Special Issue with Formalization Papers at Data Science Journal

Guidelines for Authors

Let's publish scientific claims in formal logic!

> **Obesity when accompanied by metabolic abnormality is closely associated with knee osteoarthritis.**

CONTEXT-CLASS ("in the context of all ..."): **Person**

SUBJECT-CLASS ("things of type ..."): **Obesity together with metabolic abnormality**

QUALIFIER: **generally***

RELATION-TYPE ("have a relation of type..."): **co-occurs with**

OBJECT-CLASS ("to things of type..."): **Knee osteoarthritis**

* this qualifier was changed to "frequently" in a new version

How can we represent high-level claims?

- Using the SuperPattern ontology

SuperPattern Ontology

Authors:
https://orcid.org/0000-0002-1267-0234
https://orcid.org/0000-0002-7114-6459

Download serialization:
Format JSON LD   Format RDF/XML   Format N Triples   Format TTL

License:
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Cite as:
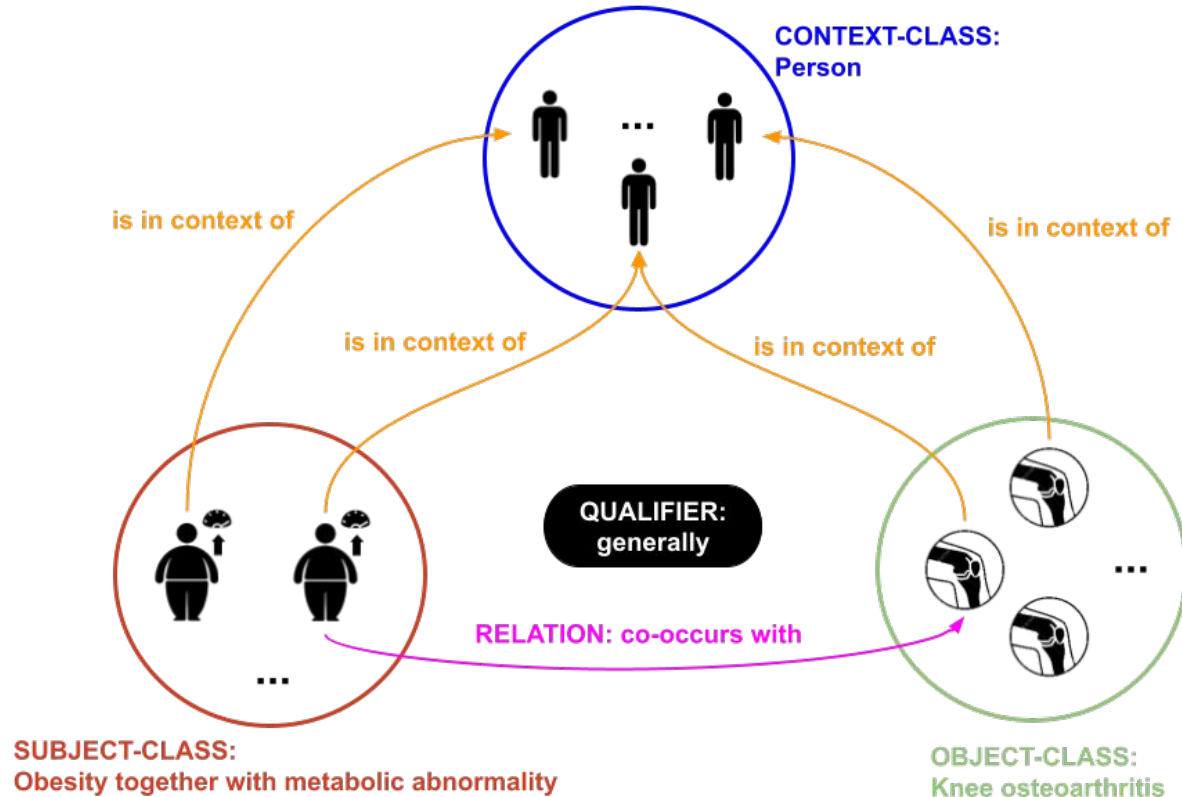https://orcid.org/0000-0002-1267-0234,https://orcid.org/0000-0002-7114-6459. SuperPattern Ontology.
Provenance of this page

SuperPattern interpretation

Informally:

Every thing of type **obesity together with metabolic abnormality** that is in the context of a thing of type **person generally*** (in at least 90% of the cases) has a relation of type "**co-occurs with**" to a thing of type **knee osteoarthritis** that is in the same context.

* this qualifier was changed to "frequently" (in at least 10% of the cases) in a new version

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Publishing such claims as nanopublications

```
@prefix this: <http://purl.org/np/RAc5YYnYevWeUd1igtqMi_eKGVhxVj7IBZ9mTY8-aCNlI> .
@prefix sub: <http://purl.org/np/RAc5YYnYevWeUd1igtqMi_eKGVhxVj7IBZ9mTY8-aCNlI#> .
@prefix np: <http://www.nanopub.org/nschema#> .
@prefix dct: <http://purl.org/dc/terms/> .
@prefix nt: <https://w3id.org/np/o/ntemplate/> .
@prefix npx: <http://purl.org/nanopub/x/> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .
@prefix orcid: <https://orcid.org/> .
@prefix prov: <http://www.w3.org/ns/prov#> .
@prefix sp: <https://w3id.org/linkflows/superpattern/terms/> .
```

```
sub:Head {
  this: np:hasAssertion sub:assertion ;
    np:hasProvenance sub:provenance ;
    np:hasPublicationInfo sub:pubinfo ;
    a np:Nanopublication .
}
```

```
sub:assertion {
  sub:spi a sp:SuperPatternInstance ;
    sp:hasContextClass <http://www.wikidata.org/entity/Q5> ;
    sp:hasObjectClass <http://www.wikidata.org/entity/Q1777118> ;
    sp:hasQualifier sp:generallyQualifier ;
    sp:hasRelation sp:cooccursWith ;
    sp:hasSubjectClass <http://purl.org/np/RAVYczMihUbgryLu1x8xhoqR6LQe4fSoWmF3SCQHfR5xE#obesity-with-metabolic-abnormality> .
}
```

```
sub:provenance {
  sub:assertion prov:wasDerivedFrom <https://doi.org/10.3109/14397595.2014.939393> .
}
```

```
sub:pubinfo {
  sub:sig npx:hasAlgorithm "RSA" ;
    npx:hasPublicKey
"MIGfMA0GCSqGSIb3DQEBAQUAA4GNADCBiQKBgQCJlM78d80R+gFMoQB1IG3f7AbqqGOCIv4HmZd1cx1KgEWMUUpPsojFNvx84fC/TltcJ8F8JafnbhDXW2HM2MhdK4yC04ROEV1\
;
    npx:hasSignature "YXzdgk7n75OhzaHpiJr7LW0T3PdUct5kBsEUDI+TiWEv8ZyH3bx4O6MRD6VxuGey0i2V+2/tSHmkc
/2P/MdbR9HqNxG8z7VXhsO7BjtYCF+MnNUFz1YlHj+gON9NyK9pFJwA2US1zkHl/CiTfKbO1hx+fwvN4eF5Yw4ykGyzEVE=" ;
    npx:hasSignatureTarget this: .
  this: dct:created "2021-05-07T15:35:00.337+03:00"^^xsd:dateTime ;
    dct:creator orcid:0000-0002-7114-6459 ;
    npx:introduces sub:spi ;
    npx:supersedes <http://purl.org/np/RA6Lpsa8P2nPzCY7ukUtnrYRlRtyFD1G6QVu8fgHJLxD0> ;
    nt:wasCreatedFromProvenanceTemplate <http://purl.org/np/RAcTpoh5Ra0ssqmcpOgWdaZ_YiPE6demO6cpw-2RvSNs8> ;
    nt:wasCreatedFromPubinfoTemplate <http://purl.org/np/RAA2MfqdBCzmz9yVWjKLXNbyfBNcwsMmOqcNUxkk1maIM> , <http://purl.org
/np/RAjpBMlw3owYhJUBo3DtsuDlXsNAJ8cnGeWAutDVjuAuI> ;
    nt:wasCreatedFromTemplate <http://purl.org/np/RAiL1AYhAZIPmCs9YXC8QaQl7rcMcnyeedEAPTi_BZR9Y> .
}
```

5

Publishing such claims as nanopublications

```
@prefix this: <http://purl.org/np/RAc5YYnYevWeUd1igtqMi_eKGVhxVj7IBZ9mTY8-aCNlI> .
@prefix sub: <http://purl.org/np/RAc5YYnYevWeUd1igtqMi_eKGVhxVj7IBZ9mTY8-aCNlI#> .
@prefix np: <http://www.nanopub.org/nschema#> .
@prefix dct: <http://purl.org/dc/terms/> .
@prefix nt: <https://w3id.org/np/o/ntemplate/> .
@prefix npx: <http://purl.org/nanopub/x/> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .
@prefix orcid: <https://orcid.org/> .
@prefix prov: <http://www.w3.org/ns/prov#> .
@prefix sp: <https://w3id.org/linkflows/superpattern/terms/> .

sub:Head {
  this: np:hasAssertion sub:assertion ;
    np:hasProvenance sub:provenance ;
    np:hasPublicationInfo sub:pubinfo ;
    a np:Nanopublication .
}

sub:assertion {
  sub:spi a sp:SuperPatternInstance ;
    sp:hasContextClass <http://www.wikidata.org/entity/Q5> ;
    sp:hasObjectClass <http://www.wikidata.org/entity/Q1777118> ;
    sp:hasQualifier sp:generallyQualifier ;
    sp:hasRelation sp:cooccursWith ;
    sp:hasSubjectClass <http://purl.org/np/RAVYczMihUbgryLu1x8xhoqR6LQe4fSoWmF3SCQHfR5xE#obesity-with-metabolic-abnormality> .
}

sub:provenance {
  sub:assertion prov:wasDerivedFrom <https://doi.org/10.3109/14397595.2014.939393> .
}

sub:pubinfo {
  sub:sig npx:hasAlgorithm "RSA" ;
    npx:hasPublicKey
"MIGfMA0GCSqGSIb3DQEBAQUAA4GNADCBiQKBgQCJlM78d80R+gFMoQB1IG3f7AbqqGOCIv4HmZd1cx1KgEWMUUpPsojFNvx84fC/TltcJ8F8JafnbhDXW2HM2MhdK4yC04ROEV1\
;
    npx:hasSignature "YXzdgk7n75OhzaHpiJr7LW0T3PdUct5kBsEUDI+TiWEv8ZyH3bx4O6MRD6VxuGey0i2V+2/tSHmkc
/2P/MdbR9HqNxG8z7VXhsO7BjtYCF+MnNUFz1YlHj+gON9NyK9pFJwA2US1zkHl/CiTfKbO1hx+fwvN4eF5Yw4ykGyzEVE=" ;
    npx:hasSignatureTarget this: .
  this: dct:created "2021-05-07T15:35:00.337+03:00"^^xsd:dateTime ;
    dct:creator orcid:0000-0002-7114-6459 ;
    npx:introduces sub:spi ;
    npx:supersedes <http://purl.org/np/RA6Lpsa8P2nPzCY7ukUtnrYRlRtyFD1G6QVu8fgHJLxD0> ;
    nt:wasCreatedFromProvenanceTemplate <http://purl.org/np/RAcTpoh5Ra0ssqmcpOgWdaZ_YiPE6demO6cpw-2RvSNs8> ;
    nt:wasCreatedFromPubinfoTemplate <http://purl.org/np/RAA2MfqdBCzmz9yVWjKLXNbyfBNcwsMmOqcNUxkk1maIM> , <http://purl.org
/np/RAjpBMlw3owYhJUBo3DtsuDlXsNAJ8cnGeWAutDVjuAuI> ;
    nt:wasCreatedFromTemplate <http://purl.org/np/RAiL1AYhAZIPmCs9YXC8QaQl7rcMcnyeedEAPTi_BZR9Y> .
}
```

Publishing such claims as nanopublications

```
sub:assertion {
  sub:spi a sp:SuperPatternInstance ;
    sp:hasContextClass <http://www.wikidata.org/entity/Q5> ;
    sp:hasObjectClass <http://www.wikidata.org/entity/Q1777118> ;
    sp:hasQualifier sp:generallyQualifier ;
    sp:hasRelation sp:cooccursWith ;
    sp:hasSubjectClass <http://purl.org/np/RAVYczMihUbgryLu1x8xhoqR6LQe4fSoWmF3SCQHfR5xE#obesity-with-metabolic-abnormality> .
}
```

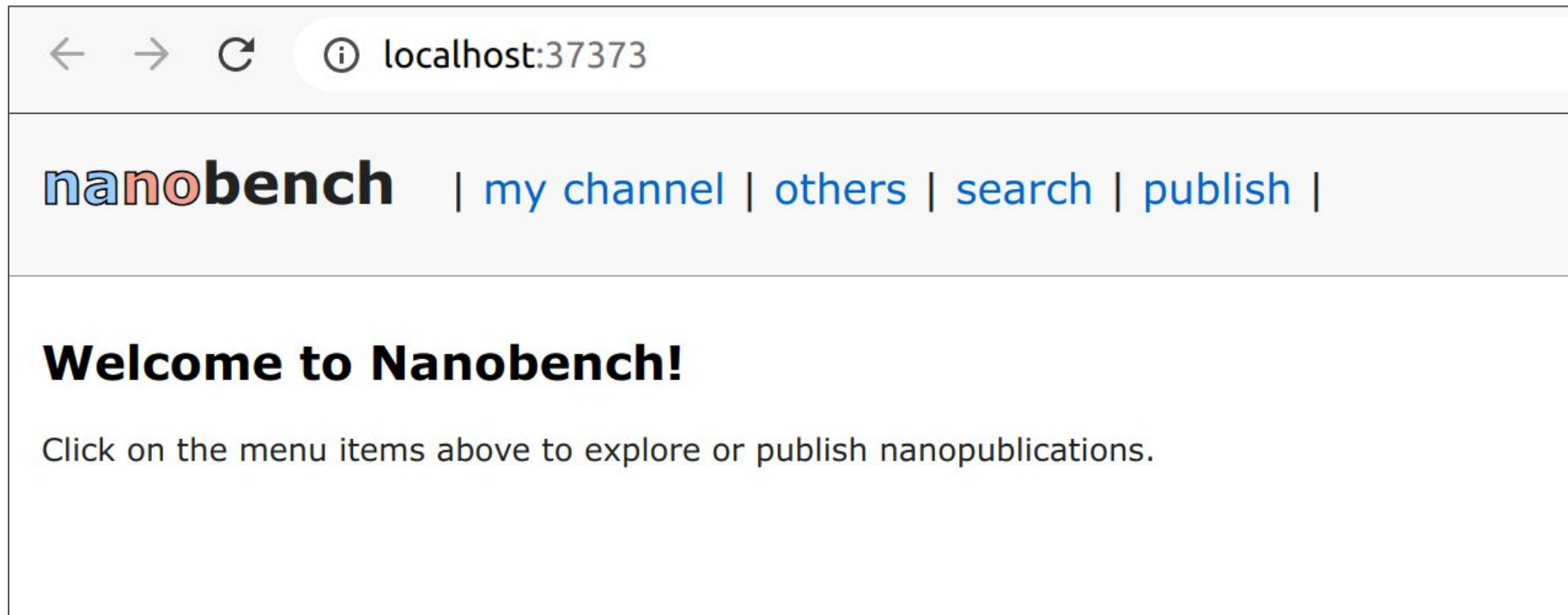|	
CONTEXT-CLASS ("in the context of all ..."):	**Person**
SUBJECT-CLASS ("things of type ..."):	**Obesity together with metabolic abnormality**
QUALIFIER:	**generally***
RELATION-TYPE ("have a relation of type..."):	**co-occurs with**
OBJECT-CLASS ("to things of type..."):	**Knee osteoarthritis**

* this qualifier was changed to "frequently" in a new version

Nanobench: user interface for publishing nanopublications

Task 1: Set up Nanobench (*now*)

- [Nanobench installation instructions](#)

- [Nanobench installation instructions with Docker](#)

Formalization paper

- A paper consisting of RDF statements that express a single scientific claim

- The scientific claim is from an existing publication

- Written with deep formal semantics from the start

- Contains a formalization of the scientific claim

- Peer-reviewed in RDF

- Same bibliometric status as a classic scientific paper (with DOIs, etc.)

Super-pattern template in Nanobench

Nanobench → Publish → Expressing a general claim with a super-pattern:

Assertion: Expressing a general claim with a super-pattern ^ (change)

SPI: This is a super-pattern instance .

SPI: In the context of all things of type [URI of the context class   ▼] .

SPI: ... things of type [URI of the subject class (A)   ▼] .

SPI: ... (qualifier) [URI of the qualifier   ▼] .

SPI: ... have a relation of type [URI of the relation type   ▼] .

SPI: ... to things of type [URI of the object class (B)   ▼] .

Provenance: [Attributed to myself   ▼] ^

[The assertion above   is attributed to me .]

Publication info [add element...   ▼]

Creator: ^

[▮ This nanopublication   is created by me .]

☐ I understand that publishing cannot be undone and that the provided information will be publicly visible and openly connected to my ORCID identifier.

[Publish]

More examples of super-pattern statements

- **Symbiosis and pathogenesis of Sinorhizobium meliloti share common molecular mechanisms.**

```
CONTEXT-CLASS ("in the context of all ..."):    sinorhizobium-meliloti
SUBJECT-CLASS ("things of type ..."):            molecular-mechanism-symbiosis
QUALIFIER:                                       sometimes
RELATION-TYPE ("have a relation of type ..."):   [subj] isSameAs [obj]
OBJECT-CLASS ("to things of type ..."):          molecular-mechanism-pathogenesis
```

More examples of super-pattern statements

- Symbiosis and pathogenesis of Sinorhizobium meliloti share common molecular mechanisms.

- **Lifelong education in the electro-mechanical industry requires extensive international knowledge of their workers.**

```
CONTEXT-CLASS ("in the context of all ..."):     worker-in-electromechanical-industry
SUBJECT-CLASS ("things of type ..."):             lifelong-education
QUALIFIER:                                        generally
RELATION-TYPE ("have a relation of type ..."):    [subj] requires [obj]
OBJECT-CLASS ("to things of type ..."):           extensive-international-knowledge
```

More examples of super-pattern statements

- Symbiosis and pathogenesis of Sinorhizobium meliloti share common molecular mechanisms.

- Lifelong education in the electro-mechanical industry requires extensive international knowledge of their workers.

- **Human ovarian and endometrial cancer cell lines are frequently misidentified.**

```
CONTEXT-CLASS ("in the context of all ..."):      NONE
SUBJECT-CLASS ("things of type ..."):              human-ovarian-cancer-cell-line OR
                                                   human-endometrial-cancer-cell-line
QUALIFIER:                                         frequently
RELATION-TYPE ("have a relation of type ..."):    [subj] includes [obj]
OBJECT-CLASS ("to things of type ..."):            misidentification
```

More examples of super-pattern statements

- Symbiosis and pathogenesis of Sinorhizobium meliloti share common molecular mechanisms.

- Lifelong education in the electro-mechanical industry requires extensive international knowledge of their workers.

- Human ovarian and endometrial cancer cell lines are frequently misidentified.

- **Inexpensive photocells for the Arduino-Visual Basic interface can be used for recording and controlling events in operant research.**

```
CONTEXT-CLASS ("in the context of all ..."):      operant-research
SUBJECT-CLASS ("things of type ..."):             inexpensive-photocell-for-arduino-vb-interface
QUALIFIER:                                        can generally
RELATION-TYPE ("have a relation of type ..."):    [subj] contributesTo [obj]
OBJECT-CLASS ("to things of type ..."):           recording-controlling-events-activity
```

More examples of super-pattern statements

- Symbiosis and pathogenesis of Sinorhizobium meliloti share common molecular mechanisms.

- Lifelong education in the electro-mechanical industry requires extensive international knowledge of their workers.

- Human ovarian and endometrial cancer cell lines are frequently misidentified.

- Inexpensive photocells for the Arduino-Visual Basic interface can be used for recording and controlling events in operant research.

- **Solid and cancellous autogenous bone grafts are used in the treatment of acute bone loss and nonunion.**

```
CONTEXT-CLASS ("in the context of all ..."):      acute-bone-loss OR acute-bone-nonunion
SUBJECT-CLASS ("things of type ..."):              solid-autogenous-bone-graft OR
                                                   cancellous-autogenous-bone-graft
QUALIFIER:                                         can generally
RELATION-TYPE ("have a relation of type ..."):     [subj] contributesTo [obj]
OBJECT-CLASS ("to things of type ..."):            treatment
```

More examples of super-pattern statements

- Symbiosis and pathogenesis of Sinorhizobium meliloti share common molecular mechanisms.

- Lifelong education in the electro-mechanical industry requires extensive international knowledge of their workers.

- Human ovarian and endometrial cancer cell lines are frequently misidentified.

- Inexpensive photocells for the Arduino-Visual Basic interface can be used for recording and controlling events in operant research.

- Solid and cancellous autogenous bone grafts are used in the treatment of acute bone loss and nonunion.

Helper! You will be provided with a helper document that can be used to create your scientific claim and its basic formalization.

Task 2: Pick paper with claim to formalize (*May*)

- Find a scientific paper (yours or somebody else's) from which to formalize one of its high-level scientific claims
- As an intermediate step, you may want to express your claim as an [AIDA sentence](#)
  - expressing claims in a general way
  - AIDA sentences: English sentences that are Atomic, Independent, Declarative, and Absolute
  - absoluteness property: excluding information about how the claim was derived and how certain we can be about its truth

Task 2: Pick paper with claim to formalize (*May*)

- [Lee S. et al. Obesity, metabolic abnormality, and knee osteoarthritis: a cross-sectional study in Korean women. Mod Rheumatol. 2015 Mar;25(2):292-7. doi: 10.3109/14397595.2014.939393.](#)

- Scientific claim expressed as an AIDA sentence:

Obesity when accompanied by metabolic abnormality is closely associated with knee osteoarthritis.

Task 3: Create abstract version of instantiated super-pattern (*May*)

CONTEXT-CLASS ("in the context of all ..."):   **Person**
SUBJECT-CLASS ("things of type ..."):   **Obesity together with metabolic abnormality**
QUALIFIER: **generally***
RELATION-TYPE ("have a relation of type..."): **co-occurs with**
OBJECT-CLASS ("to things of type..."):   **Knee osteoarthritis**

● Use the SuperPatter ontology to find the qualifier and the relation type that is the closest to the desired representation

* this qualifier was changed to "frequently" in a new version

Task 3: Create abstract version of instantiated super-pattern (*May*)

CONTEXT-CLASS ("in the context of all ..."):   **Person**

SUBJECT-CLASS ("things of type ..."):   **Obesity together with metabolic abnormality**

QUALIFIER: **generally***

RELATION-TYPE ("have a relation of type..."): **co-occurs with**

OBJECT-CLASS ("to things of type..."):   **Knee osteoarthritis**

- Link new classes to WikiData where possible
  - Person (~Human)
  - Knee osteoarthritis
- Nanobench connects to WikiData and provides autocomplete when filling in forms

* this qualifier was changed to "frequently" in a new version

Task 4: Define new classes where needed (*June*)

CONTEXT-CLASS ("in the context of all ..."): **Person**
SUBJECT-CLASS ("things of type ..."): **Obesity together with metabolic abnormality**
QUALIFIER: **generally***
RELATION-TYPE ("have a relation of type..."): **co-occurs with**
OBJECT-CLASS ("to things of type..."): **Knee osteoarthritis**

- *Nanobench → Publish → Defining a new class*
  *(*we'll worry about the class definitions later; discuss it with us*)*

Assertion: Defining a new class ^ (change)

obesity-with-metabolic-abnormal	is a class .
obesity-with-metabolic-abnormal	is called " obesity with metabolic abnormality " .
obesity-with-metabolic-abnormal	is defined as follows: " Obesity conditions together with metabolic abnormality. " .
obesity-with-metabolic-abnormal	is a subclass of https://www.wikidata.org/Q12174 × ▾ . *(optional)*

* this qualifier was changed to "frequently" in a new version

Task 5: Publish the first version of your super-pattern instance with Nanobench (*June*)

Nanobench → Publish → Expressing a general claim with a super-pattern:

Assertion: Expressing a general claim with a super-pattern ^ (change)

SPI: This is a super-pattern instance .

SPI: In the context of all things of type human - common name of Homo sapiens, unique extant species of the genus Homo (http://ww… × ▾ .

SPI: ... things of type http://purl.org/np/RAVYczMihUbgryLu1x8xhoqR6LQe4fSoWmF3SCQHfR5xE#obesity-with-metabolic… × ▾ .

SPI: ... (qualifier) generally × ▾ .

SPI: ... have a relation of type A co-occurs with B × ▾ .

SPI: ... to things of type knee osteoarthritis (http://www.wikidata.org/entity/Q1777118) × ▾ .

Provenance: Derived from an existing entity ▾ ^

The assertion above was derived from https://doi.org/10.3109/14397595.2014.939393 .

Publication info add element... ▾

Creator: ^

This nanopublication is created by me .

Task 6: Review some other contributions (*June-August*)

Nanobench → Publish → Making a review comment according to the LinkFlows model:

Publish a new Nanopublication

Assertion: Making a review comment according to the LinkFlows model ^ (change)

This comment   is a   review comment   .
This comment   refers to   [the URL of the paper or text this review comment is about]   .
This comment   is a   [comment about the content   × ▾]   .
This comment   is a   [negative comment   × ▾]   .
This comment   is a   [comment that declares that an action is needed   × ▾]   .
This comment   has impact level   " [integer value from 1 (low impact) to 5 (high impact)]   "   .
This comment   has the comment text   " [The content of this comment as free text]   "   .

Provenance: [Attributed to myself   ▾] ^

The assertion above   is attributed to   me   .

Publication info [add element...   ▾]
Creator: ^

This nanopublication   is created by   me   .

☐ I understand that publishing cannot be undone and that the provided information will be publicly visible and openly connected to my ORCID identifier.

Publish

Task 7: Improve your contributions based on reviews and publish new version (*July-August*)

Nanobench → my channel:

```
http://purl.org/np/RAc5YYnYevWeUd1igtqMi_eKGVhxVj7IBZ9mTY8-aCNII   | Actions: comment...  retract...  update...
```

```
spi   type   SuperPatternInstance   .
spi   hasContextClass   Q5   .
spi   hasObjectClass   Q1777118   .
spi   hasQualifier   generallyQualifier   .
spi   hasRelation   cooccursWith   .
spi   hasSubjectClass   obesity-with-metabolic-abnormality   .
```

```
this assertion   wasDerivedFrom   14397595.2014.939393   .
```

```
sig   hasAlgorithm   "RSA"   .
sig   hasPublicKey
"MIGfMA0GCSqGSIb3DQEBAQUAA4GNADCBiQKBgQCJlM78d80R+gFMoQB1IG3f7AbqqGOCIv4HmZd1cx1KgEWMUUpPsojFNvx84fC/TltcJ8F8.
mmCEY7mUoeEW10mWZqjk+S9TnmiAQbFGcpExP8aosr2aTR7CSQIDAQAB"   .
sig   hasSignature
"YXzdgk7n75OhzaHpiJr7LW0T3PdUct5kBsEUDI+TiWEv8ZyH3bx4O6MRD6VxuGey0i2V+2/tSHmkc/2P/MdbR9HqNxG8z7VXhsO7BjtYCF+M
Yw4ykGyzEVE="   .
sig   hasSignatureTarget   this   .
this   created   "2021-05-07T15:35:00.337+03:00"   .
this   creator   0000-0002-7114-6459   .
this   introduces   spi   .
this   supersedes   RA6Lpsa8P2   .
this   wasCreatedFromProvenanceTemplate   RAcTpoh5Ra   .
this   wasCreatedFromPubinfoTemplate   RAA2MfqdBC   .
this   wasCreatedFromPubinfoTemplate   RAjpBMlw3o   .
this   wasCreatedFromTemplate   RAiL1AYhAZ   .
```

Task 8: If accepted: Make official final version (*September*)

Publish a new Nanopublication

Assertion: Expressing a general claim with a super-pattern ^ (change)

> SPI: This is a super-pattern instance .
>
> SPI: In the context of all things of type   [human - common name of Homo sapiens, unique extant species of the genus Homo (http://ww… × ▾]   .
>
> SPI: ... things of type   [http://purl.org/np/RAVYczMihUbgryLu1x8xhoqR6LQe4fSoWmF3SCQHfR5xE#obesity-with-metabolic… × ▾]   .
>
> SPI: ... (qualifier)   [generally   × ▾]   .
>
> SPI: ... have a relation of type   [A co-occurs with B   × ▾]   .
>
> SPI: ... to things of type   [knee osteoarthritis (http://www.wikidata.org/entity/Q1777118)   × ▾]   .

Provenance: [Derived from an existing entity   ▾] ^

> [The assertion above]   was derived from   [https://doi.org/10.3109/14397595.2014.939393]   .

Publication info [add element...   ▾]

Creator: ^

> [▪ This nanopublication]   is created by me .

This is what it will look like eventually (roughly)

A formalization of one of the main claims of "Obesity, metabolic abnormality, and knee osteoarthritis: a cross-sectional study in Korean women" by Lee S. et al.

`Cite`

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Affiliations: [a] Department of Computer Science, Vrije Universiteit Amsterdam, The Netherlands. E-mail: t.kuhn@vu.nl

Correspondence: [*] Corresponding author: Tobias Kuhn, Department of Computer Science, Vrije Universiteit Amsterdam, De Boelelaan 1081, 1081 HV Amsterdam, The Netherlands. E-mail: t.kuhn@vu.nl.

`Nanopublication`

Abstract

I present here a formalization of one of the main findings of the article "Obesity, metabolic abnormality, and knee osteoarthritis: a cross-sectional study in Korean women" by Lee S. et al., originally published in Modern Rheumatology in 2015.

1. Formalization

I will here briefly explain the formalization as specified in the nanopublication representation of this publication.

The main claim of [1] covered here can be informally expressed in the following sentence: *Obesity when accompanied by metabolic abnormality is closely associated with knee osteoarthritis.*

…

References

[1] Lee S. et al. Obesity, metabolic abnormality, and knee osteoarthritis: a cross-sectional study in Korean women. Mod Rheumatol. 2015 Mar;25(2):292-7. doi: 10.3109/14397595.2014.939393.

Any questions?

Feel free to reach out to us:

Cristina Bucur: c.i.bucur@vu.nl
Tobias Kuhn: t.kuhn@vu.nl