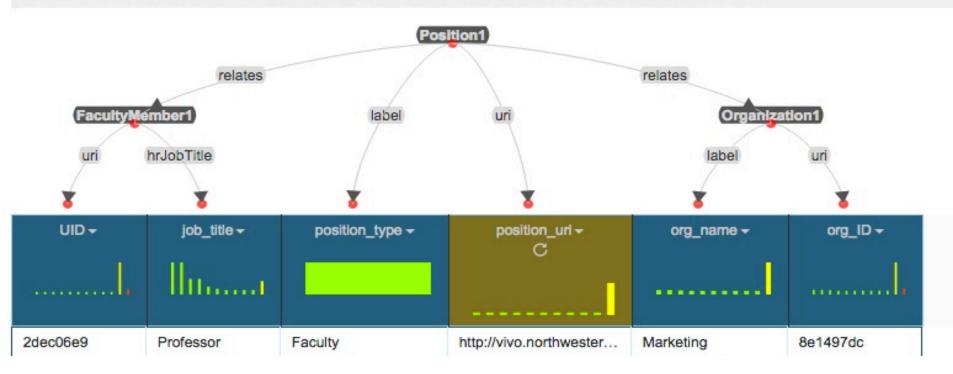
Subject	Predicate	Object	Context
<http: 2001-01-01t00:00:00="" individual="" vivo.northwestern.edu=""></http:>	<http: 02="" 1999="" 22-rdf-syntax-ns#type="" www.w3.org=""></http:>	<http: core#datetimevalue="" ontology="" vivoweb.org=""></http:>	<http: -="" localhost.com="" person="" person_tsv="" vivo15="" worksheets=""></http:>
<http: 2001-01-01t00:00:00="" individual="" vivo.northwestern.edu=""></http:>	<http: core#datetimeprecision="" ontology="" vivoweb.org=""></http:>	<http: core#yearprecision="" ontology="" vivoweb.org=""></http:>	<http: -="" localhost.com="" person="" person_tsv="" vivo15="" worksheets=""></http:>
<http: 2001-01-01t00:00:00="" individual="" vivo.northwestern.edu=""></http:>	<http: core#datetime="" ontology="" vivoweb.org=""></http:>	<u>"2001-01-01T00:00:00"</u>	<http: -="" localhost.com="" person="" person_tsv="" vivo15="" worksheets=""></http:>
<http: individual="" n2deco6e9="" vivo.northwestern.edu=""></http:>	<http: 02="" 1999="" 22-rdf-syntax-ns#type="" www.w3.org=""></http:>	<http: core#facultymember="" ontology="" vivoweb.org=""></http:>	<http: -="" localhost.com="" person="" person_tsv="" vivo15="" worksheets=""></http:>
<http: individual="" n2deco6e9="" vivo.northwestern.edu=""></http:>	<http: 01="" 2000="" rdf-schema#label="" www.w3.org=""></http:>	<u>"Sadav, Manjit S."</u>	<http: -="" localhost.com="" person="" person_tsv="" vivo15="" worksheets=""></http:>
<http: individual="" n2deco6e9="" vivo.northwestern.edu=""></http:>	<http: core#hrjobtitle="" ontology="" vivoweb.org=""></http:>	"Professor"	<http: -="" localhost.com="" person="" person_tsv="" vivo15="" worksheets=""></http:>
<http: individual="" n2deco6e9="" vivo.northwestern.edu=""></http:>	<http: core#end="" ontology="" vivoweb.org=""></http:>	<http: 2014-01-01t00:00:00="" individual="" vivo.northwestern.edu=""></http:>	<http: -="" localhost.com="" person="" tsv="" vivo15="" worksheets=""></http:>
<http: individual="" n2deco6e9="" vivo.northwestern.edu=""></http:>	<http: core#start="" ontology="" vivoweb.org=""></http:>	<http: 2000-10-01t00:00="" individual="" vivo.northwestern.edu=""></http:>	<http: -="" localhost.com="" person="" person_tsv="" vivo15="" worksheets=""></http:>
<http: individual="" n2deco6e9="" vivo.northwestern.edu=""></http:>	<http: ontology="" vivo.northwestern.edu="" vlocal#netid=""></http:>	"Sadav"	<http: -="" localhost.com="" person="" person_tsv="" vivo15="" worksheets=""></http:>
<http: individual="" n2deco6e9="" vivo.northwestern.edu=""></http:>	<http: arg_2000028="" obo="" purl.obolibrary.org=""></http:>	<http: individual="" nvcard2deco6e9="" vivo.northwestern.edu=""></http:>	<http: -="" localhost.com="" person="" person_tsv="" vivo15="" worksheets=""></http:>
<http: individual="" nc81ef444="" vivo.northwestern.edu=""></http:>	<http: 02="" 1999="" 22-rdf-syntax-ns#type="" www.w3.org=""></http:>	<http: core#facultymember="" ontology="" vivoweb.org=""></http:>	<http: -="" localhost.com="" person="" person_tsv="" vivo15="" worksheets=""></http:>



#### **Modeling the position file**

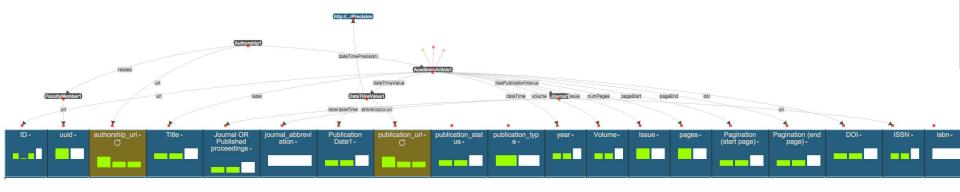
positions - positions.tsv - | R2RML Model | RDF

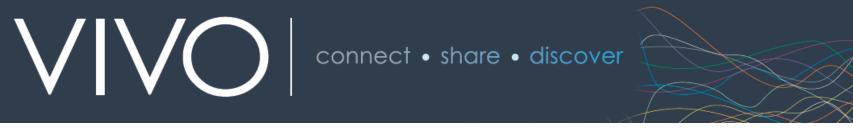
Name: positions - positions.tsv | Prefix: s | Base URI: http://vivo.northwestern.edu/individual/n



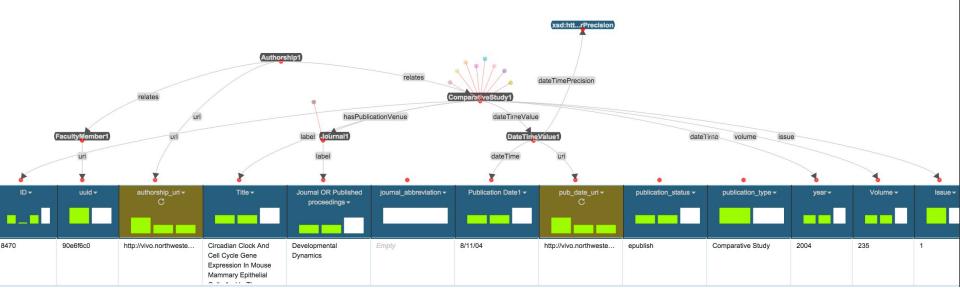


# Modeling publications data- academic articles



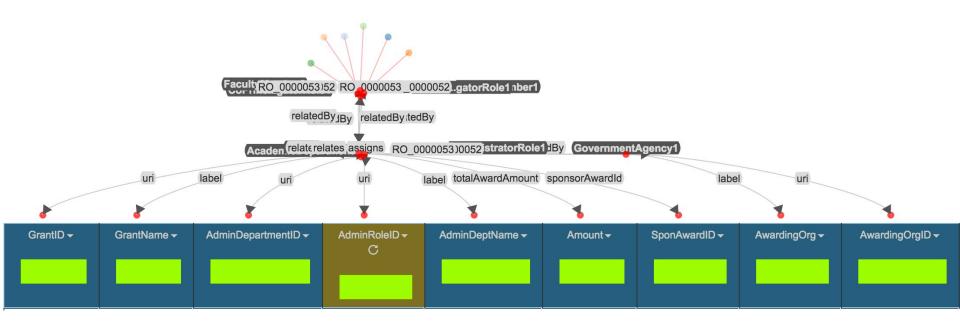


# Modeling publications data – comparative study



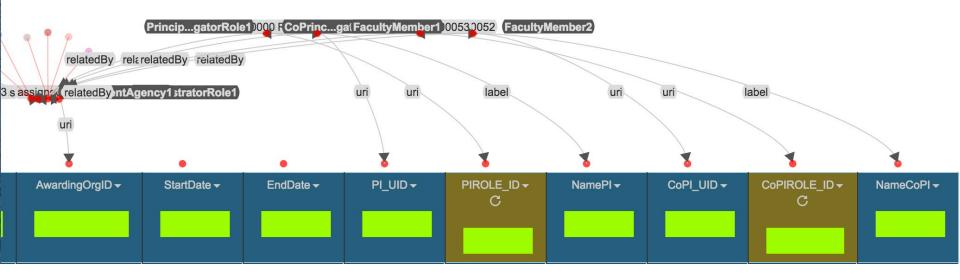


#### **Modeling grants data**





#### Modeling grants data - continued



 $\mathbf{V}\mathbf{I}\mathbf{V}$ 

#### **Modeling grants data - RDF**

<http://vivo.northwestern.edu/individual/n8e1497dc> <http://purl.obolibrary.org/obo/RO 0000053> <http://vivo.northwestern.edu/individual/n8e1497dc role> . <http://vivo.northwestern.edu/individual/n2dec06e9> <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <http://vivoweb.org/ontology/core#FacultyMember> . <http://vivo.northwestern.edu/individual/n2dec06e9> <http://vivoweb.org/ontology/core#relatedBv> <http://vivo.northwestern.edu/individual/n1440213> . <http://vivo.northwestern.edu/individual/n2dec06e9> <http://www.w3.org/2000/01/rdf-schema#label> "Sadav, Manjit S." . <http://vivo.northwestern.edu/individual/n8e1497dc\_role> <http://vivoweb.org/ontology/core#relatedBy> <http://vivo.northwestern.edu/individual/n1440213> . <http://vivo.northwestern.edu/individual/nc81ef44 role> <http://vivoweb.org/ontology/core#relatedBy> <http://vivo.northwestern.edu/individual/n1440213> . <http://vivo.northwestern.edu/individual/n1440213> <http://vivoweb.org/ontology/core#relates> <http://vivo.northwestern.edu/individual/nc81ef44> . <http://vivo.northwestern.edu/individual/n1440213> <a href="http://vivoweb.org/ontology/core#relates">http://vivo.northwestern.edu/individual/n8e1497dc">http://vivoweb.org/ontology/core#relates</a> <a href="http://vivo.northwestern.edu/individual/n8e1497dc">http://vivo.northwestern.edu/individual/n8e1497dc</a> <a href="http://viv <http://vivo.northwestern.edu/individual/n2dec06e9 role> <http://vivoweb.org/ontology/core#relatedBy> <http://vivo.northwestern.edu/individual/n1440213> . <http://vivo.northwestern.edu/individual/n1440213> <http://www.w3.org/2000/01/rdf-schema#label> "Example VIVO Grant" . <http://vivo.northwestern.edu/individual/nc81ef44> <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <http://vivoweb.org/ontology/core#FacultyMember> . <http://vivo.northwestern.edu/individual/n2dec06e9 role> <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <http://vivoweb.org/ontology/core#PrincipalInvestigatorRole> <http://vivo.northwestern.edu/individual/n1440213> <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <http://vivoweb.org/ontology/core#Grant> . <http://vivo.northwestern.edu/individual/norq194fe9> <http://www.w3.orq/1999/02/22-rdf-syntax-ns#type> <http://vivoweb.org/ontology/core#GovernmentAgency> . <http://vivo.northwestern.edu/individual/nc81ef44> <http://purl.obolibrary.org/obo/RO 0000053> <http://vivo.northwestern.edu/individual/nc81ef44 role> . <http://vivo.northwestern.edu/individual/norg194fe9> <http://vivoweb.org/ontology/core#assigns> <http://vivo.northwestern.edu/individual/n1440213> . <http://vivo.northwestern.edu/individual/n1440213> <http://vivoweb.org/ontology/core#sponsorAwardId> "ICER-1440213" . <http://vivo.northwestern.edu/individual/n1440213> <http://vivoweb.org/ontology/core#totalAwardAmount> "123456" . <http://vivo.northwestern.edu/individual/n8e1497dc role> <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <http://vivoweb.org/ontology/core#AdministratorRole> . <http://vivo.northwestern.edu/individual/n8e1497dc role> <http://purl.obolibrary.org/obo/RO 0000052> <http://vivo.northwestern.edu/individual/n8e1497dc> . <http://vivo.northwestern.edu/individual/n1440213> <a href="http://vivoweb.org/ontology/core#relates">http://vivo.northwestern.edu/individual/n2dec06e9</a> or <http://vivo.northwestern.edu/individual/n1440213> <a href="http://vivoweb.org/ontology/core#relates">http://vivo.northwestern.edu/individual/n2dec06e9></a>. <http://vivo.northwestern.edu/individual/n8e1497dc> <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <http://vivoweb.org/ontology/core#AcademicDepartment> . <http://vivo.northwestern.edu/individual/n2dec06e9 role> <http://purl.obolibrary.org/obo/R0 0000052> <http://vivo.northwestern.edu/individual/n2dec06e9> . <http://vivo.northwestern.edu/individual/nc81ef44 role> <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <http://vivoweb.org/ontology/core#CoPrincipalInvestigatorRole> <http://vivo.northwestern.edu/individual/nc81ef44> <http://vivoweb.org/ontology/core#relatedBy> <http://vivo.northwestern.edu/individual/n1440213> . <http://vivo.northwestern.edu/individual/n2dec06e9> <http://purl.obolibrary.org/obo/R0 0000053> <http://vivo.northwestern.edu/individual/n2dec06e9 role> . <http://vivo.northwestern.edu/individual/nc8lef44 role> <http://purl.obolibrary.org/obo/R0 0000052> <http://vivo.northwestern.edu/individual/nc8lef44> . <http://vivo.northwestern.edu/individual/n8e1497dc> <http://www.w3.org/2000/01/rdf-schema#label> "Marketing" . <http://vivo.northwestern.edu/individual/nc81ef44> <http://www.w3.org/2000/01/rdf-schema#label> "German, Mindy E." . <http://vivo.northwestern.edu/individual/n1440213> <http://vivoweb.org/ontology/core#assignedBy> <http://vivo.northwestern.edu/individual/norg194fe9> . <http://vivo.northwestern.edu/individual/norg194fe9> <http://www.w3.org/2000/01/rdf-schema#label> "National Science Foundation" . <http://vivo.northwestern.edu/individual/n1440213> <http://vivoweb.org/ontology/core#relates> <http://vivo.northwestern.edu/individual/nc81ef44 role> .

#### **Workbench: grants N-Triples**

Subject	Predicate	Object
<http: individual="" n2dec06e9="" vivo.northwestern.edu=""></http:>	<a href="http://www.w3.org/1999/02/22-rdf-syntax-ns#type">http://www.w3.org/1999/02/22-rdf-syntax-ns#type</a>	<http: core#facultymember="" ontology="" vivoweb.org=""></http:>
<http: individual="" n2deco6e9="" vivo.northwestern.edu=""></http:>	<http: 01="" 2000="" rdf-schema#label="" www.w3.org=""></http:>	"Sadav, Manjit S."
<http: individual="" n2deco6e9="" vivo.northwestern.edu=""></http:>	<http: core#relatedby="" ontology="" vivoweb.org=""></http:>	<http: individual="" n1440213="" vivo.northwestern.edu=""></http:>
<http: individual="" n2deco6e9="" vivo.northwestern.edu=""></http:>	<http: obo="" purl.obolibrary.org="" ro_000053=""></http:>	<http: individual="" n2deco6e9_role="" vivo.northwestern.edu=""></http:>
<http: individual="" n8e1497dc="" vivo.northwestern.edu=""></http:>	<a href="http://www.w3.org/1999/02/22-rdf-syntax-ns#type">http://www.w3.org/1999/02/22-rdf-syntax-ns#type</a>	<http: core#academicdepartment="" ontology="" vivoweb.org=""></http:>
<http: individual="" n8e1497dc="" vivo.northwestern.edu=""></http:>	<http: 01="" 2000="" rdf-schema#label="" www.w3.org=""></http:>	"Marketing"
<http: individual="" n8e1497dc="" vivo.northwestern.edu=""></http:>	<http: obo="" purl.obolibrary.org="" ro_0000053=""></http:>	<http: individual="" n8e1497dc_role="" vivo.northwestern.edu=""></http:>
<http: individual="" n8e1497dc_role="" vivo.northwestern.edu=""></http:>	<a href="http://www.w3.org/1999/02/22-rdf-syntax-ns#type">http://www.w3.org/1999/02/22-rdf-syntax-ns#type</a>	<http: core#administratorrole="" ontology="" vivoweb.org=""></http:>
<http: individual="" n8e1497dc_role="" vivo.northwestern.edu=""></http:>	<http: core#relatedby="" ontology="" vivoweb.org=""></http:>	<http: individual="" n1440213="" vivo.northwestern.edu=""></http:>
<http: individual="" n8e1497dc_role="" vivo.northwestern.edu=""></http:>	<http: obo="" purl.obolibrary.org="" ro_0000052=""></http:>	<http: individual="" n8e1497dc="" vivo.northwestern.edu=""></http:>
<http: individual="" n1440213="" vivo.northwestern.edu=""></http:>	<http: core#relates="" ontology="" vivoweb.org=""></http:>	<http: individual="" n2deco6e9="" vivo.northwestern.edu=""></http:>
<http: individual="" n1440213="" vivo.northwestern.edu=""></http:>	<http: core#relates="" ontology="" vivoweb.org=""></http:>	<http: individual="" n8e1497dc_role="" vivo.northwestern.edu=""></http:>
<http: individual="" n1440213="" vivo.northwestern.edu=""></http:>	<http: core#relates="" ontology="" vivoweb.org=""></http:>	<http: individual="" nc81ef44_role="" vivo.northwestern.edu=""></http:>
<http: individual="" n1440213="" vivo.northwestern.edu=""></http:>	<http: core#relates="" ontology="" vivoweb.org=""></http:>	<http: individual="" nc81ef44="" vivo.northwestern.edu=""></http:>
<a href="http://vivo.northwestern.edu/individual/n1440213">http://vivo.northwestern.edu/individual/n1440213</a>	<http: core#relates="" ontology="" vivoweb.org=""></http:>	<http: individual="" n2deco6e9_role="" vivo.northwestern.edu=""></http:>
<http: individual="" n1440213="" vivo.northwestern.edu=""></http:>	<a href="http://www.w3.org/1999/02/22-rdf-syntax-ns#type">http://www.w3.org/1999/02/22-rdf-syntax-ns#type</a>	<http: core#grant="" ontology="" vivoweb.org=""></http:>
<http: individual="" n1440213="" vivo.northwestern.edu=""></http:>	<http: 01="" 2000="" rdf-schema#label="" www.w3.org=""></http:>	"Example VIVO Grant"
<http: individual="" n1440213="" vivo.northwestern.edu=""></http:>	<http: core#assignedby="" ontology="" vivoweb.org=""></http:>	<http: individual="" norg194fe9="" vivo.northwestern.edu=""></http:>
<a href="http://vivo.northwestern.edu/individual/n1440213">http://vivo.northwestern.edu/individual/n1440213</a>	<http: core#sponsorawardid="" ontology="" vivoweb.org=""></http:>	<u>"ICER-1440213"</u>
<a href="http://vivo.northwestern.edu/individual/n1440213">http://vivo.northwestern.edu/individual/n1440213</a>	<http: core#totalawardamount="" ontology="" vivoweb.org=""></http:>	"123456"
<http: individual="" nc81ef44_role="" vivo.northwestern.edu=""></http:>	<a href="http://www.w3.org/1999/02/22-rdf-syntax-ns#type">http://www.w3.org/1999/02/22-rdf-syntax-ns#type</a>	<http: core#coprincipalinvestigatorrole="" ontology="" vivoweb.org=""></http:>
<a href="http://vivo.northwestern.edu/individual/nc81ef44_role&gt;">http://vivo.northwestern.edu/individual/nc81ef44_role&gt;"&gt;http://vivo.northwest</a>	<http: core#relatedby="" ontology="" vivoweb.org=""></http:>	<http: individual="" n1440213="" vivo.northwestern.edu=""></http:>
<a href="http://vivo.northwestern.edu/individual/nc81ef44_role&gt;">http://vivo.northwestern.edu/individual/nc81ef44_role&gt;"&gt;http://vivo.northwest</a>	<http: obo="" purl.obolibrary.org="" ro_0000052=""></http:>	<http: individual="" nc81ef44="" vivo.northwestern.edu=""></http:>
<a href="http://vivo.northwestern.edu/individual/nc81ef44&gt;">http://vivo.northwestern.edu/individual/nc81ef44&gt;</a>	<a href="http://www.w3.org/1999/02/22-rdf-syntax-ns#type">http://www.w3.org/1999/02/22-rdf-syntax-ns#type</a>	<http: core#facultymember="" ontology="" vivoweb.org=""></http:>
<a href="http://vivo.northwestern.edu/individual/nc81ef44&gt;">http://vivo.northwestern.edu/individual/nc81ef44&gt;</a>	<http: 01="" 2000="" rdf-schema#label="" www.w3.org=""></http:>	"German, Mindy E."
<a href="http://vivo.northwestern.edu/individual/nc81ef44&gt;">http://vivo.northwestern.edu/individual/nc81ef44&gt;</a>	<http: core#relatedby="" ontology="" vivoweb.org=""></http:>	<http: individual="" n1440213="" vivo.northwestern.edu=""></http:>
<http: individual="" nc81ef44="" vivo.northwestern.edu=""></http:>	<http: obo="" purl.obolibrary.org="" ro_000053=""></http:>	<http: individual="" nc81ef44_role="" vivo.northwestern.edu=""></http:>
<http: individual="" n2deco6e9_role="" vivo.northwestern.edu=""></http:>	<a href="http://www.w3.org/1999/02/22-rdf-syntax-ns#type">http://www.w3.org/1999/02/22-rdf-syntax-ns#type</a>	<http: core#principalinvestigatorrole="" ontology="" vivoweb.org=""></http:>
<http: individual="" n2deco6e9_role="" vivo.northwestern.edu=""></http:>	<http: core#relatedby="" ontology="" vivoweb.org=""></http:>	<a href="http://vivo.northwestern.edu/individual/n1440213&gt;">http://vivo.northwestern.edu/individual/n1440213&gt;</a>
<a href="http://vivo.northwestern.edu/individual/n2deco6e9_role&gt;">http://vivo.northwestern.edu/individual/n2deco6e9_role&gt;"&gt;http://vivo.northwestern.edu/individual/n2</a>	<http: obo="" purl.obolibrary.org="" ro_000052=""></http:>	<http: individual="" n2deco6e9="" vivo.northwestern.edu=""></http:>
<a href="http://vivo.northwestern.edu/individual/norg194fe9&gt;">http://vivo.northwestern.edu/individual/norg194fe9&gt;"&gt;http://vivo.northwestern.edu/individual/norg194fe9"&gt;http://vivo.northwestern.edu/individual/norg194fe9</a> ">http://vivo.northwestern.edu/individual/norg194fe9">http://vivo.northwestern.edu/individual/norg194fe9">http://vivo.northwestern.edu/individual/norg194fe9">http://vivo.northwestern.edu/individual/norg194fe9">http://vivo.northwestern.edu/individual/norg194fe9">http://vivo.northwesterna/norg194fe9">http://vivo.north	<http: 02="" 1999="" 22-rdf-syntax-ns#type="" www.w3.org=""></http:>	<a href="http://vivoweb.org/ontology/core#GovernmentAgency&gt;">http://vivoweb.org/ontology/core#GovernmentAgency&gt;"&gt;http://vivoweb.org/ontology/core#GovernmentAgency"&gt;http://vivoweb.org/ontology/core#GovernmentAgency&gt;"&gt;http://vivoweb.org/ontology/core#GovernmentAgency</a> ">http://vivoweb.org/ontology/core#GovernmentAgency">http://vivoweb.corg/ontology/core#GovernmentAgency
<a href="http://vivo.northwestern.edu/individual/norg194fe9&gt;">http://vivo.northwestern.edu/individual/norg194fe9&gt;"&gt;http://vivo.northwestern.edu/individual/norg194fe9"&gt;http://vivo.northwestern.edu/individual/norg194fe9</a> ">http://vivo.northwestern.edu/individual/norg194fe9">http://vivo.northwestern.edu/individual/norg194fe9">http://vivo.northwestern.edu/individual/norg194fe9">http://vivo.northwestern.edu/individual/norg194fe9">http://vivo.northwestern.edu/individual/norg194fe9">http://vivo.northwesterna/norg194fe9">http://vivo.north	<http: 01="" 2000="" rdf-schema#label="" www.w3.org=""></http:>	"National Science Foundation"
<a href="http://vivo.northwestern.edu/individual/norg194fe9&gt;">http://vivo.northwestern.edu/individual/norg194fe9&gt;</a>	<http: core#assigns="" ontology="" vivoweb.org=""></http:>	<http: individual="" n1440213="" vivo.northwestern.edu=""></http:>



#### **Workbench: PI role N-Triples**

Subject	Predicate	Object
<http: individual="" n2deco6e9_role="" vivo.northwestern.edu=""></http:>	<a href="http://www.w3.org/1999/02/22-rdf-syntax-">http://www.w3.org/1999/02/22-rdf-syntax-</a>	<http: core#principalinvestigatorrole="" ontology="" vivoweb.org=""></http:>
· 이상 가지 않는 것은 다 가지 않는 것이 있었던 것이 가지 않는 것이 있는 것이 있었다. 또 가지 않는 것이 있는 것이 있다. 또 	<u>ns#type&gt;</u>	n de la factoria de la companya de l
<a href="http://vivo.northwestern.edu/individual/n2deco6e9_role&gt;">http://vivo.northwestern.edu/individual/n2deco6e9_role&gt;"&gt;http://vivo.northwestern.edu/individual/n2</a>	<a href="http://www.w3.org/1999/02/22-rdf-syntax-">http://www.w3.org/1999/02/22-rdf-syntax-</a>	<http: core#principalinvestigatorrole="" ontology="" vivoweb.org=""></http:>
	<u>ns#type&gt;</u>	
<a href="http://vivo.northwestern.edu/individual/n2deco6e9_role&gt;">http://vivo.northwestern.edu/individual/n2deco6e9_role&gt;"&gt;http://vivo.northwestern.edu/individual/n2</a>	<http: core#relatedby="" ontology="" vivoweb.org=""></http:>	<a href="http://vivo.northwestern.edu/individual/n1440213&gt;">http://vivo.northwestern.edu/individual/n1440213&gt;</a>
<a href="http://vivo.northwestern.edu/individual/n2deco6e9_role&gt;">http://vivo.northwestern.edu/individual/n2deco6e9_role&gt;"&gt;http://vivo.northwestern.edu/individual/n2</a>	<http: core#relatedby="" ontology="" vivoweb.org=""></http:>	<a href="http://vivo.northwestern.edu/individual/n1440213">http://vivo.northwestern.edu/individual/n1440213</a>
<http: individual="" n2deco6e9_role="" vivo.northwestern.edu=""></http:>	<a href="http://purl.obolibrary.org/obo/RO_0000052&gt;">http://purl.obolibrary.org/obo/RO_000052&gt;</a>	<a href="http://vivo.northwestern.edu/individual/n2deco6e9">http://vivo.northwestern.edu/individual/n2deco6e9</a>
<http: individual="" n2deco6e9_role="" vivo.northwestern.edu=""></http:>	<a href="http://purl.obolibrary.org/obo/RO_0000052&gt;">http://purl.obolibrary.org/obo/RO_000052&gt;</a>	<a href="http://vivo.northwestern.edu/individual/n2dec06e9">http://vivo.northwestern.edu/individual/n2dec06e9</a>
<a href="http://vivo.northwestern.edu/individual/n2deco6e9">http://vivo.northwestern.edu/individual/n2deco6e9</a>	<a href="http://purl.obolibrary.org/obo/RO_0000053&gt;">http://purl.obolibrary.org/obo/RO_000053&gt;</a>	<http: individual="" n2dec06e9_role="" vivo.northwestern.edu=""></http:>
<a href="http://vivo.northwestern.edu/individual/n2deco6e9">http://vivo.northwestern.edu/individual/n2deco6e9</a>	<a href="http://purl.obolibrary.org/obo/RO_0000053&gt;">http://purl.obolibrary.org/obo/RO_0000053&gt;</a>	<a href="http://vivo.northwestern.edu/individual/n2deco6e9_role&gt;">http://vivo.northwestern.edu/individual/n2deco6e9_role&gt;"&gt;http://vivo.northwestern.edu/individual/n2</a>
<a href="http://vivo.northwestern.edu/individual/n1440213">http://vivo.northwestern.edu/individual/n1440213</a>	<http: core#relates="" ontology="" vivoweb.org=""></http:>	<a href="http://vivo.northwestern.edu/individual/n2dec06e9_role&gt;">http://vivo.northwestern.edu/individual/n2dec06e9_role&gt;"&gt;http://vivo.northwestern.edu/individual/n2</a>
<a href="http://vivo.northwestern.edu/individual/n1440213&gt;">http://vivo.northwestern.edu/individual/n1440213&gt;</a>	<http: core#relates="" ontology="" vivoweb.org=""></http:>	<http: individual="" n2dec06e9_role="" vivo.northwestern.edu=""></http:>



#### **References:**

- <a href="https://github.com/vioil/ontology\_extensions">https://github.com/vioil/ontology\_extensions</a>
- •<u>https://github.com/vioil/DataPropeties-id</u>
- •<u>https://github.com/vioil/R2RML-Karma</u>
- <u>https://www.youtube.com/channel/</u> <u>UCb9vsw2XvZDzZtEwe0aH9eA</u>
- <u>http://www.isi.edu/integration/karma/</u>

VVO

### Thank you Violeta Ilik

Galter Health Sciences Library Feinberg School of Medicine Northwestern University Clinical and Translational Sciences Institute (NUCATS), Chicago, IL <u>https://galter.northwestern.edu/staff/Violeta-Ilik</u> <u>http://vivo.vivoweb.org/display/n10603</u>

(D) http://orcid.org/0000-0003-2588-3084