

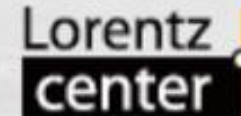


# Stop Data Sharing

Barend Mons 08-03-2023

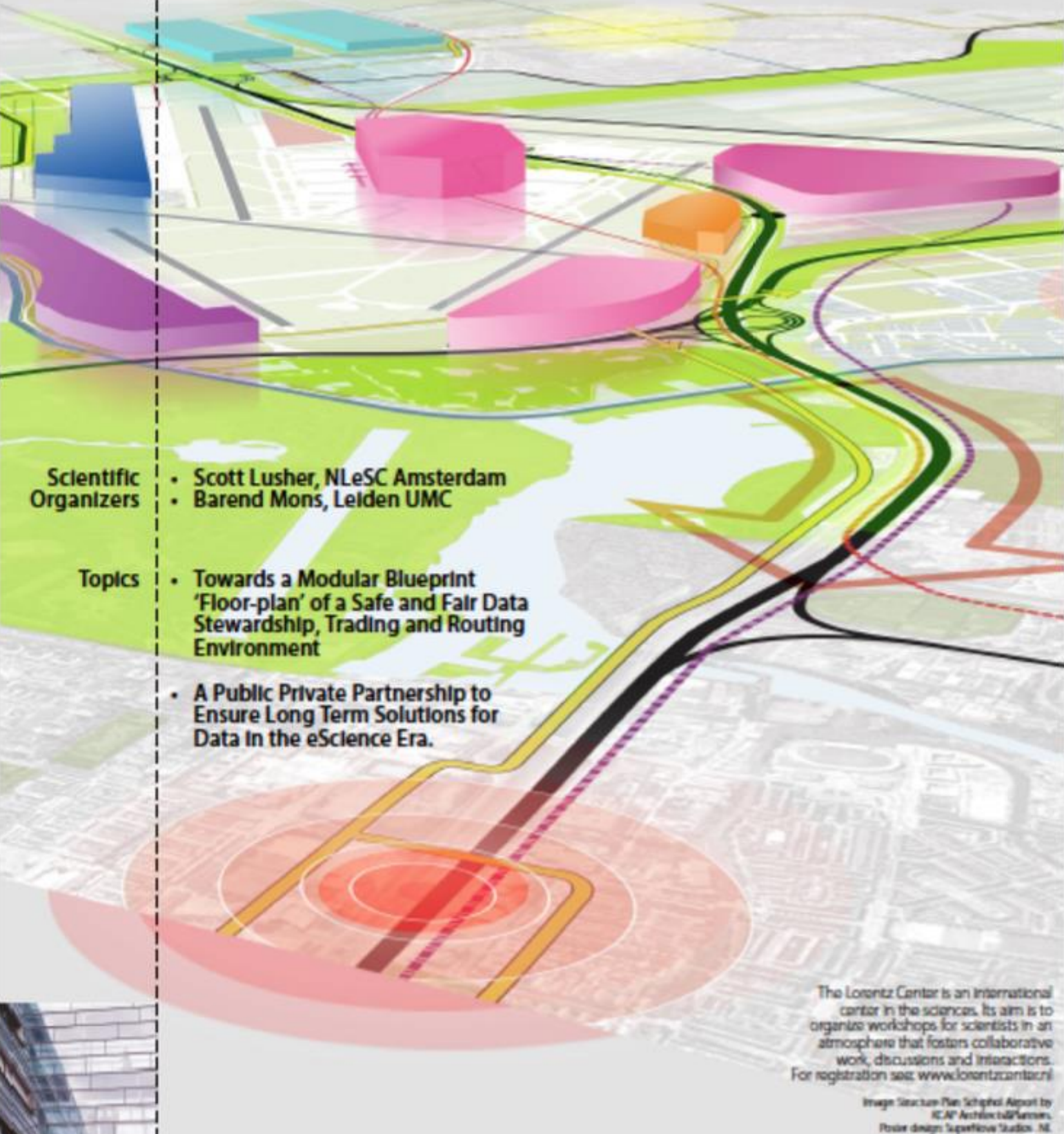


# The (long-awaited) FAIR Digital Object



## Jointly Designing a Data FAIRPORT

Workshop: 13 - 16 January 2014, Leiden, the Netherlands



**Scientific Organizers**


- Scott Lusher, NLeSC Amsterdam
- Barend Mons, Leiden UMC

**Topics**

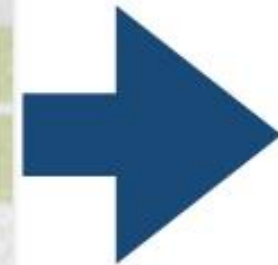
- Towards a Modular Blueprint 'Floor-plan' of a Safe and Fair Data Stewardship, Trading and Routing Environment
- A Public Private Partnership to Ensure Long Term Solutions for Data in the eScience Era.

The Lorentz Center is an international center in the sciences. Its aim is to organize workshops for scientists in an atmosphere that fosters collaborative work, discussions and interactions. For registration see: [www.lorentzcenter.nl](http://www.lorentzcenter.nl)

Image: Structure Plan Schiphol Airport by ICAP Architectuur & Planning. Photo: design SuperNova Studio, NL



[www.lorentzcenter.nl](http://www.lorentzcenter.nl)



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[Open Access](#) | [Published: 15 March 2016](#)

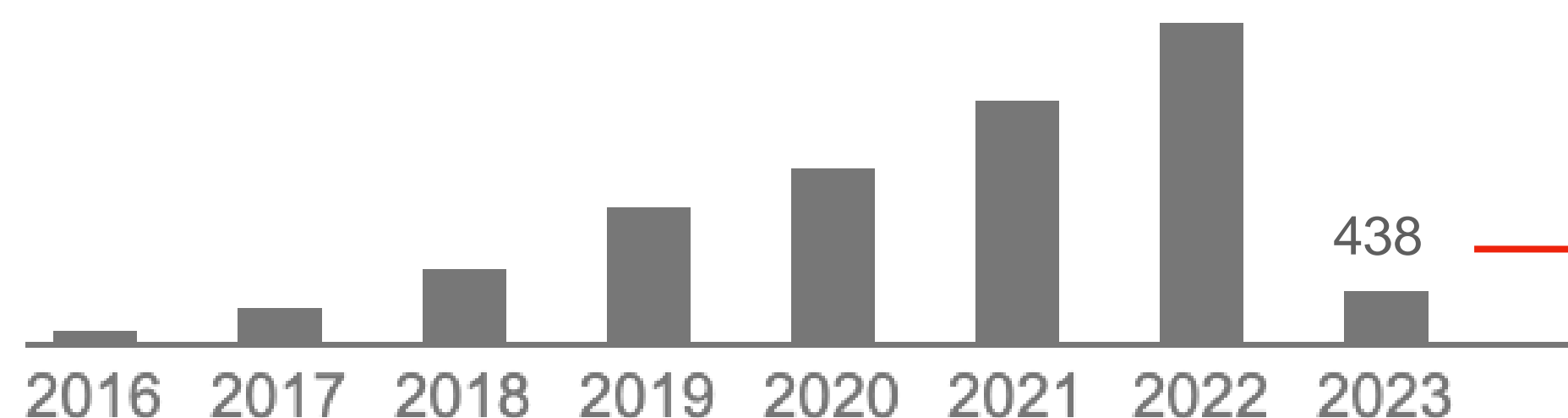
### The FAIR Guiding Principles for scientific data management and stewardship

[Mark D. Wilkinson](#), [Michel Dumontier](#), [IJsbrand Jan Aalbersberg](#), [Gabrielle Appleton](#), [Myles Axton](#), [Arie Baak](#), [Niklas Blomberg](#), [Jan-Willem Boiten](#), [Luiz Bonino da Silva Santos](#), [Philip E. Bourne](#), [Jildau Bouwman](#), [Anthony J. Brookes](#), [Tim Clark](#), [Mercè Crosas](#), [Ingrid Dillo](#), [Olivier Dumon](#), [Scott Edmunds](#), [Chris T. Evelo](#), [Richard Finkers](#), [Alejandra Gonzalez-Beltran](#), [Alasdair J.G. Gray](#), [Paul Groth](#), [Carole Goble](#), [Jeffrey S. Grethe](#), [Jaap Heringa](#), [Peter A.C. 't Hoen](#), [Rob Hooft](#), [Tobias Kuhn](#), [Ruben Kok](#), [Joost Kok](#), [Scott J. Lusher](#), [Maryann E. Martone](#), [Albert Mons](#), [Abel L. Packer](#), [Bengt Persson](#), [Philippe Rocca-Serra](#), [Marco Roos](#), [Rene van Schaik](#), [Susanna-Assunta Sansone](#), [Erik Schultes](#), [Thierry Sengstag](#), [Ted Slater](#), [George Strawn](#), [Morris A. Swertz](#), [Mark Thompson](#), [Johan van der Lei](#), [Erik van Mulligen](#), [Jan Velterop](#), [Andra Waagmeester](#), [Peter Wittenburg](#), [Katherine Wolstencroft](#), [Jun Zhao](#) & [Barend Mons](#)  [— Show fewer authors](#)

*Scientific Data* **3**, Article number: 160018 (2016) | [Cite this article](#)

**488k** Accesses | **4555** Citations | **2031** Altmetric | [Metrics](#)

### Cited by 9416



...the FAIR Principles put specific emphasis on **enhancing the ability of machines to automatically find and use the data**, in addition to supporting its reuse by individuals.

**pseudo-FAIR**

# FAIR PRINCIPLES – TECHNOLOGY-RELATED

## Findable:

- F1. (meta)data are assigned a globally unique and persistent identifier;
- F2. data are described with rich metadata;
- F3. metadata clearly and explicitly include the identifier of the data it describes;
- F4. (meta)data are registered or indexed in a searchable resource;

## Interoperable:

- I1. (meta)data use a formal, accessible, shared, and broadly applicable language for knowledge representation.
- I2. (meta)data use vocabularies that follow FAIR principles;
- I3. (meta)data include qualified references to other (meta)data;

## Accessible:

- A1. (meta)data are retrievable by their identifier using a standardized communications protocol;
  - A1.1 the protocol is open, free, and universally implementable;
  - A1.2. the protocol allows for an authentication and authorization procedure, where necessary;
- A2. metadata are accessible, even when the data are no longer available;

## Reusable:

- R1. (meta)data are richly described with a plurality of accurate and relevant attributes;
  - R1.1. (meta)data are released with a clear and accessible data usage license;
  - R1.2. (meta)data are associated with detailed provenance;
  - R1.3. (meta)data meet domain-relevant community standards;

# FAIR PRINCIPLES – SOCIAL CONTRACT—RELATED

## Findable:

- F1. (meta)data are assigned a globally unique and **persistent** identifier;
- F2. data are described with **rich** metadata;
- F3. metadata clearly and explicitly include the identifier of the data it describes;
- F4. (meta)data are registered or indexed in a searchable resource;

## Interoperable:

- I1. (meta)data use a formal, accessible, shared, and broadly applicable language for knowledge representation.
- I2. (meta)data use vocabularies **that follow FAIR principles**;
- I3. (meta)data include qualified references to other (meta)data;

## Accessible:

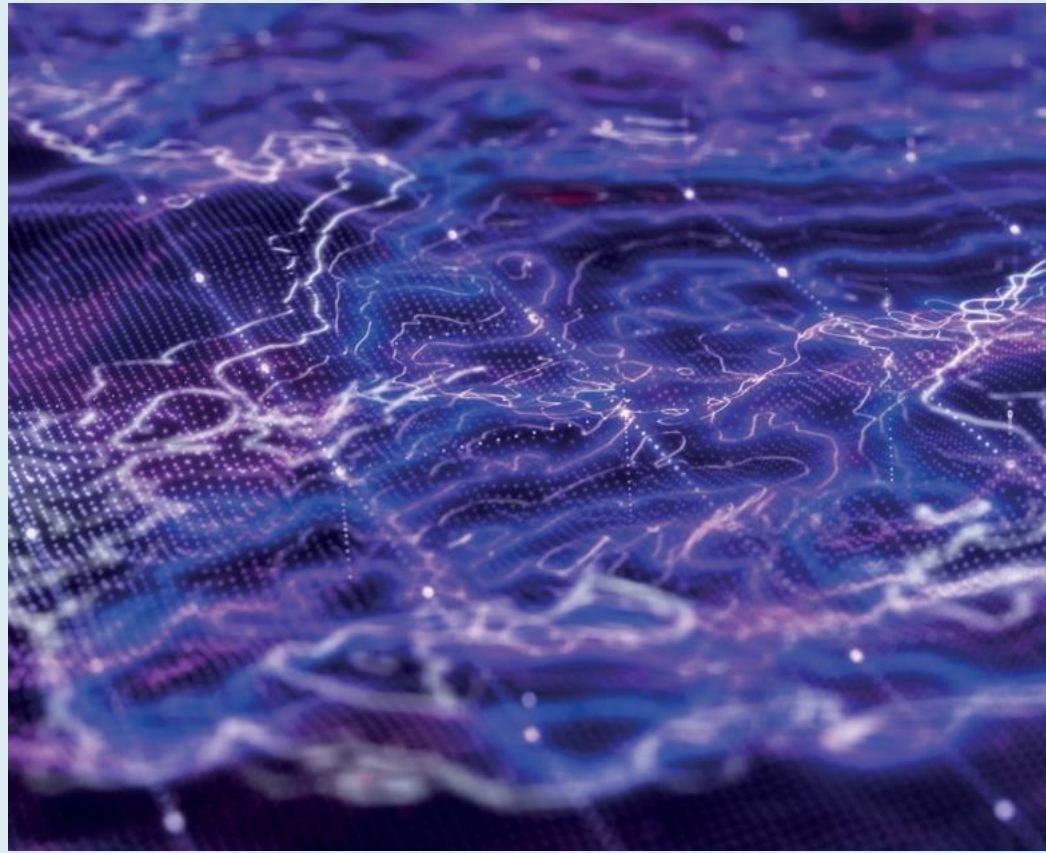
- A1. (meta)data are retrievable by their identifier using a standardized communications protocol;
  - A1.1 **the protocol is open, free, and universally implementable**;
  - A1.2. the protocol allows for an authentication and authorization procedure, where necessary;
- A2. metadata are accessible, **even when the data are no longer available**;

## Reusable:

- R1. (meta)data are **richly** described with a plurality of **accurate and relevant** attributes;
  - R1.1. **(meta)data are released with a clear and accessible data usage license**;
  - R1.2. (meta)data are associated with **detailed** provenance;
  - R1.3. (meta)data meet **domain-relevant community** standards;

# Failed PIDs and unreliable PID implementations

February 2023



**GUPRI**

Intended Defined Meaning



The Machine knows what I mean

FAIR ~~≡~~ The next standard

FAIR ~~≡~~ Open by default

FAIR ~~≡~~ (Just) for people

FAIR ~~≡~~ For all data



FAIR → Findable, Accessible, Interoperable, Reusable

[nature](#) > [scientific data](#) > [comment](#) > [article](#)

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# The FAIR Guiding Principles for scientific data management and stewardship

[Mark D. Wilkinson](#), [Michel Dumontier](#), [IJsbrand Jan Aalbersberg](#), [Gabrielle Appleton](#), [Myles Axton](#), [Arie Baak](#), [Niklas Blomberg](#), [Jan-Willem Boiten](#), [Luiz Bonino da Silva Santos](#), [Philip E. Bourne](#), [Jildau Bouwman](#), [Anthony J. Brookes](#), [Tim Clark](#), [Mercè Crosas](#), [Ingrid Dillo](#), [Olivier Dumon](#), [Scott Edmunds](#), [Chris T. Evelo](#), [Richard Finkers](#), [Alejandra Gonzalez-Beltran](#), [Alasdair J.G. Gray](#), [Paul Groth](#), [Carole Goble](#), [Jeffrey S. Grethe](#), ... [Barend Mons](#) ✉ [+ Show authors](#)

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□ [The FAIR Guiding Principles for scientific data management and stewardship](#) 8038 2016  
MD Wilkinson, M Dumontier, IJJ Aalbersberg, G Appleton, M Axton, ...  
Scientific data 3

**Hype term** →

- In the top 5% of all research outputs scored by Altmetric
- One of the highest-scoring outputs from this source (#1 of 2,285)
- High Attention Score compared to outputs of the same age (99th percentile)

FAIR →

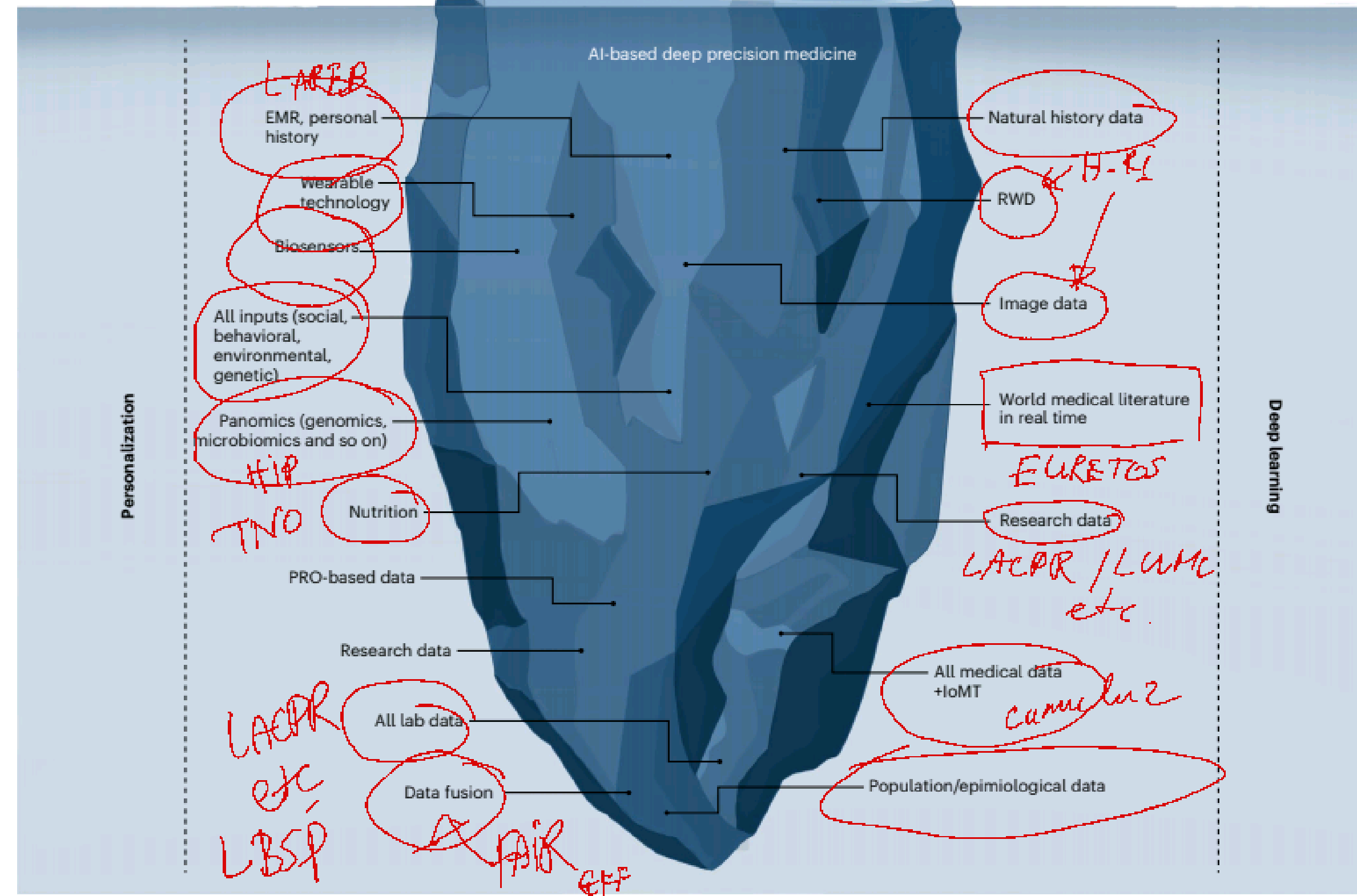
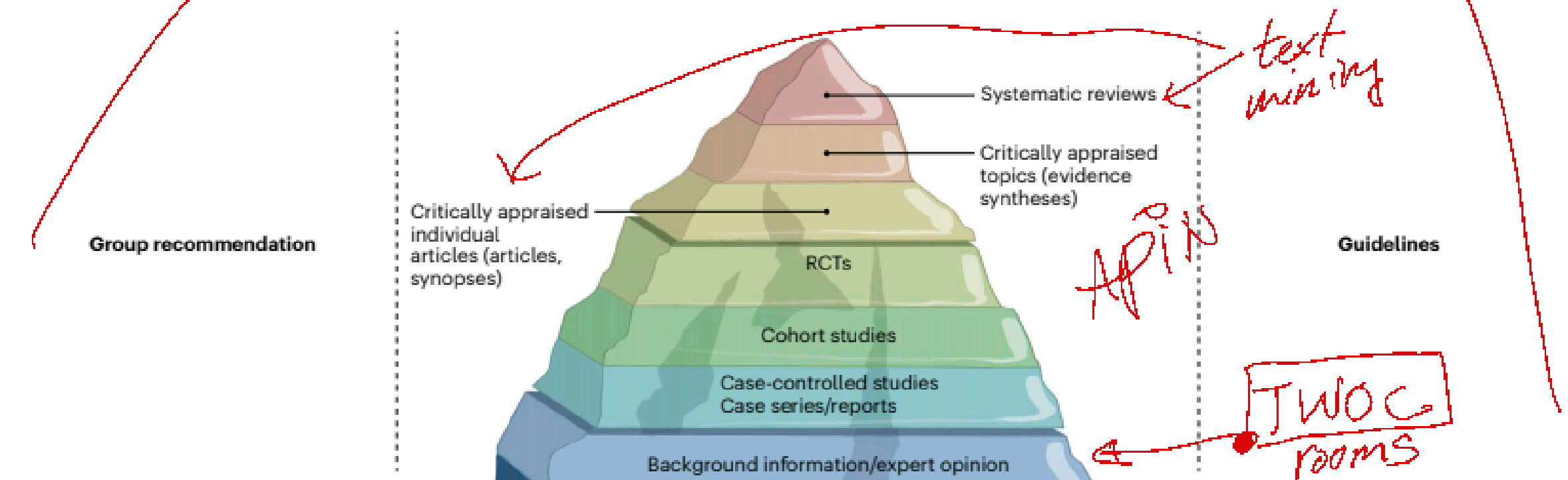
Fully AI Ready →



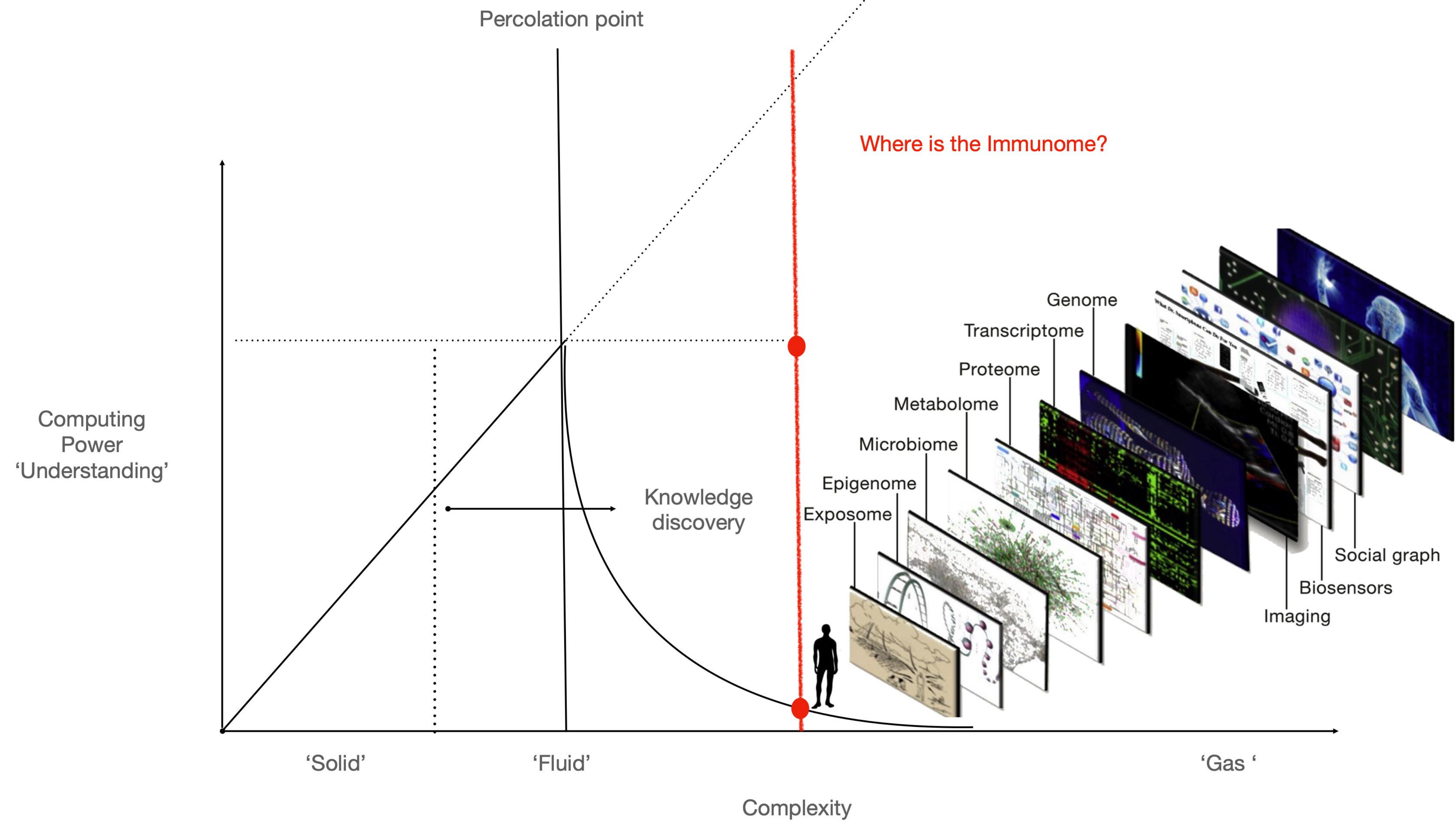
**The Machine knows what we mean !**

**Ah....., as a side effect We know what the machine means**

*analysis*



Chaos is just order, but perceived by a lesser mind





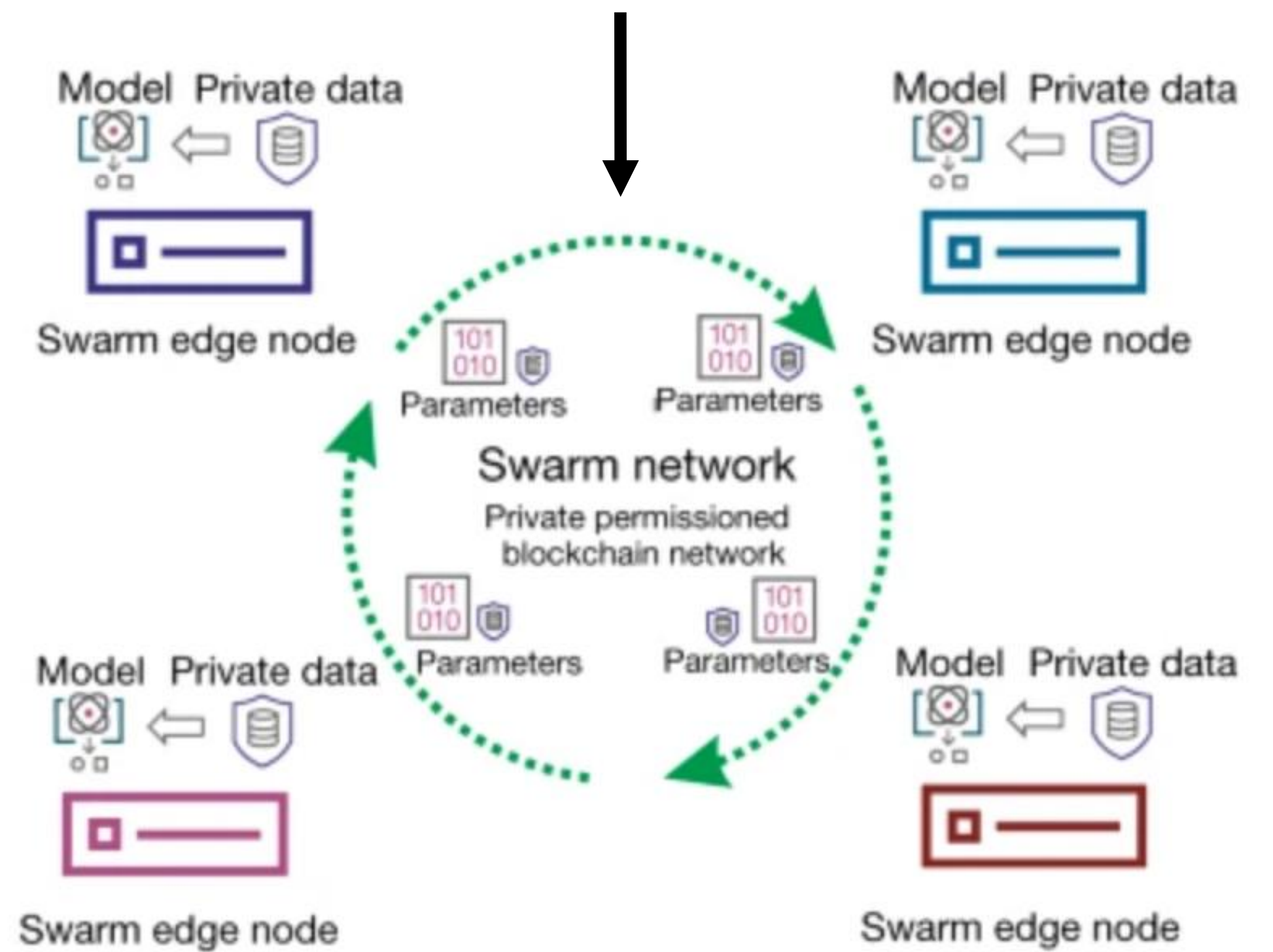
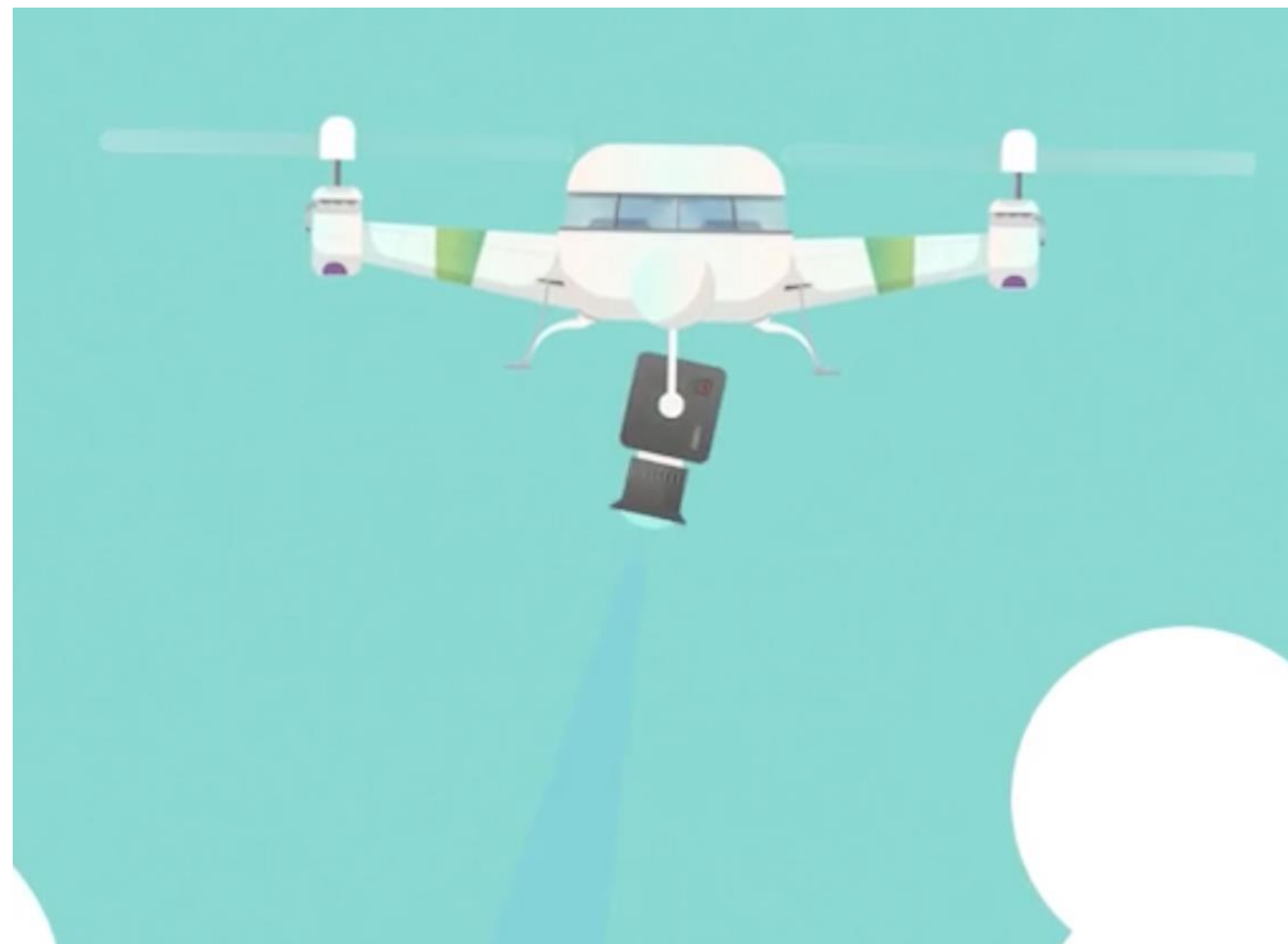
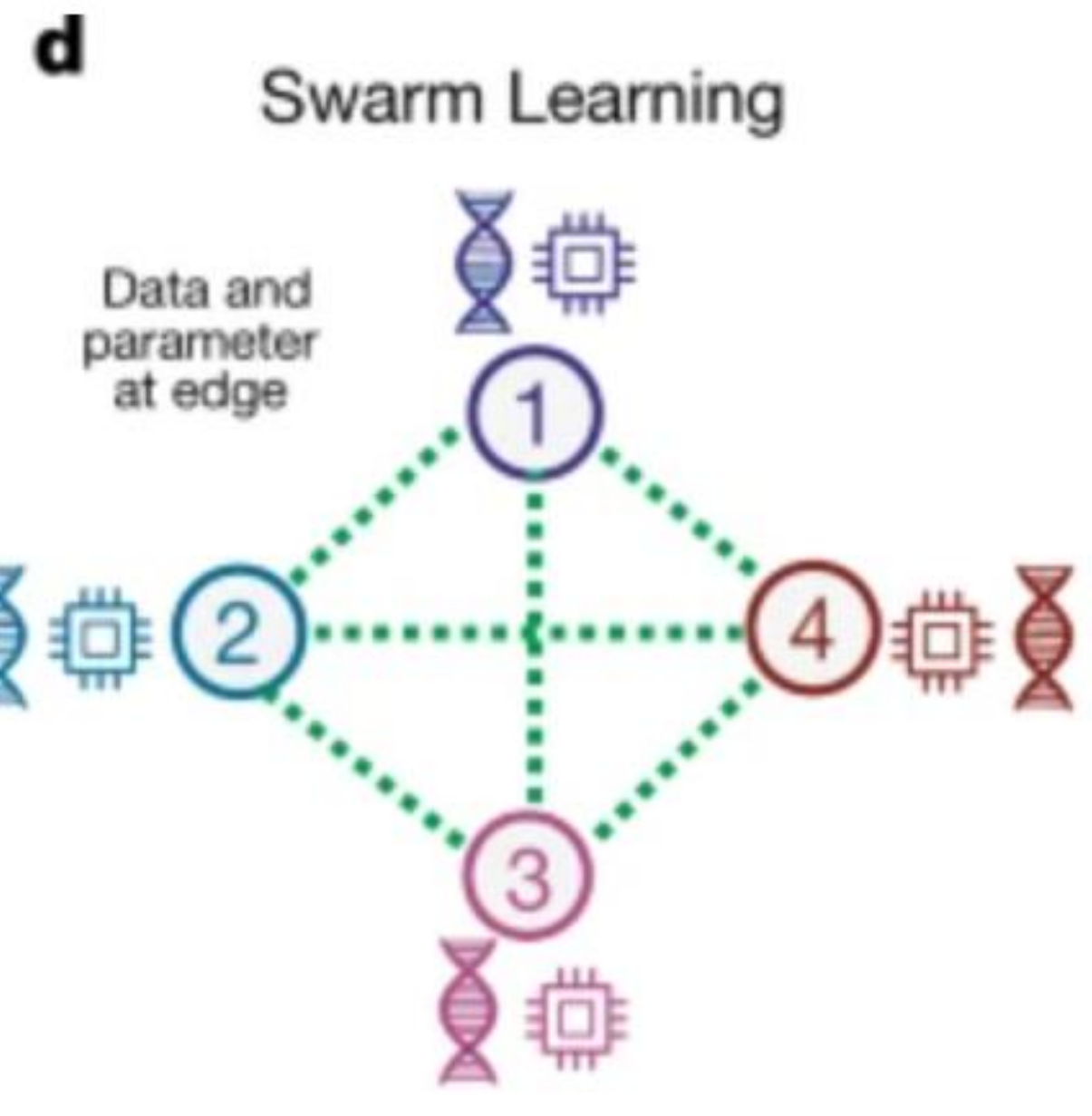
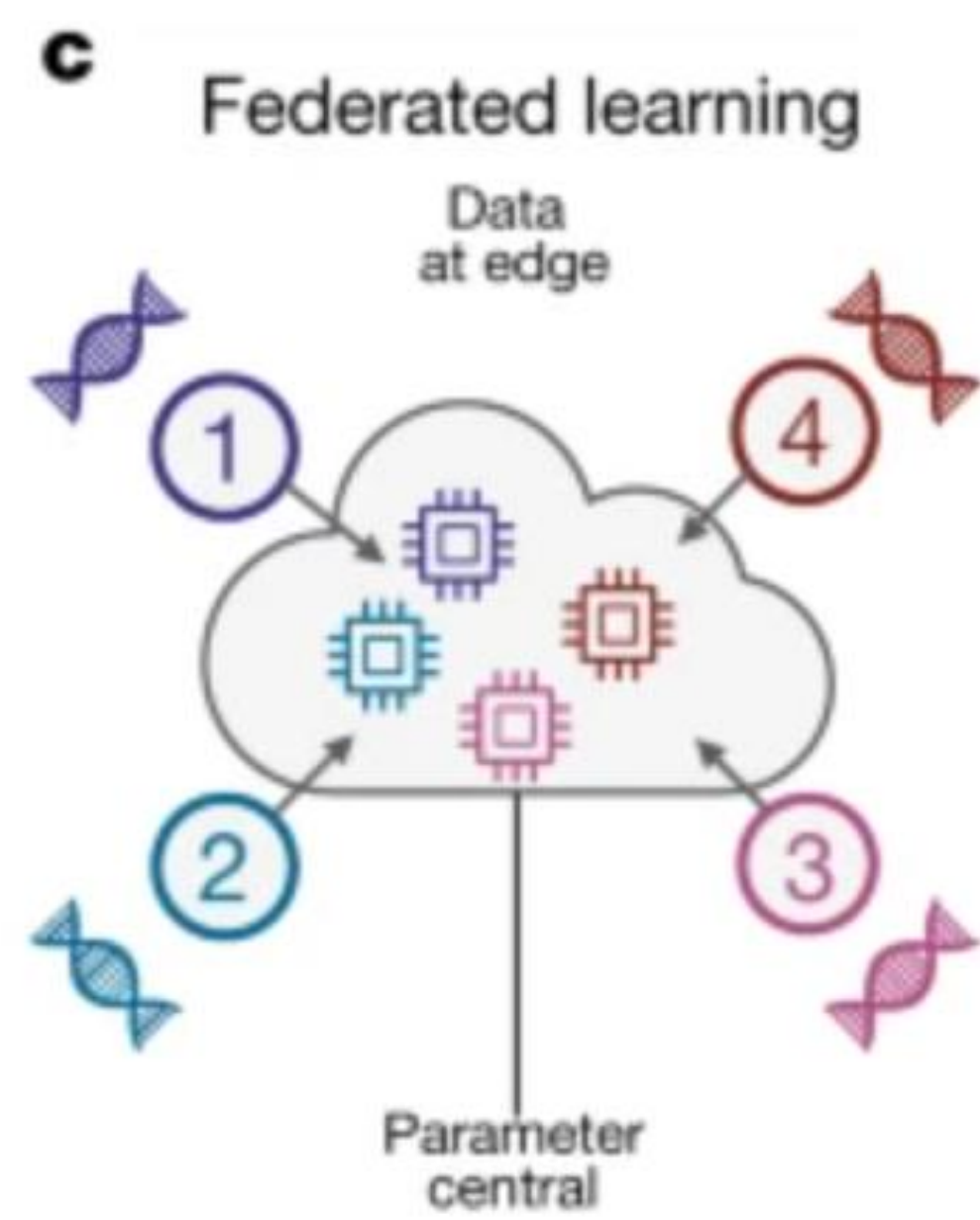
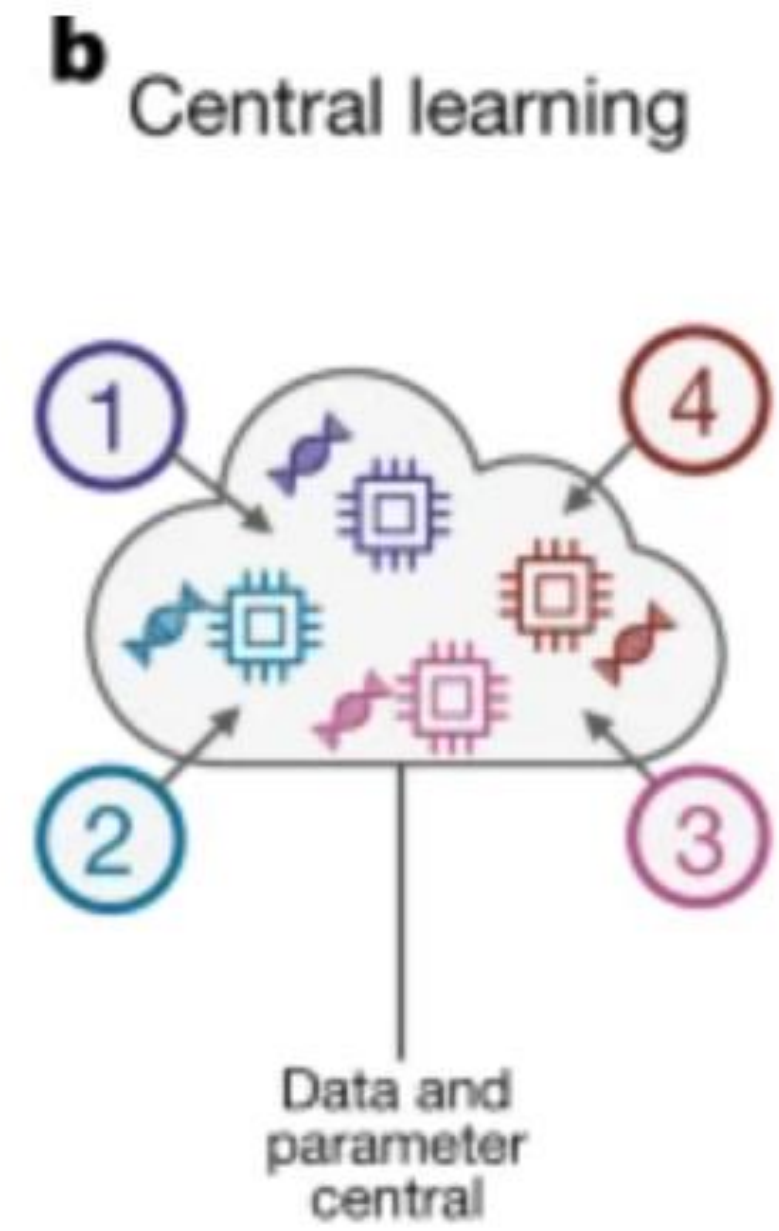
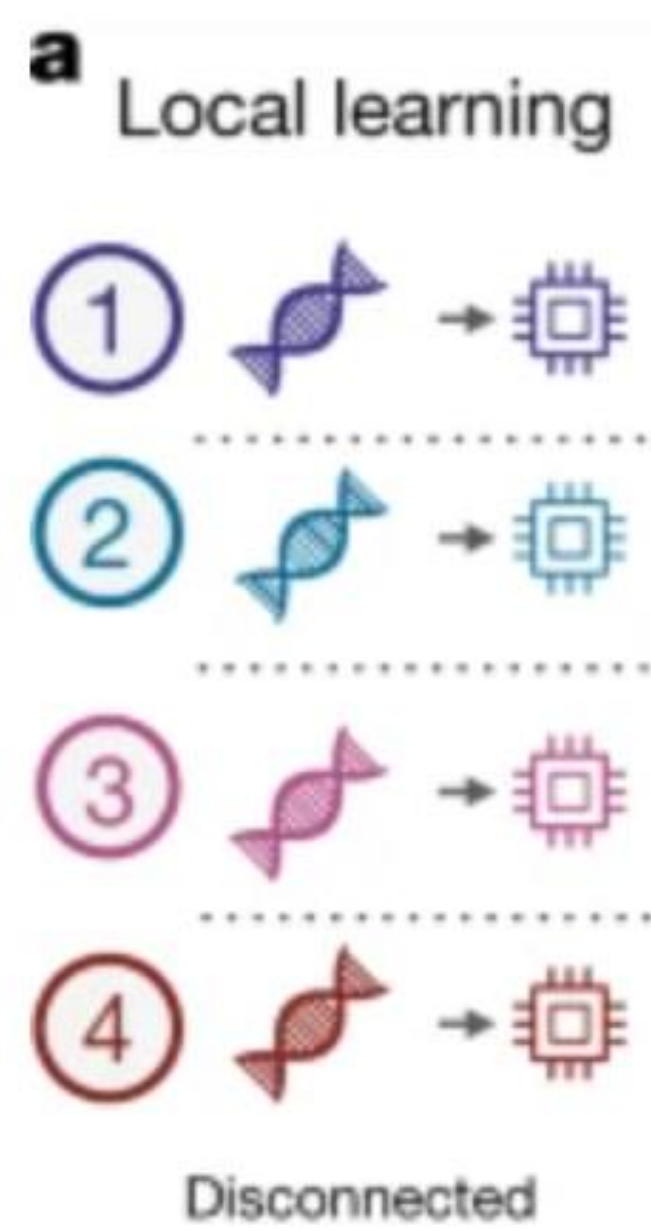


Fig.1

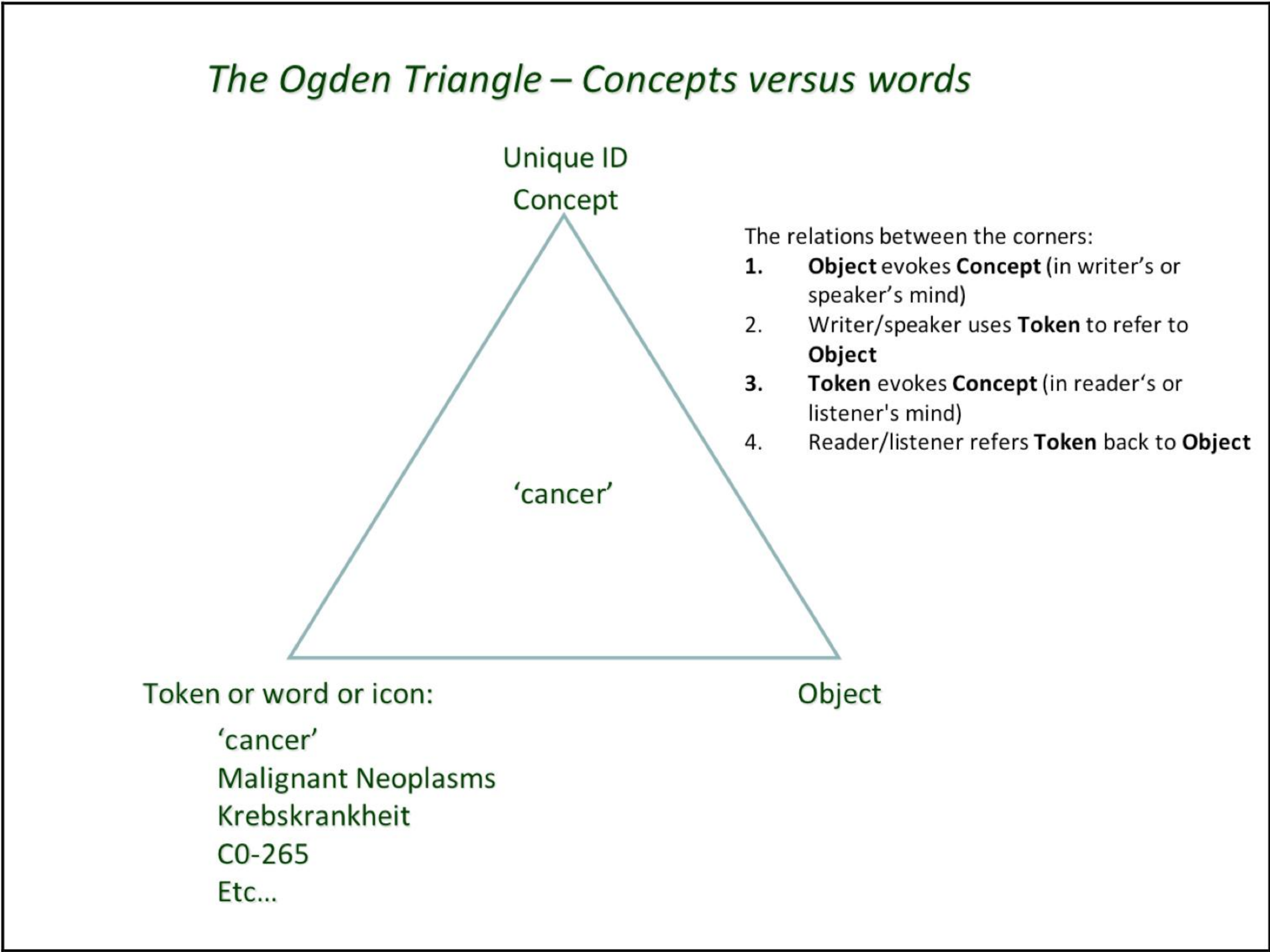


Fig.2

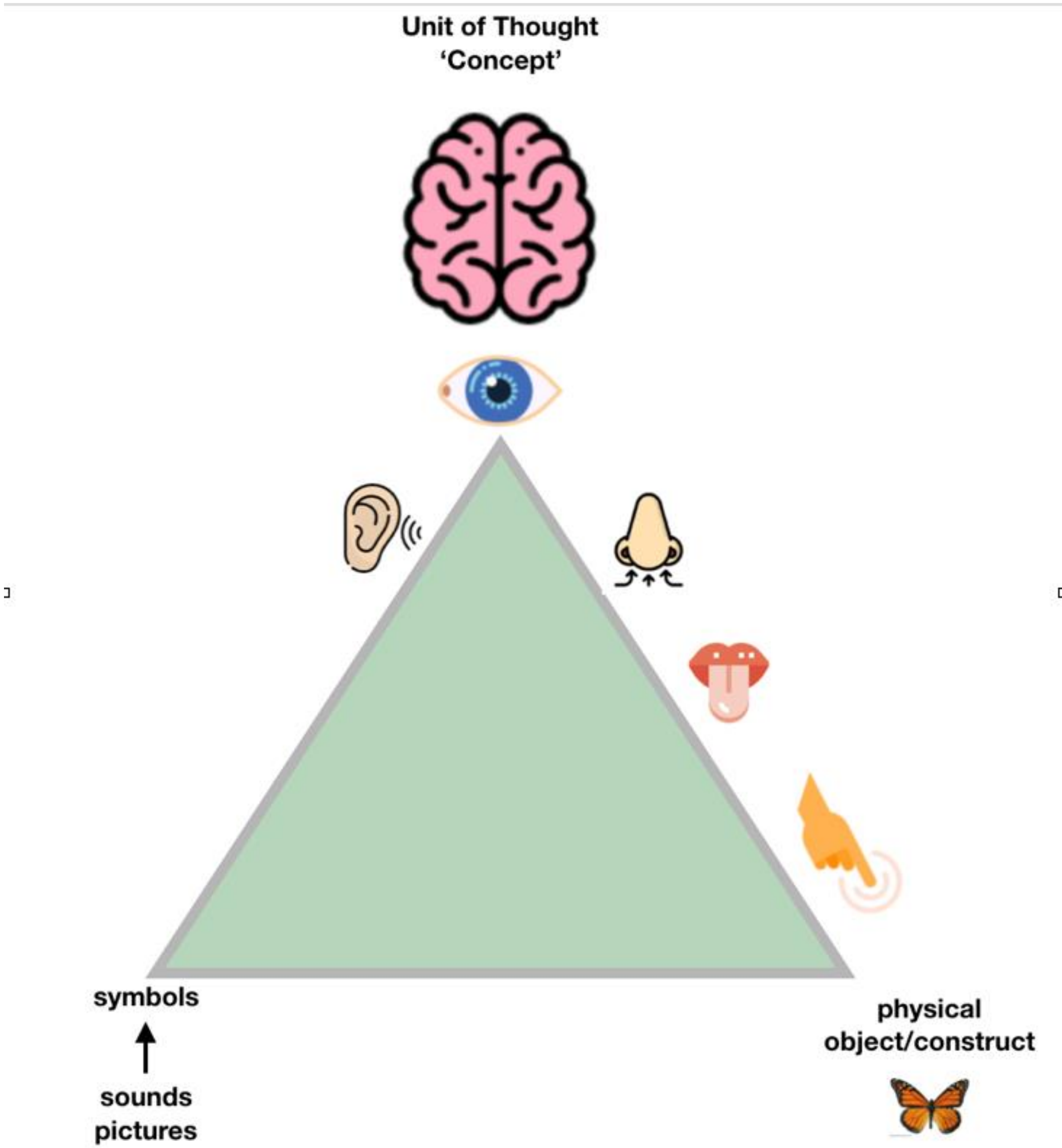
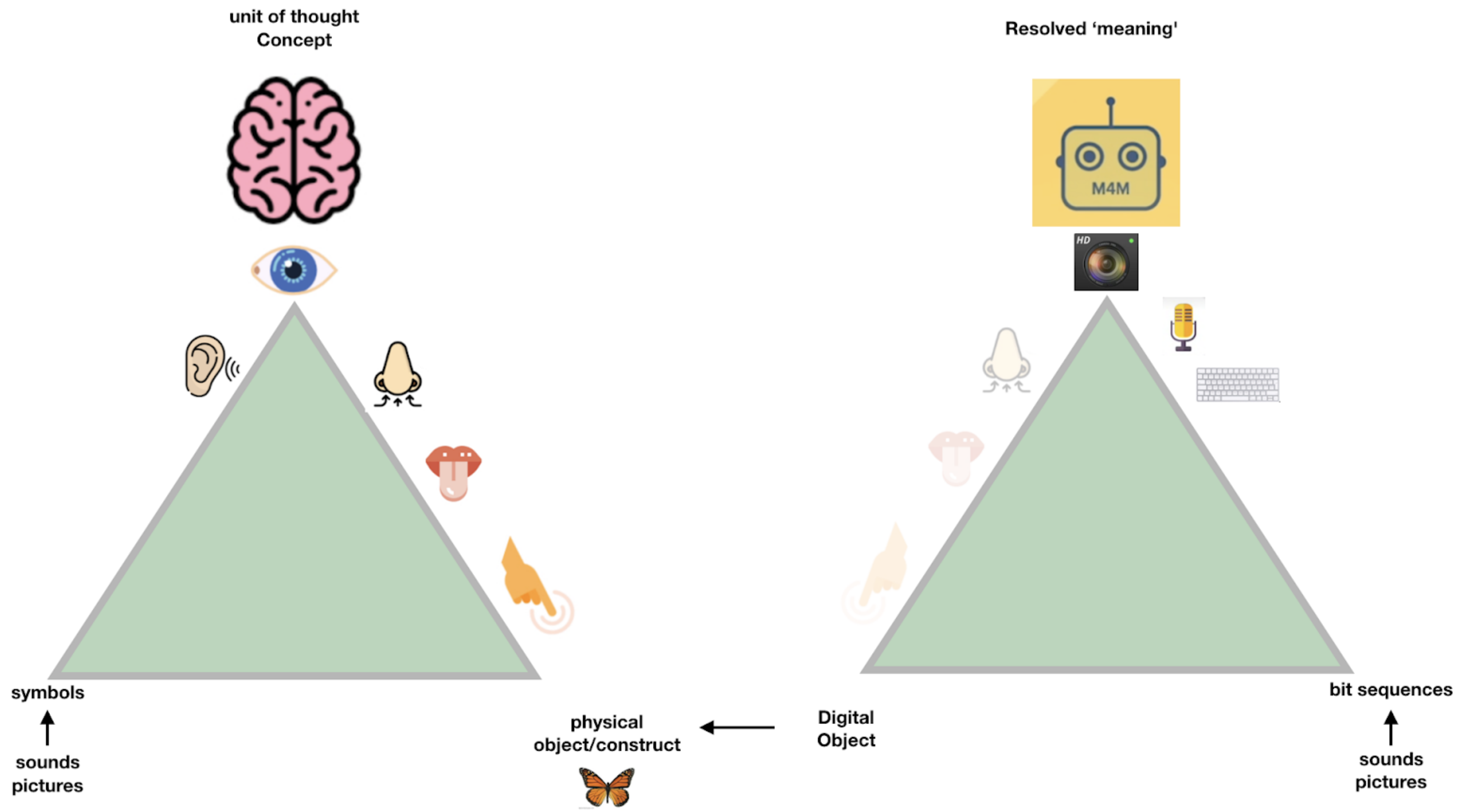


Fig.3

Machines are restricted to limited input devices



And have much more of a problem with ambiguity

Fig.4

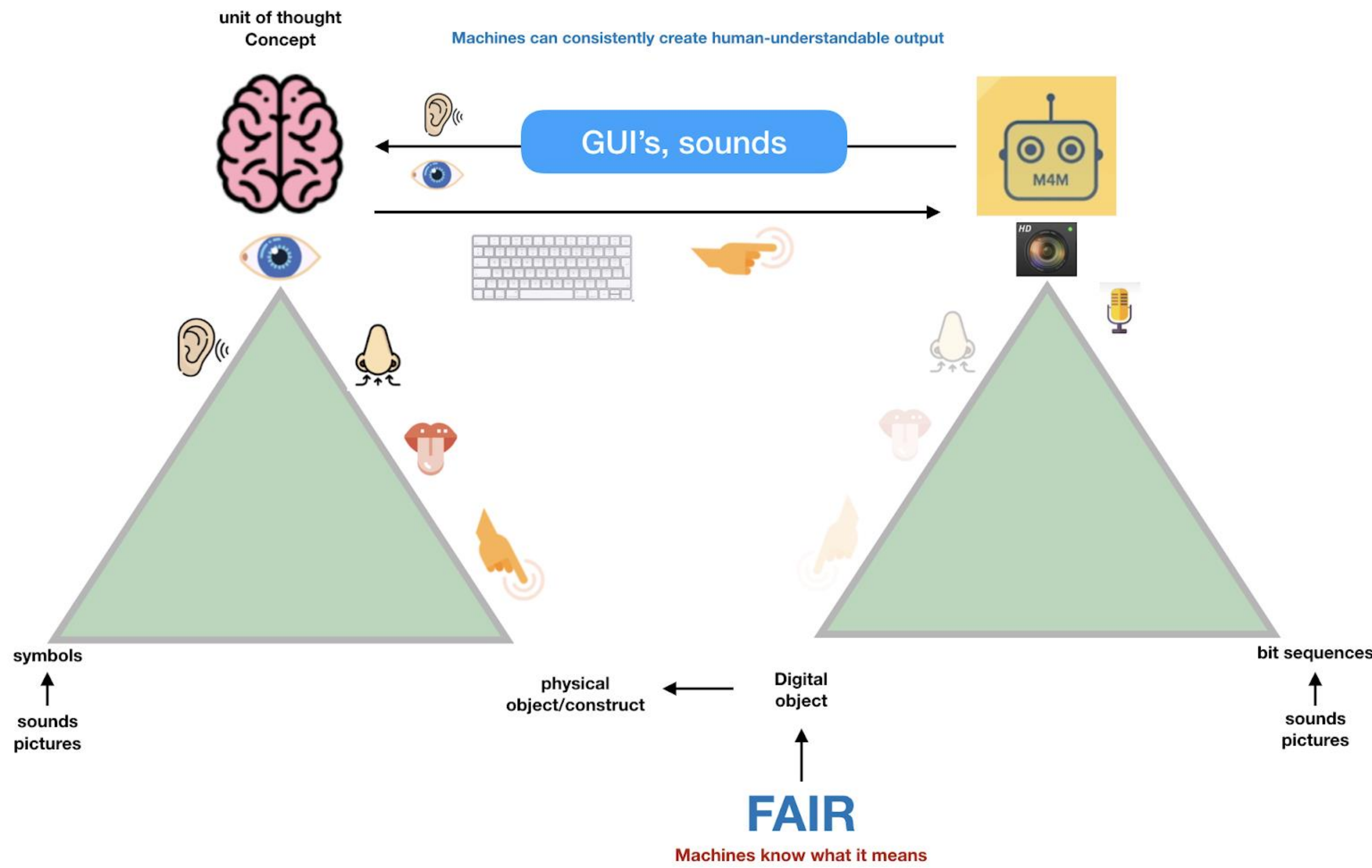


Fig.7

```
@prefix skos: <http://www.w3.org/2004/02/skos/core#> .
@prefix fip: <https://w3id.org/fair/fip/terms/> .
@prefix this: <http://purl.org/np/RABv2ScOD0VIRskTF3WaQhc8gtly0_MtEVzDKPitRPaRo#> .
@prefix sub: <http://purl.org/np/RABv2ScOD0VIRskTF3WaQhc8gtly0_MtEVzDKPitRPaRo#> .
@prefix np: <http://www.nanopub.org/nschema#> .
@prefix dct: <http://purl.org/dc/terms/> .
@prefix nt: <https://w3id.org/np/a/ntemplate/> .
@prefix npx: <http://purl.org/nanopub/x/> .
@prefix xsd: <http://www.w3.org/2001/XMLSchema#> .
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#> .
@prefix orcid: <https://orcid.org/> .
@prefix prov: <http://www.w3.org/ns/prov#> .

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

sub:assertion {
  sub:FDO a fip:Available-FAIR-Enabling-Resource , fip:FAIR-Enabling-Resource , fip:Metadata-data-linking-mechanism ;
  rdfs:comment "A FDO is a unit composed of data that is a sequence of bits, or a set of sequences of bits, each of the sequences being structured (typed) in a way that is interpretable by one or more computer systems, and having as essential elements an assigned globally uniqueandpersistent identifier (PID), a type definition for the object as a whole and a metadata description (which itself can be another FAIR digital object) of the properties of the object, making the whole findable, accessible, interoperable and reusable both by humans and computers for the reliable interpretation and processing of the data represented by the object." ;
  rdfs:label "FDO|Fair Digital Object" ;
  skos:exactMatch <https://github.com/GEDE-RDA-Europe/GEDE/tree/master/FAT0200DigitalN200objects> .
}

sub:provenance {
  sub:assertion prov:wasAttributedTo orcid:0000-0003-2195-3997 .
}

sub:pubinfo {
  sub:sig npx:hasAlgorithm "RSA" ;
  npx:hasPublicKey "MIGfMA0GCQgQSi63DQEBQUAA4GNADCBiQKBggQCCpCFtn7kbe6taJb0TD0aCcCsSEFSWqt6J4+z02w+TfY7/eI0gJZY01pL6G3Az0ZRNwVYWRPS1Ni ykaFuaRuBi tvk1GKfGdprfZbvXwe0xpqCTRBQX9EeFyQyd+Ra/ajfw/UsG8skeu1xnUEpnQbpgbQYc/fvhJNN0UwEc77m0x1DAQAB" ;
  npx:hasSignature "NcJR0eQESaw03wyaFwongu1KZ9tS32abj7HGuRZQlEqQfs+Mlh+HkSk0rnXg/UuV0Hk7/uECRnt+TI3NsLPQJ6/YZ04gJttvrLaLzaSEGsZ831Wj+KfrF113331Wg36ZrGno9ASwa70Y7bUorb1rkhTbcMaZX1NsW0ng101EXoQ=" ;
  npx:hasSignatureTarget this: .
  this: dct:created "2022-01-15T18:58:33.789+01:00"^^xsd:dateTime ;
  dct:creator orcid:0000-0003-2195-3997 ;
  npx:introduces sub:FDO ;
  nt:wasCreatedFromProvenanceTemplate <http://purl.org/np/RANwQa4ICWSS0jw7gp99nBpXBasapetZF1fIM3H2gYTM> ;
  nt:wasCreatedFromPubinfoTemplate <http://purl.org/np/RAAZMFqdBcZnz9yVWjKLJNbyfBNcwsM0qcNlxxk1ma1N> ;
  nt:wasCreatedFromTemplate <http://purl.org/np/RAAMMylianP-BtP9YhjIgNp7Ndeju_J850jgK-J102CSII> .
}
```

Nanopub schema: <https://nanopub.org/nschema>

A nanopub example [https://np.petapico.org/RABv2ScOD0VIRskTF3WaQhc8gtly0\\_MtEVzDKPitRPaRo#FDO](https://np.petapico.org/RABv2ScOD0VIRskTF3WaQhc8gtly0_MtEVzDKPitRPaRo#FDO)

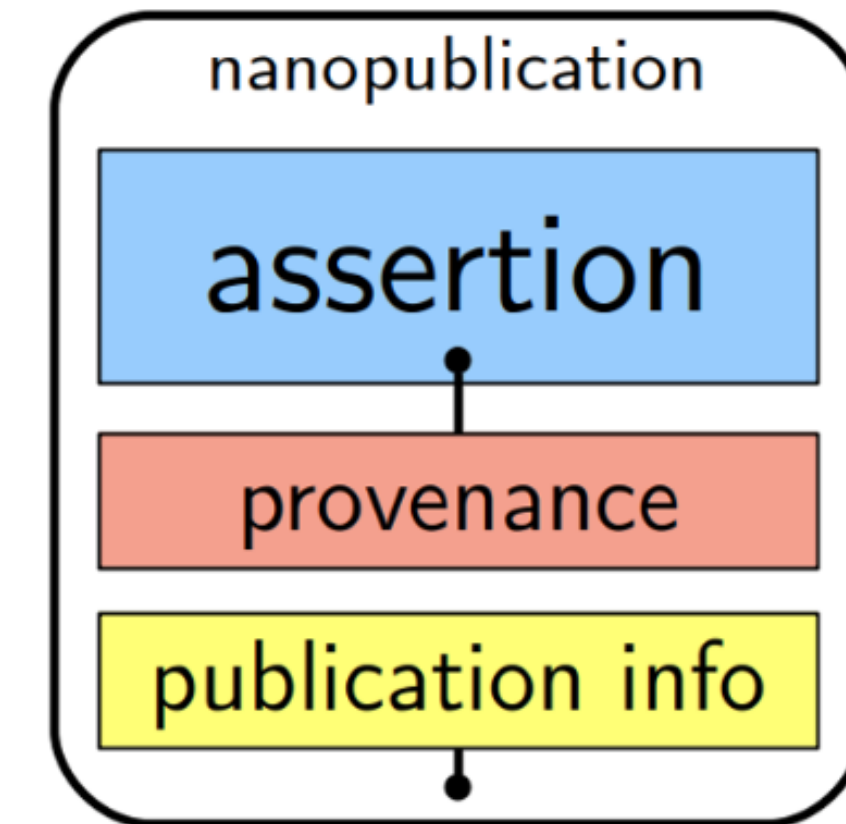
# The Comparative Anatomy of Nanopublications and FAIR Digital Objects

▼ Erik Anthony Schultes, Barbara Magagna, Tobias Kuhn, Marek Suchánek, Luiz Olavo Bonino da Silva Santos, Barend Mons

## Abstract ▲

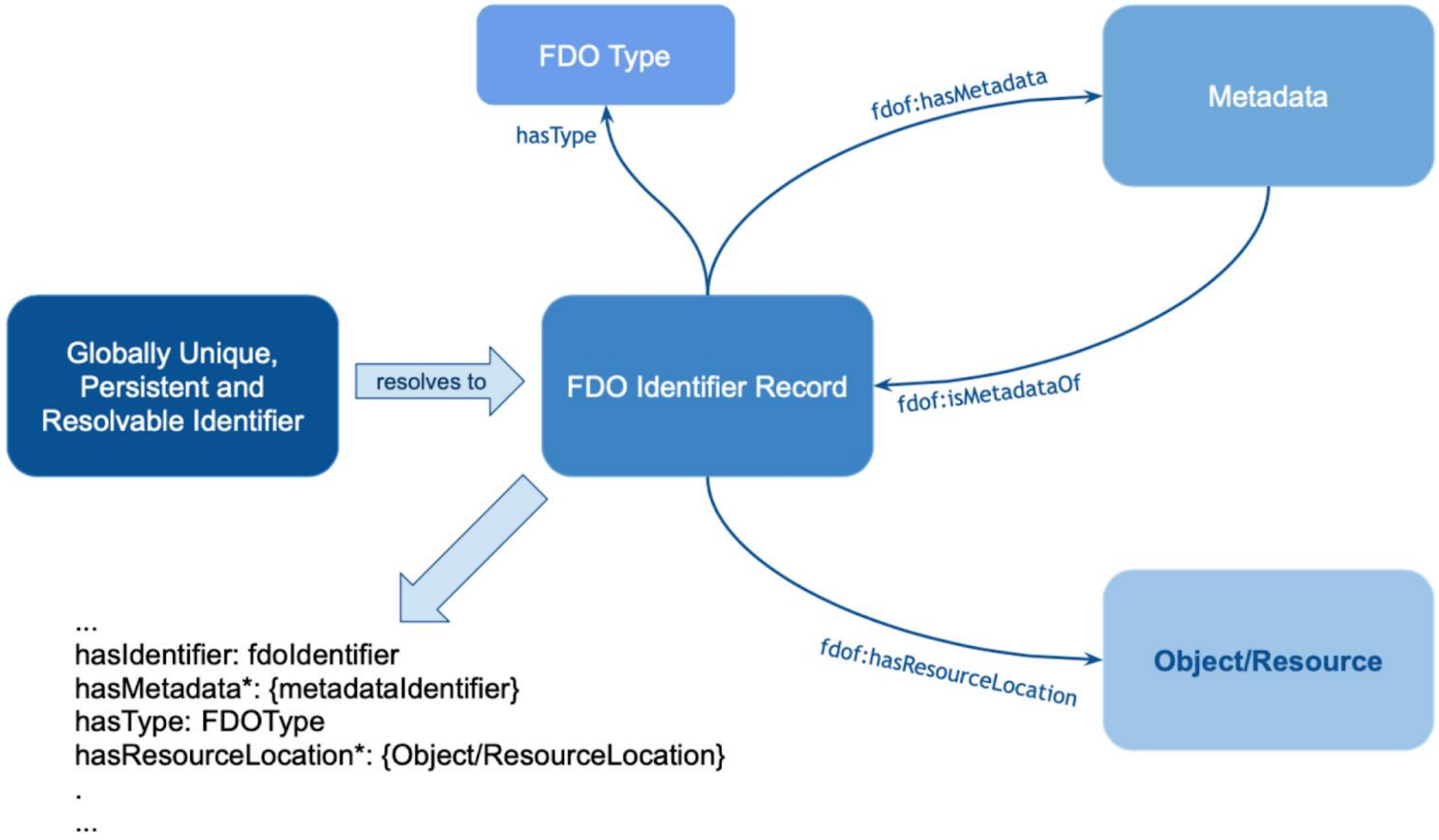
Beginning in 1995, early Internet pioneers proposed Digital Objects as encapsulations of data and metadata made accessible through persistent identifier resolution services (Kahn and Wilensky 2006). In recent years, this Digital Object Architecture has been extended to include the FAIR Guiding Principles (Wilkinson et al. 2016), resulting in the concept of a FAIR Digital Object (FDO), a minimal, uniform container making any digital resource machine-actionable. Intense effort is currently underway by a global community of experts to clarify definitions around an FDO Framework (FDOF) and to provide technical specifications (FAIR DO group 2020, FAIR Digital Object Forum 2020, Bonino da Silva Santos (2021)) regarding their potential implementation.

Beginning in 2009, nanopublications were independently conceived (Groth et al. 2010) as a minimal, uniform container making individual semantic assertions and their associated provenance metadata, machine-actionable. They represent minimal units of structured data as citable entities (Mons and Velterop 2009). A nanopublication consists of an *assertion*, the *provenance* of the assertion, and the provenance of the nanopublication (*publication info*). Nanopublications are implemented in and aligned with Semantic Web technologies such as RDF, OWL, and SPARQL (World Wide Web Consortium (W3C) 2015) and can be permanently and



= FDO

Fig.6





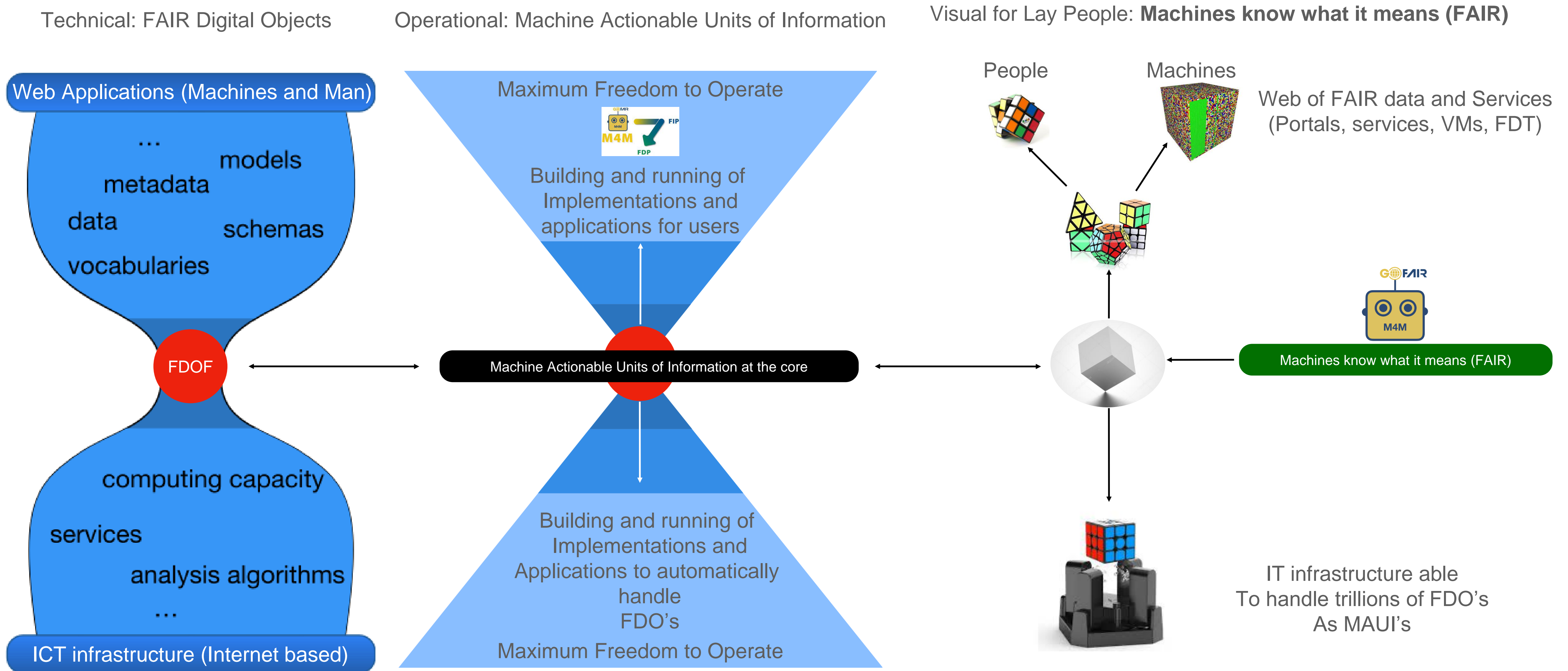


Fig.5

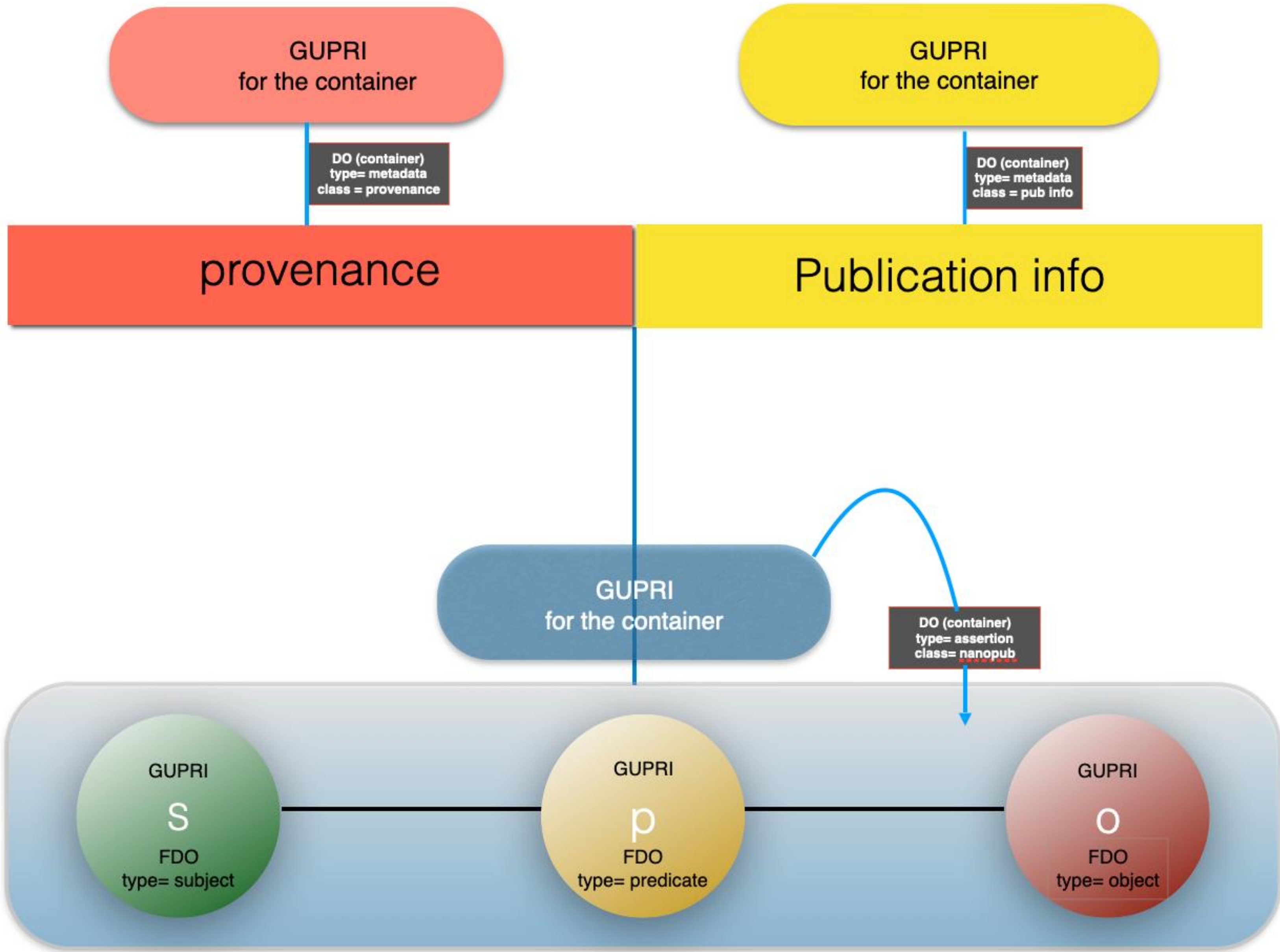
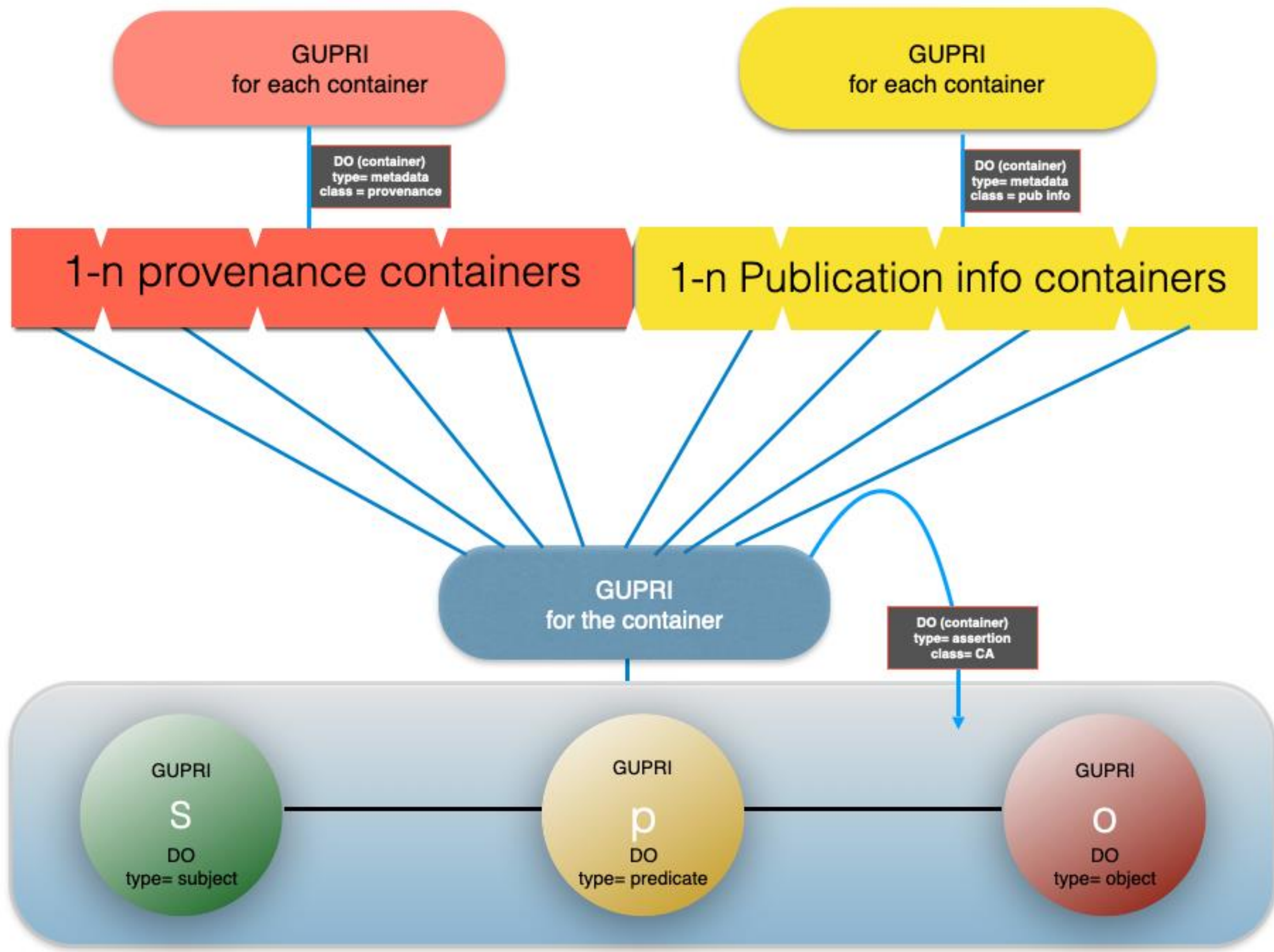


Fig.8



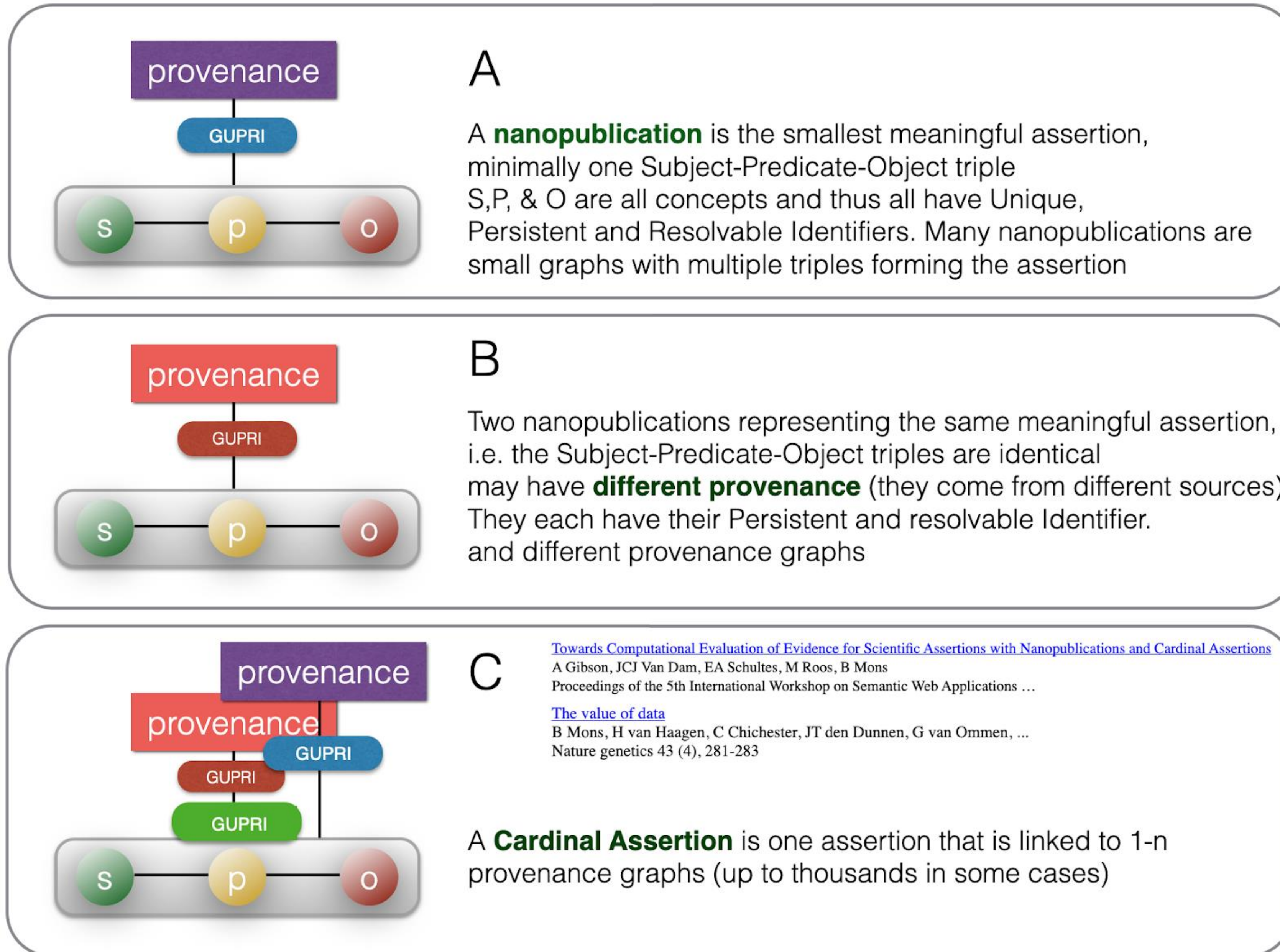
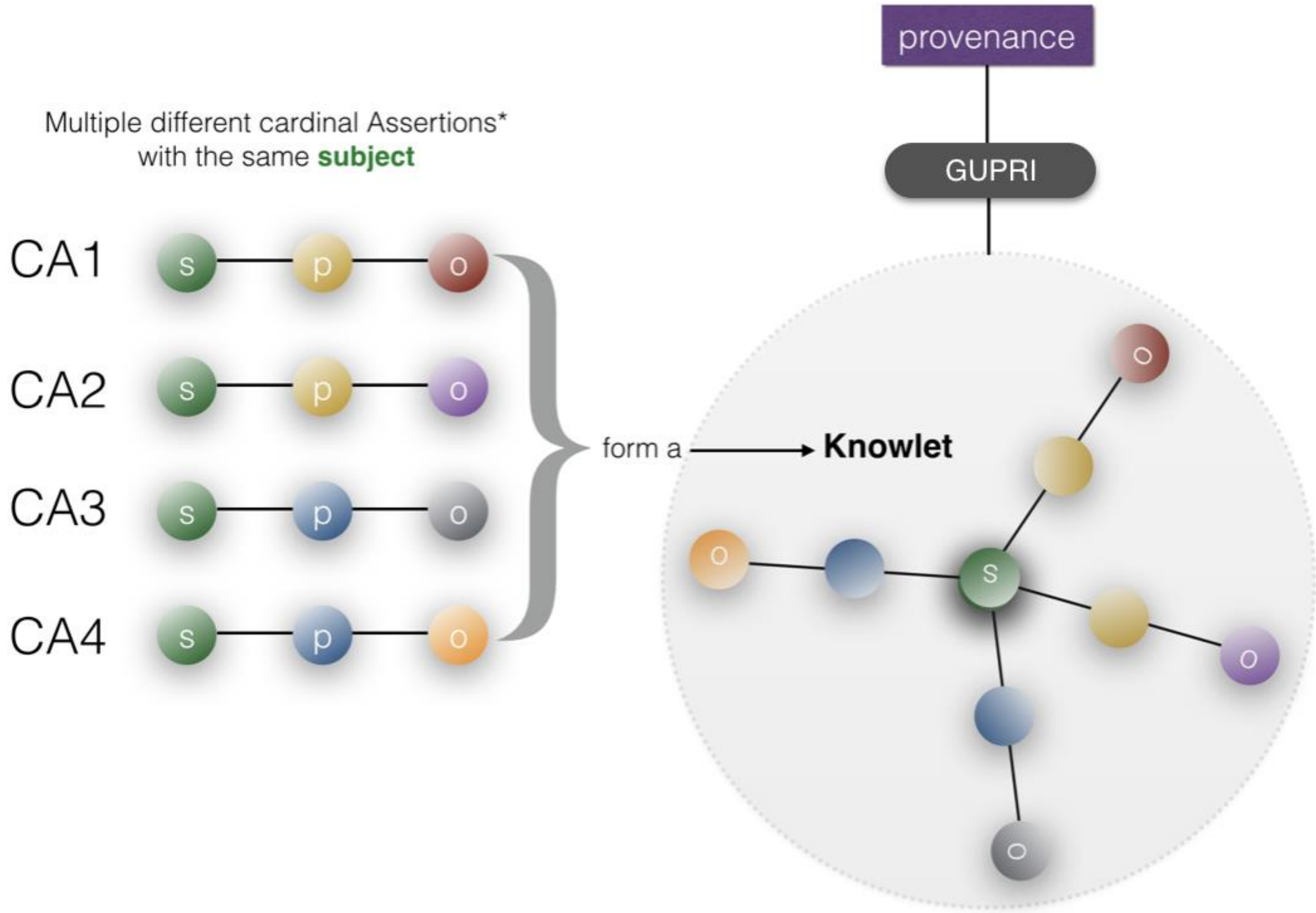
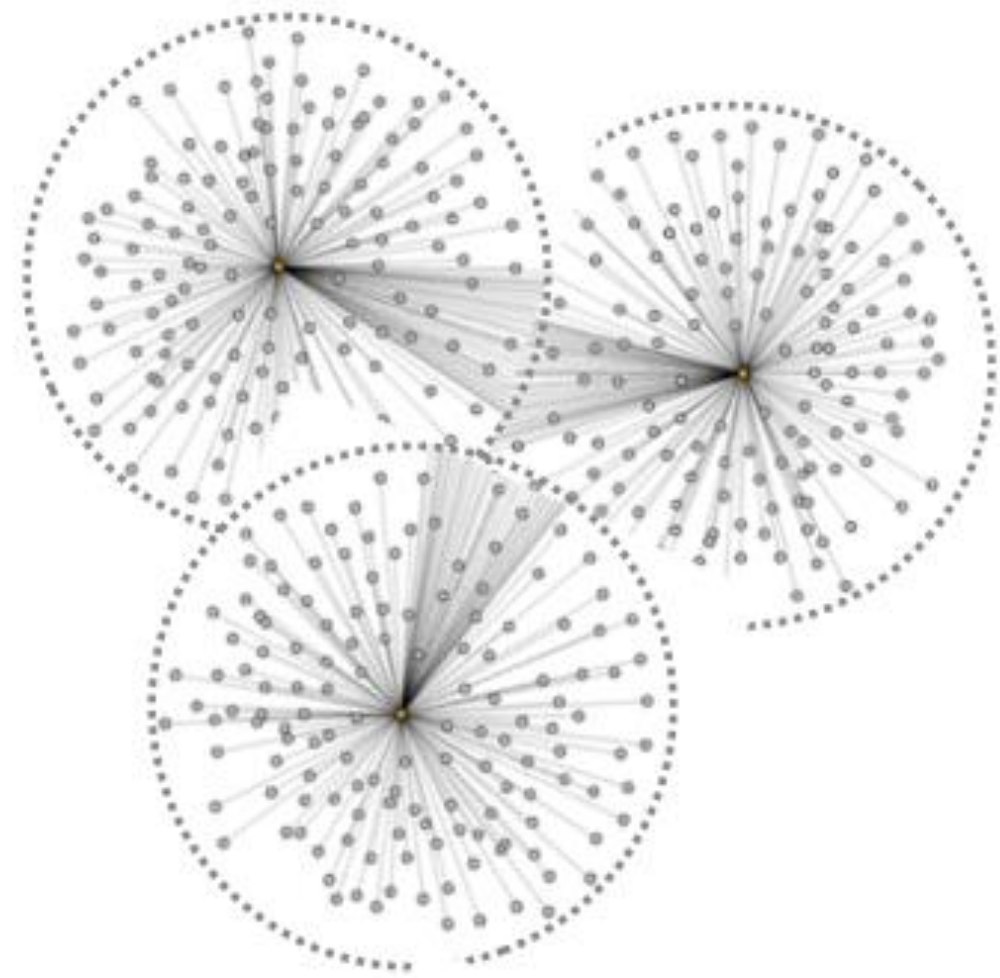


Fig.10

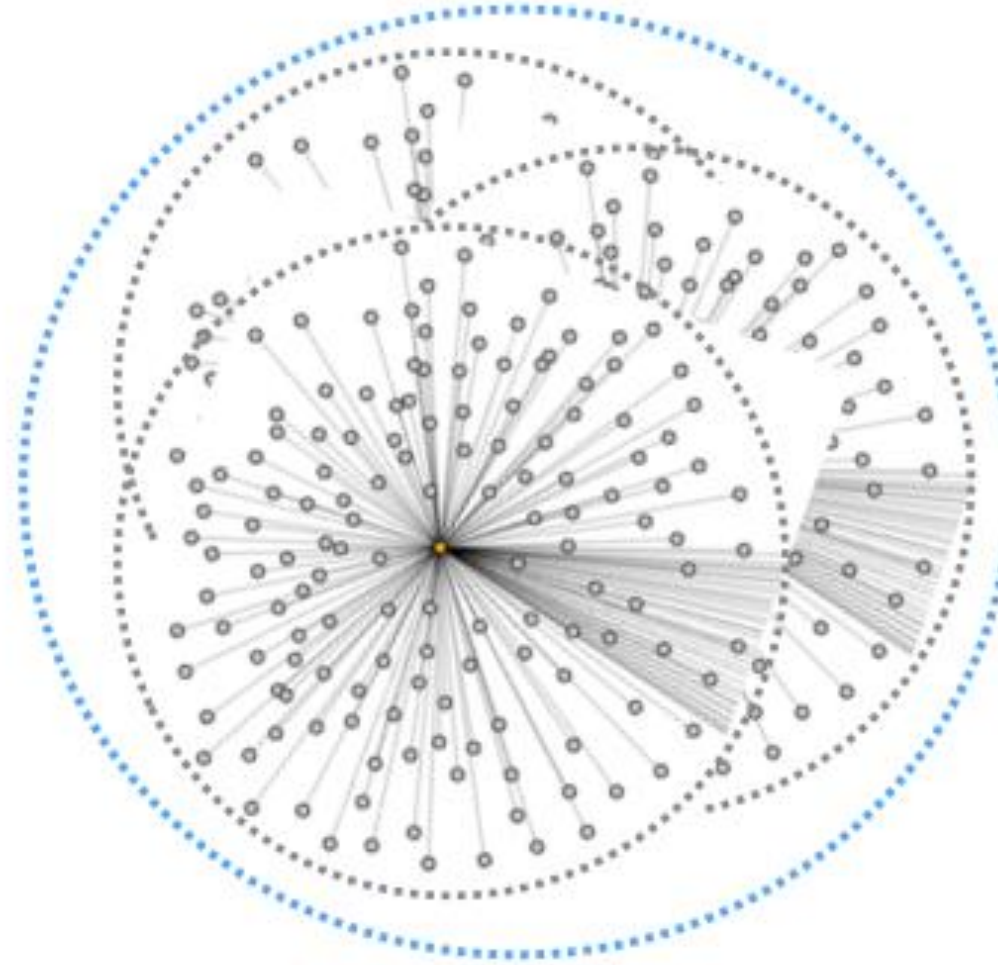


GUPRI's and Provenance not depicted for simplicity reasons

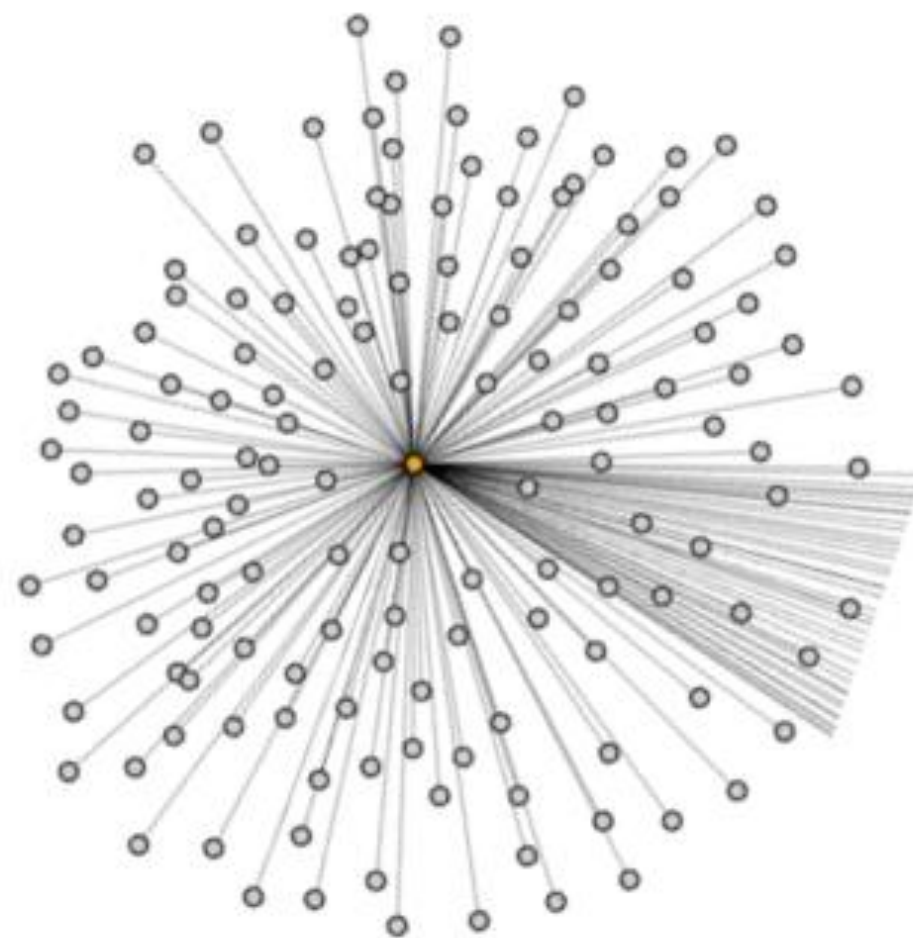
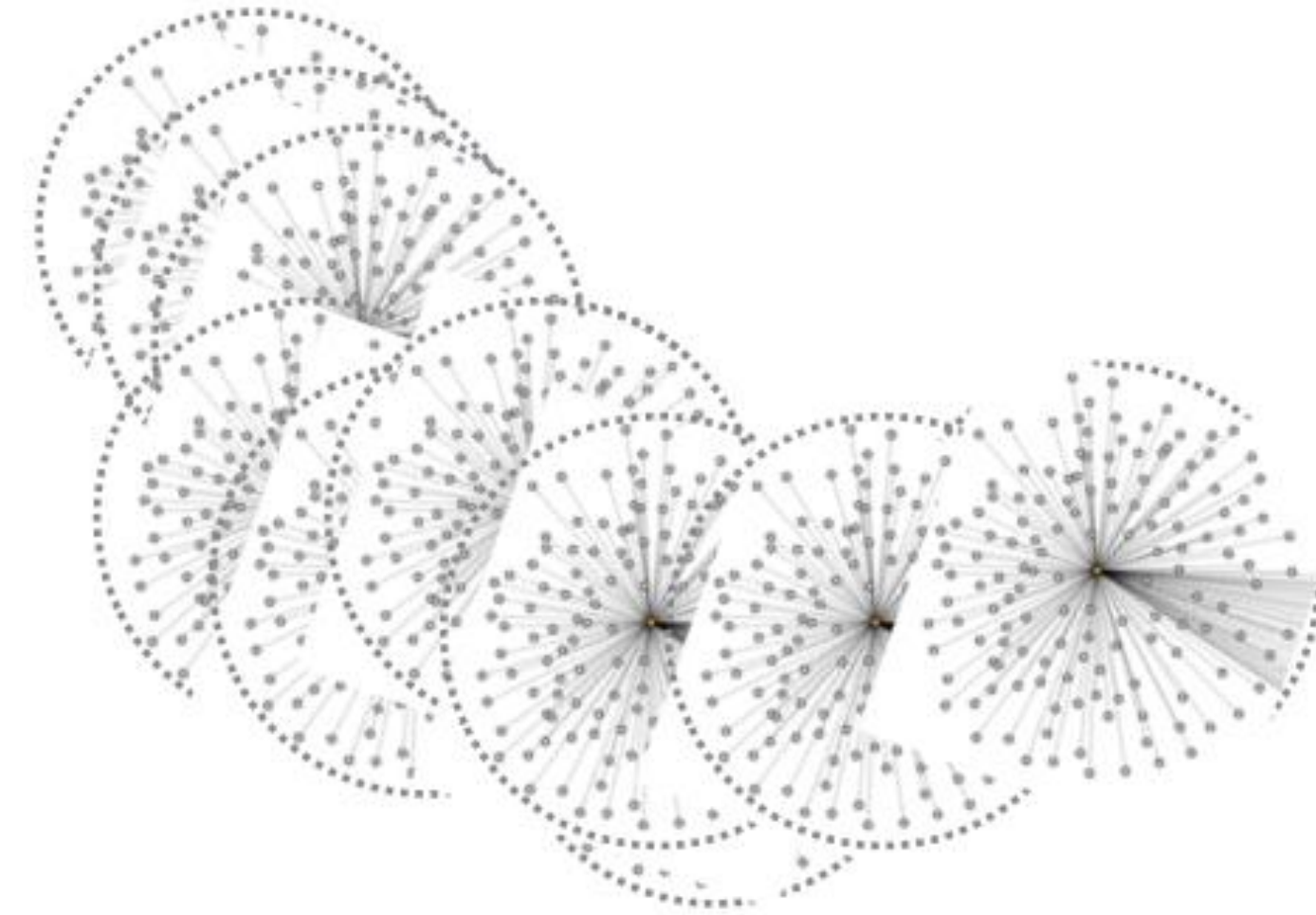
**A**  
**conceptual similarity**  
**(hypothesis generation)**



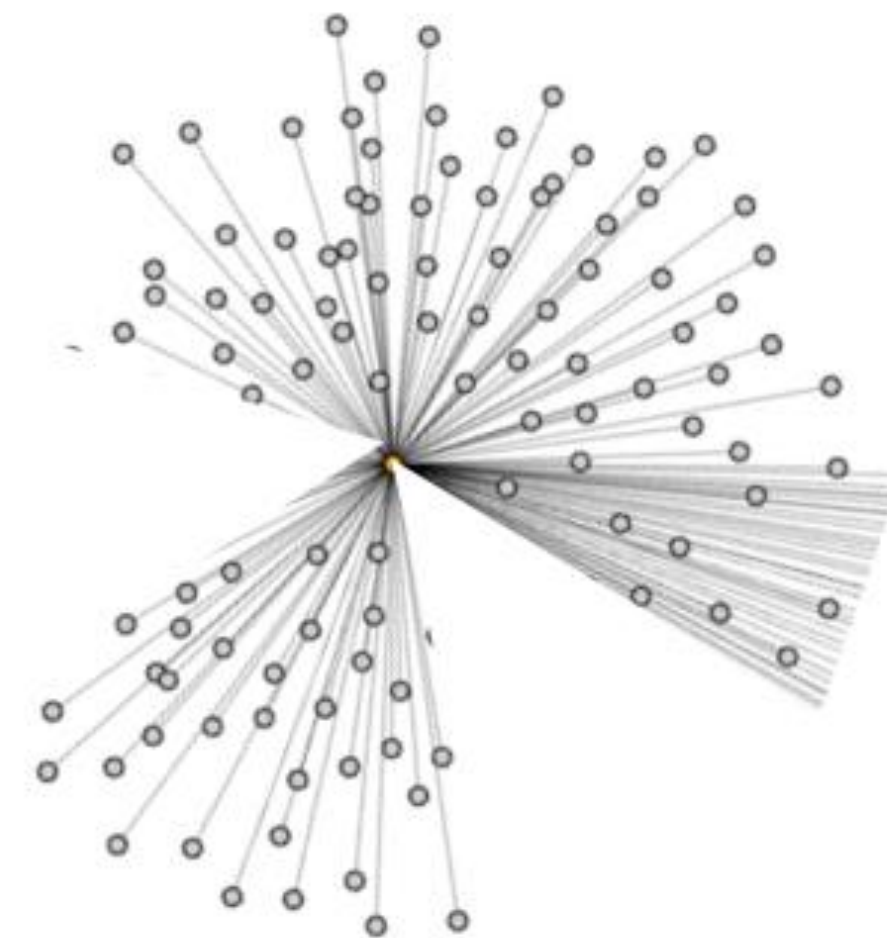
**B**  
**Near sameness**  
**(semantic lenses)**



**C**  
**conceptual drift**  
**(meta-data/blockchain)**



**D**  
**QUA's**  
**(semantic bias)**

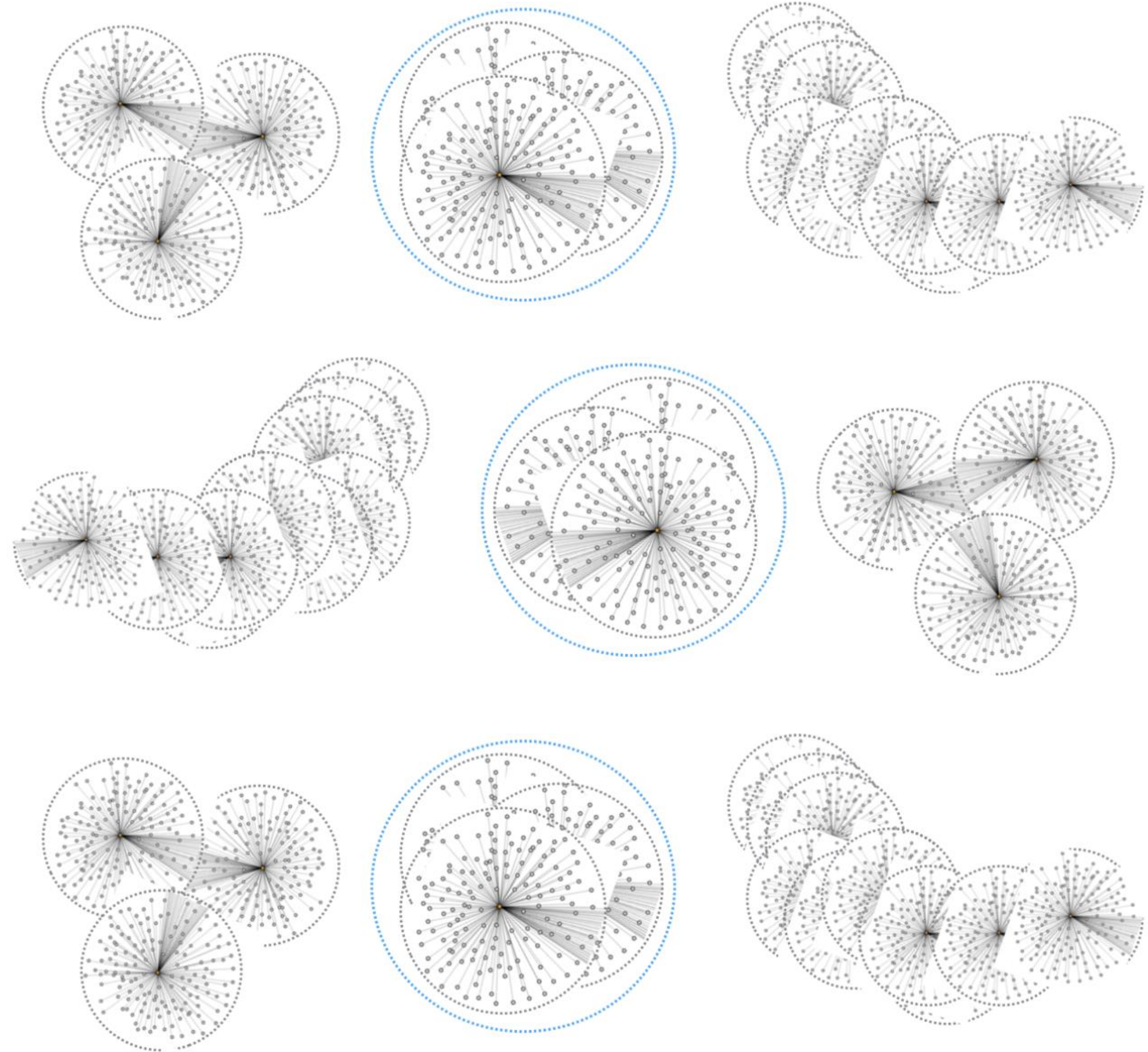


The Definitive Explanation of How Consciousness  
Determines the Structure of the Universe

# THE GRAND BIOCENTRIC DESIGN

How Life Creates Reality

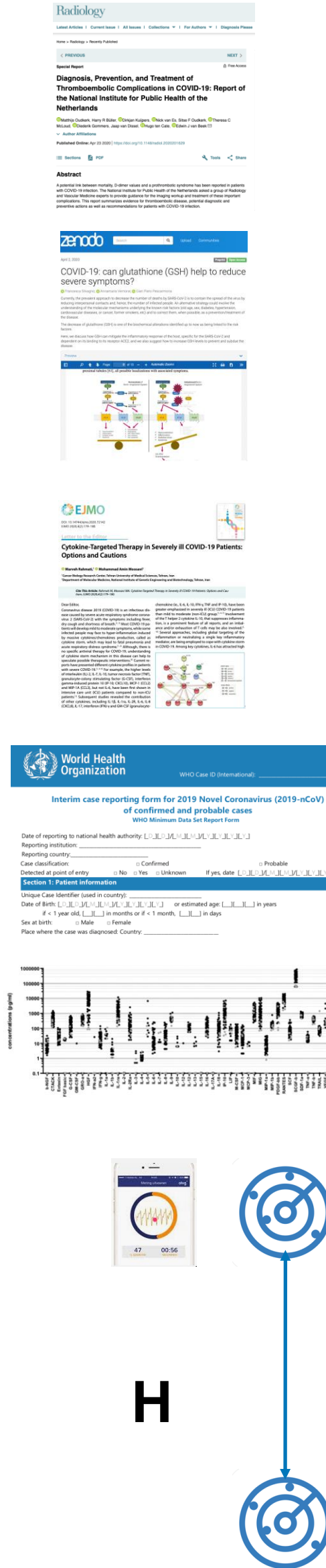
ROBERT LANZA, MD  
*and* MATEJ PAVŠIČ  
*with Bob Berman*



New Publications  
Real World Observations  
Clinical and Self reporting

# Disease Modelling Workflow (COVID-19)

AI-ready Established  
Knowledge  
Plus selected connectors  
Subhypotheses



**A1**

FAIR abstract  
Paper 1

FAIR abstract  
Paper 2

FAIR abstract  
Paper 3

**A2**

Case Report  
Forms/ EPD

Clinical  
measurements

Self Reporting  
(apps)

FAIR

FAIR

FAIR

FAIR

FAIR

FAIR

**EURETOS** AI PLATFORM (Other tools if available)

**C**

Greatest Common  
Denominator (GDC)  
'Connectome'

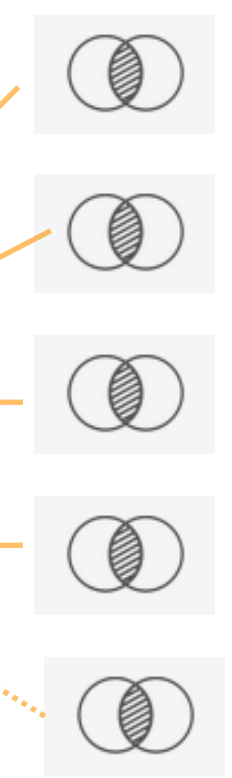
Multiple Algorithms

**D**

Interactive disease Model(s)

1 2 3 ...

Systematic *in silico*  
Rationalisation



**B**

SARS-Cov-2/human proteome

ACE2/ACE

Cytokine Storm (CRS)

Renin-angiotensin system

Further sub-hypotheses

**E**

Expert introduced concept

Drug, mechanism, cell type etc.

**F**

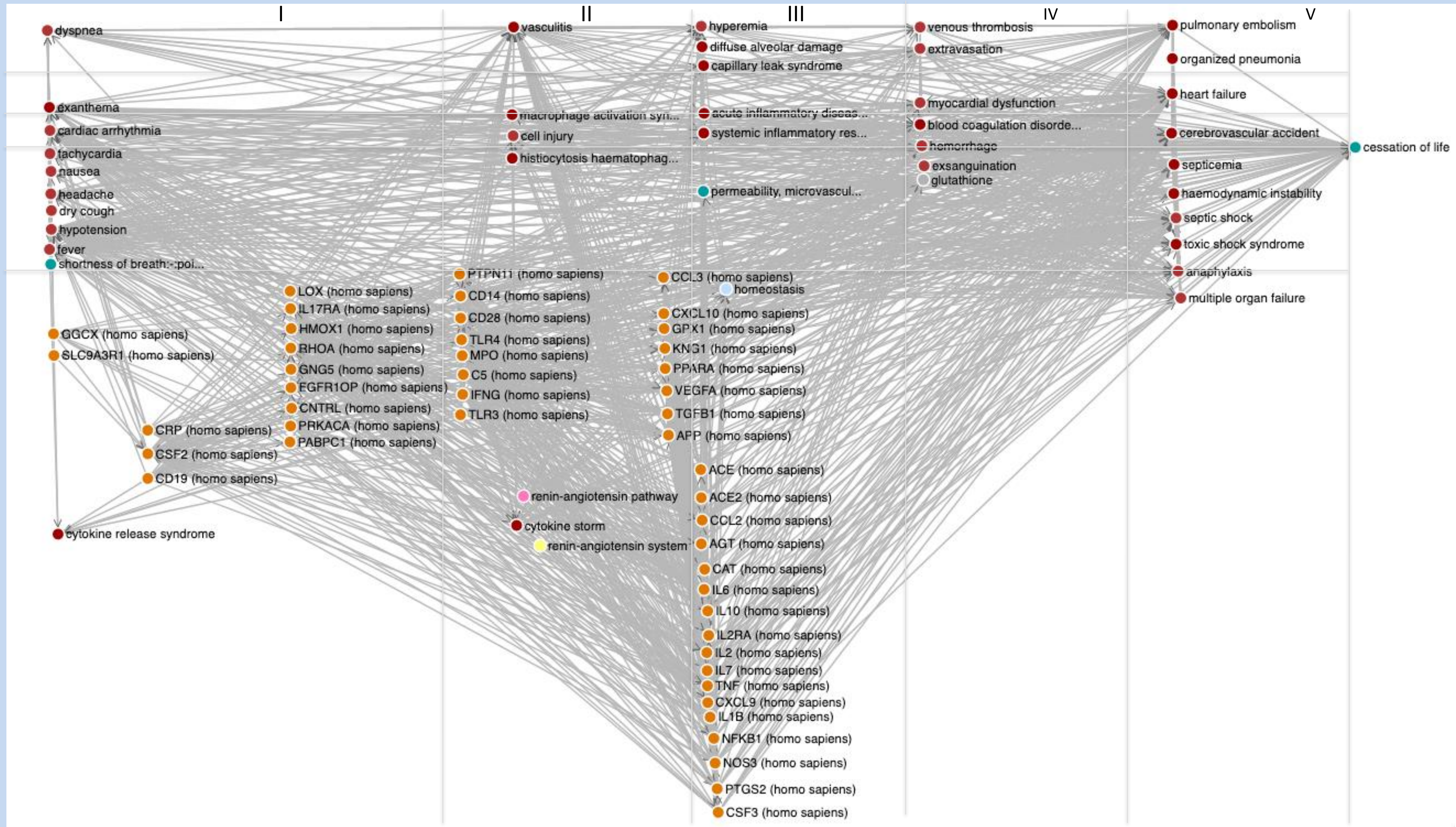
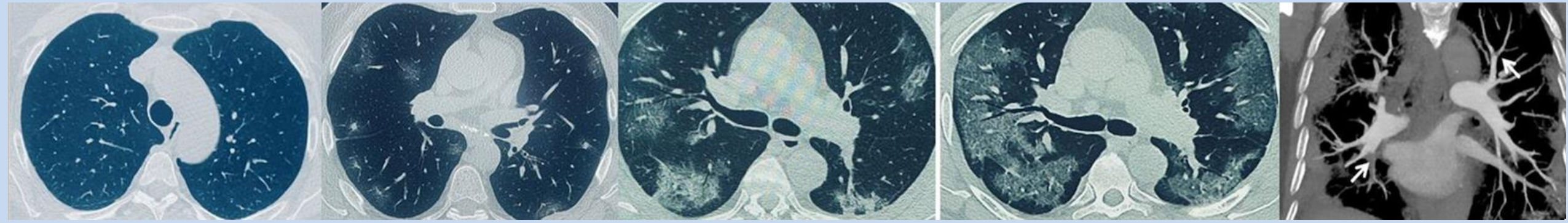
A microscopy image of a biological structure with a red line overlaid, next to a line graph with multiple colored peaks.

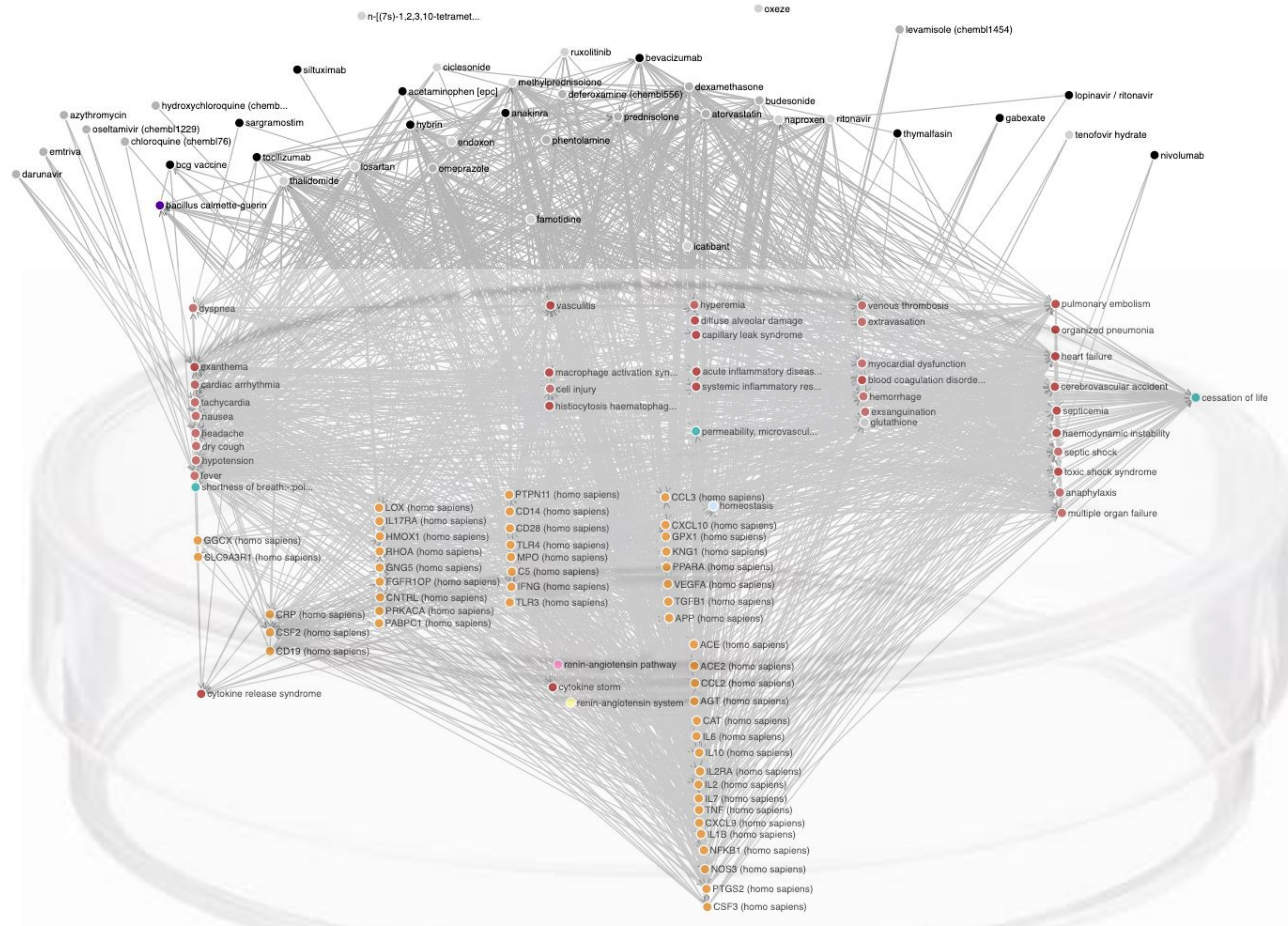
**G**

Curation, annotation and  
Hypothesis discussion  
Disease phase alignment  
Innovative OA publication  
Visualisation

Community annotation options





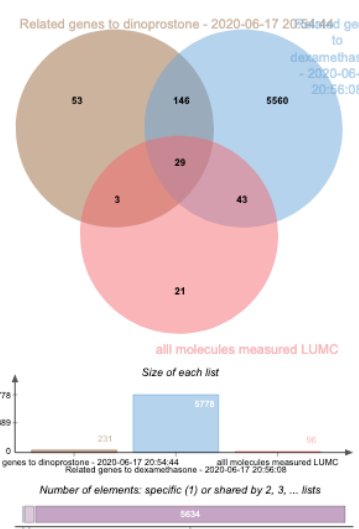
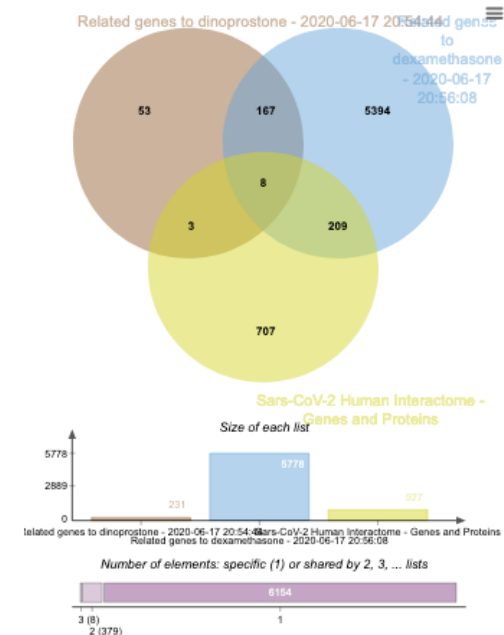


**EURETOS**  
AI PLATFORM

Cardinal assertion

Provenance

Supporting or contesting Evidence



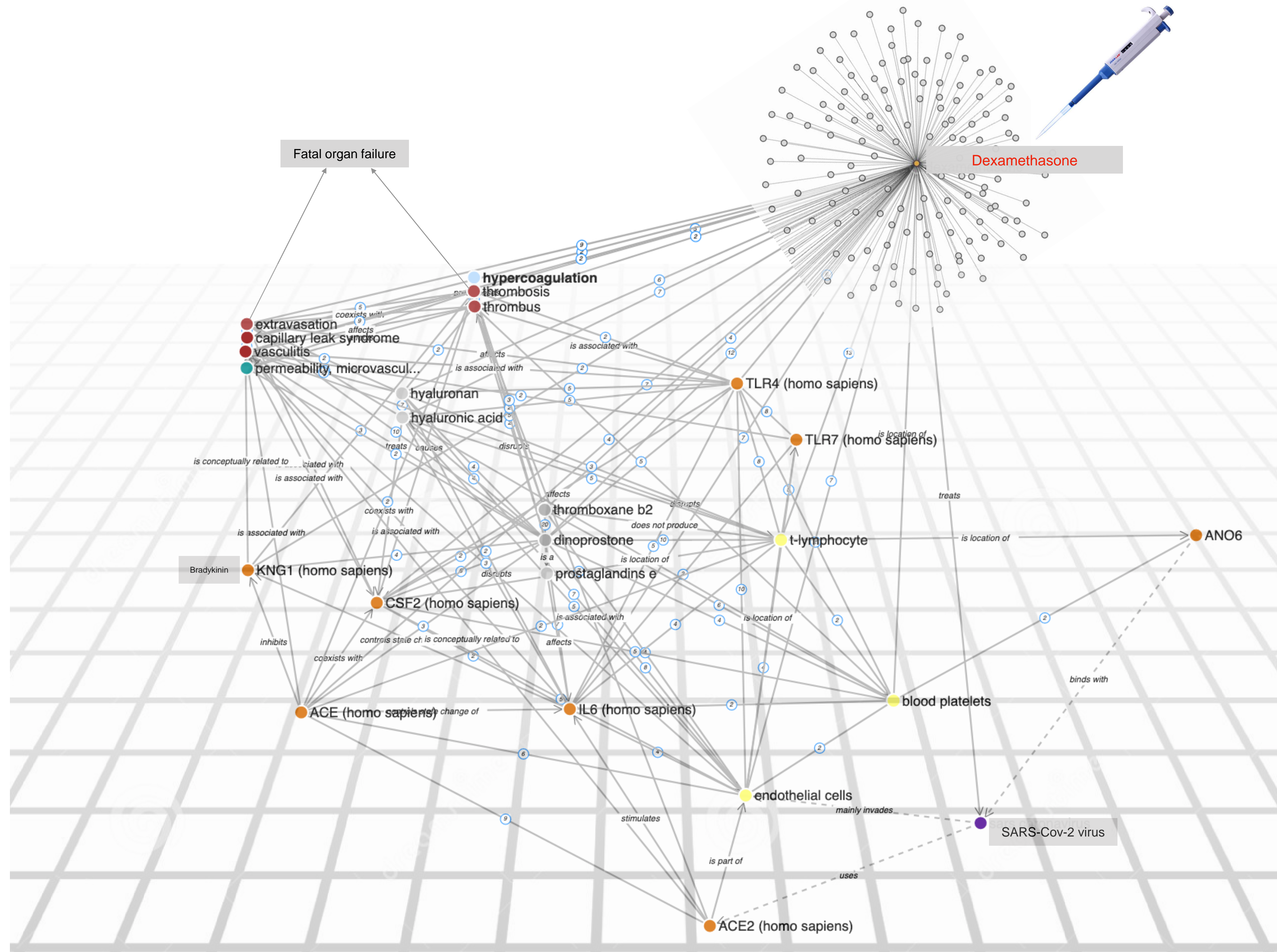
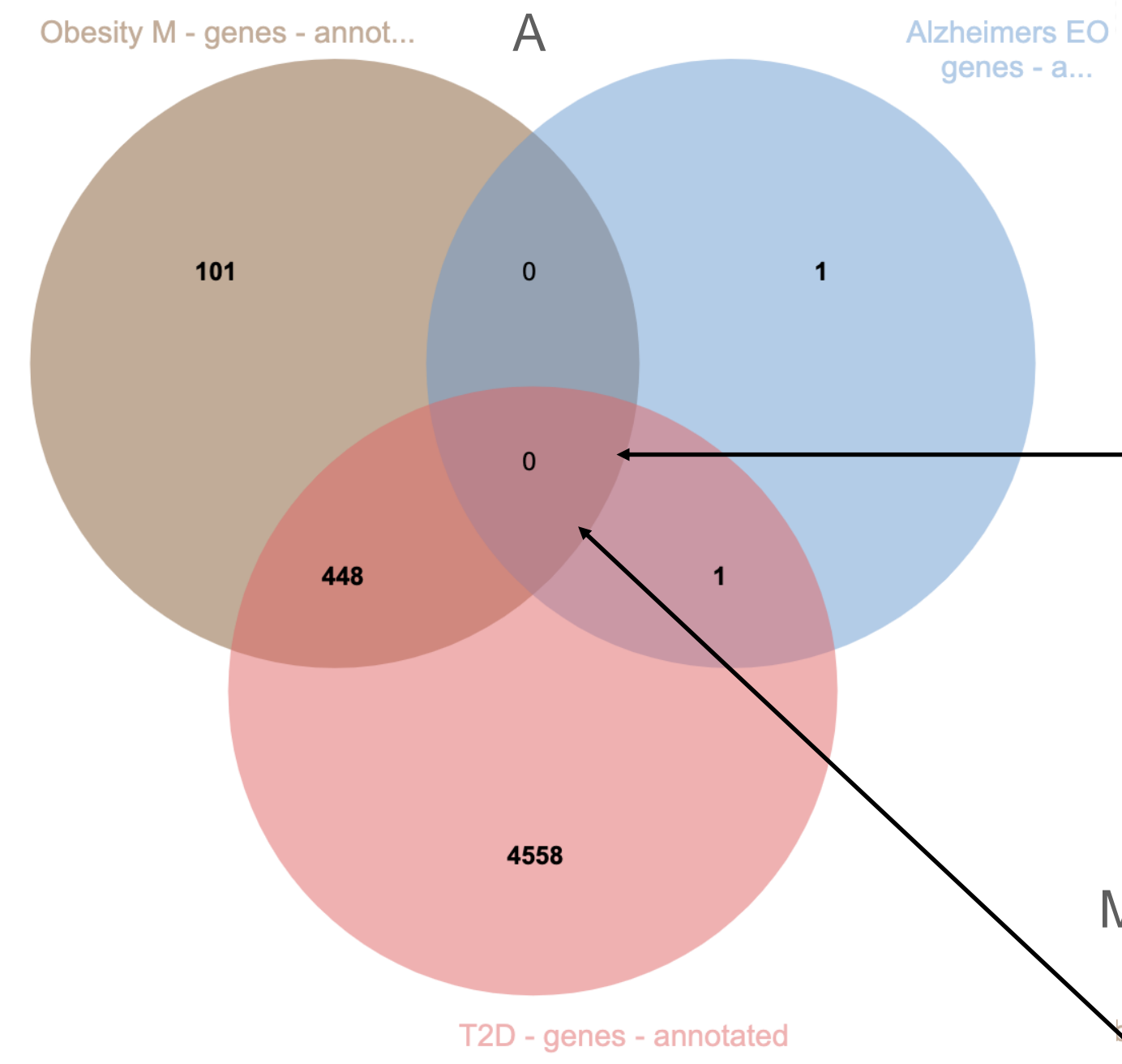
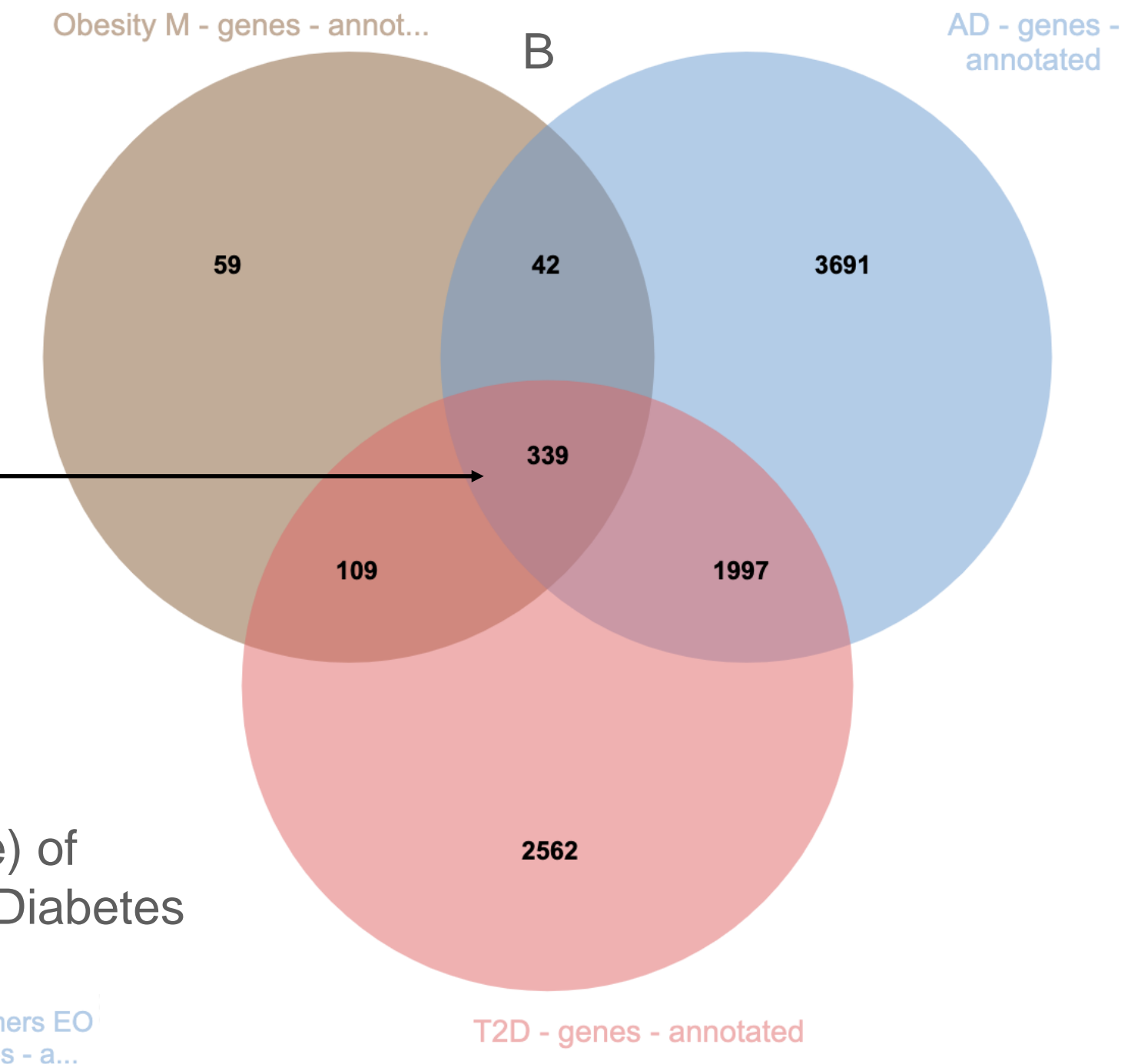


Fig.12

Knowlets (qua-genes, annotated) of Morbid Obesity, Early Onset Alzheimer and Type 2 Diabetes



Knowlets (qua-genes, annotated) of Morbid Obesity, Alzheimer and Type 2 Diabetes



Knowlets (qua-genes, co-occurrence) of Morbid Obesity, Alzheimer and Type 2 Diabetes

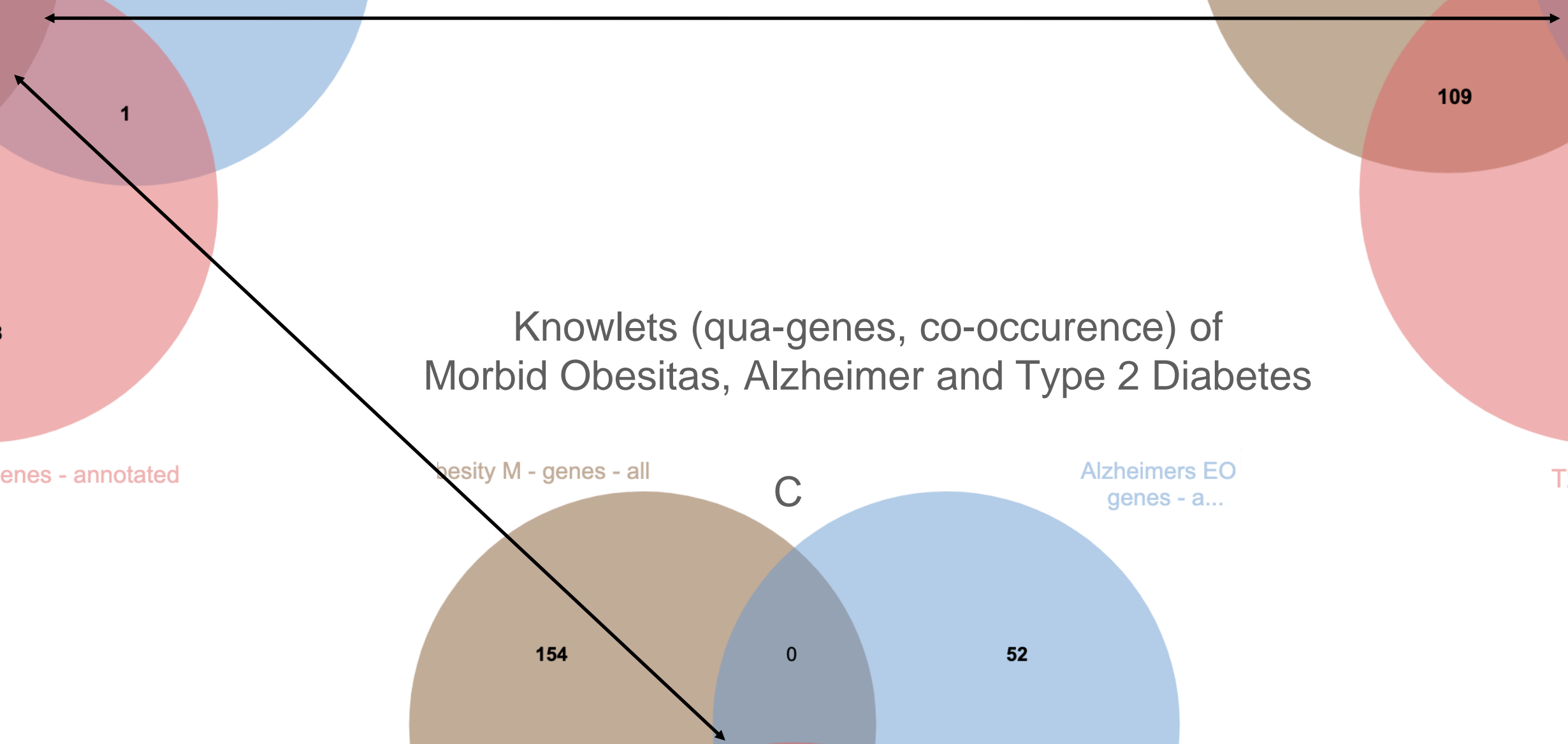
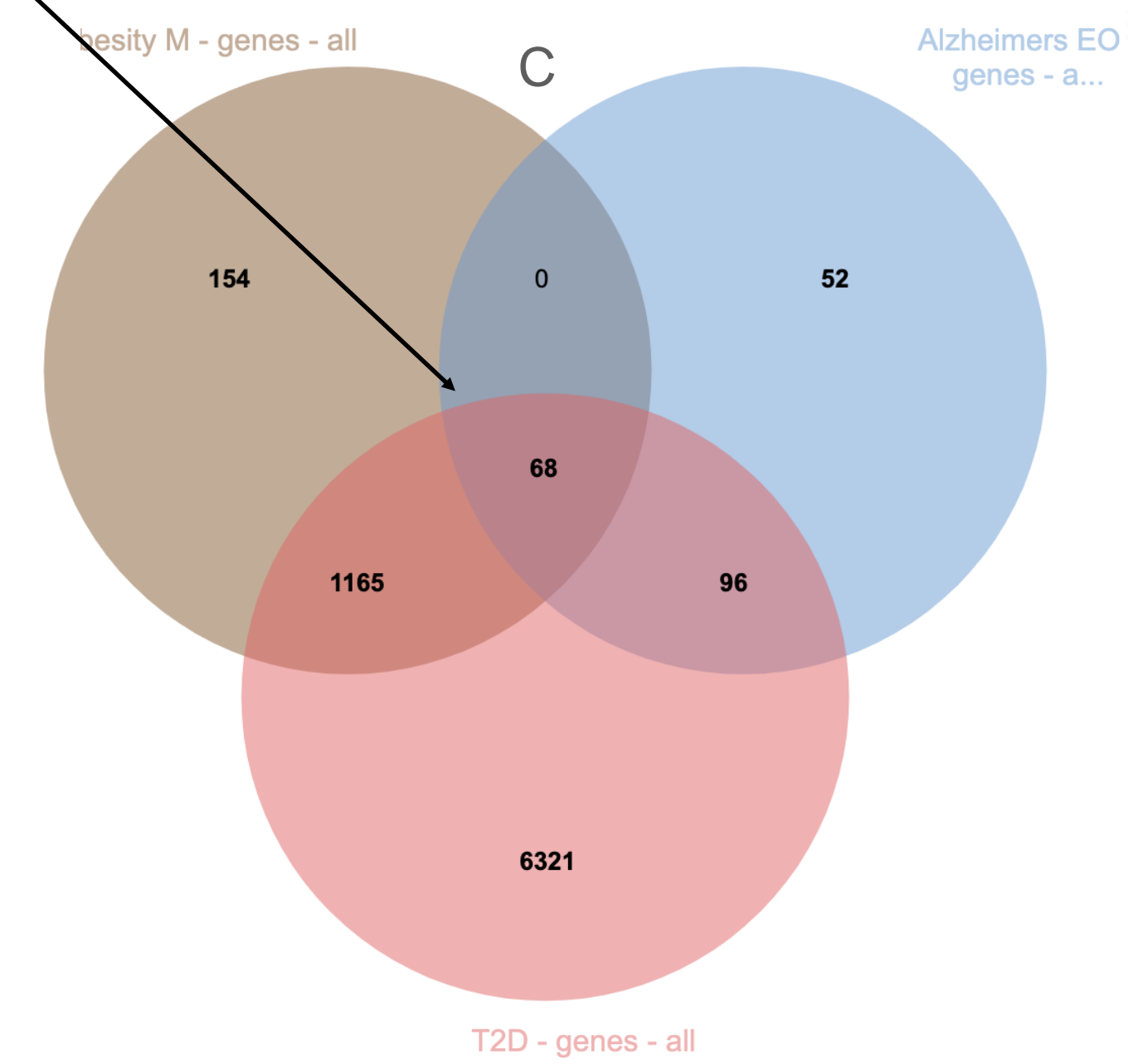
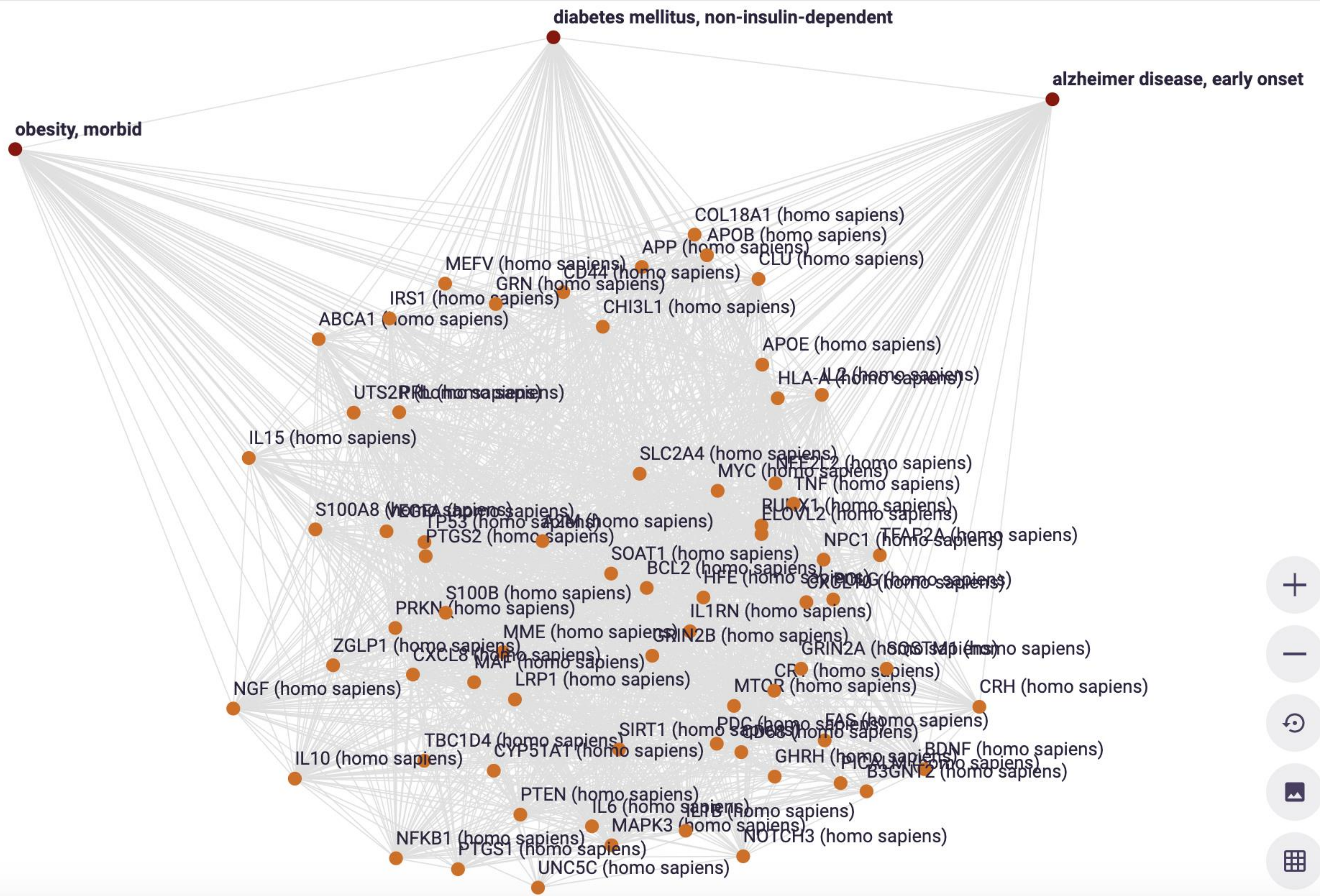
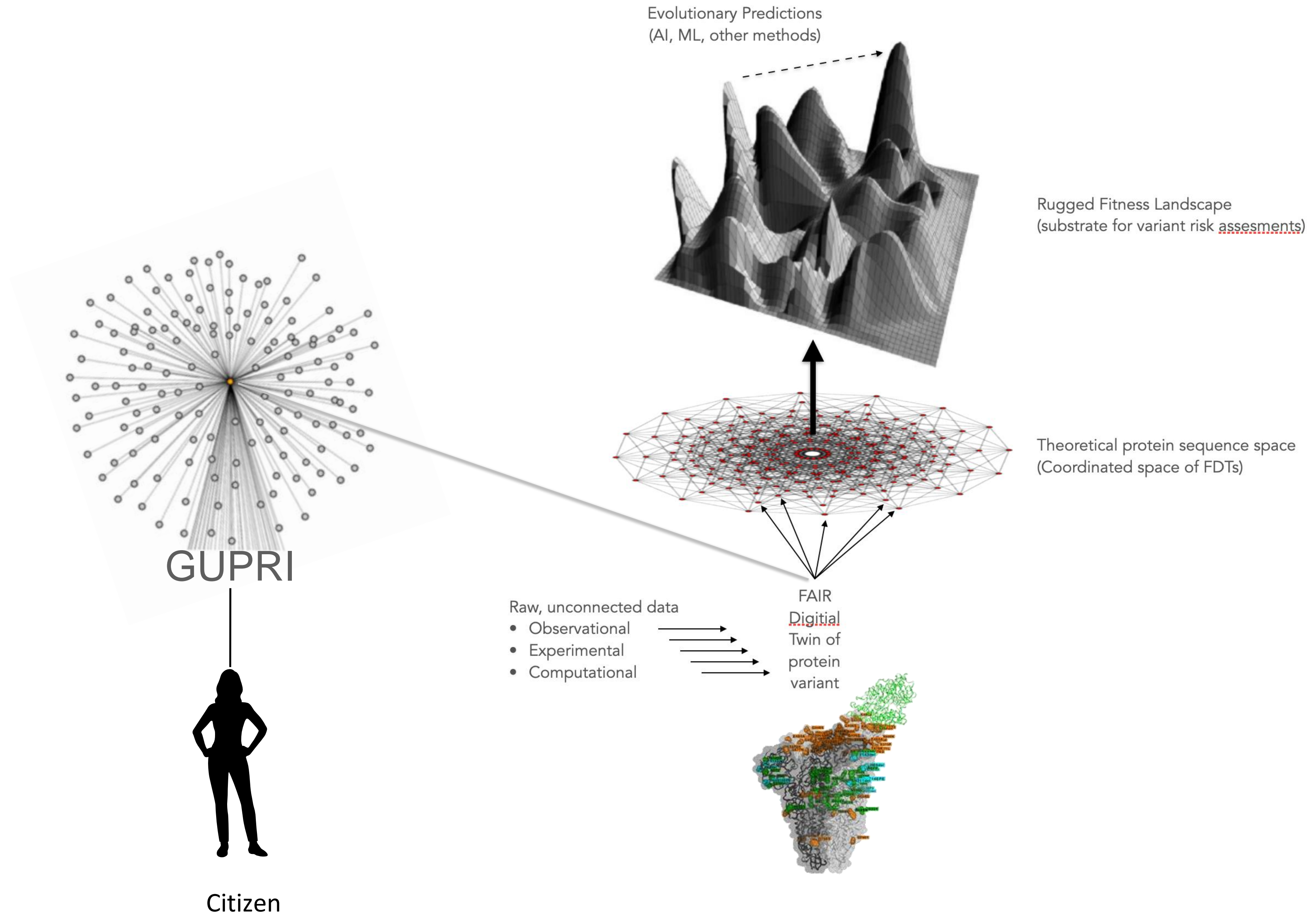
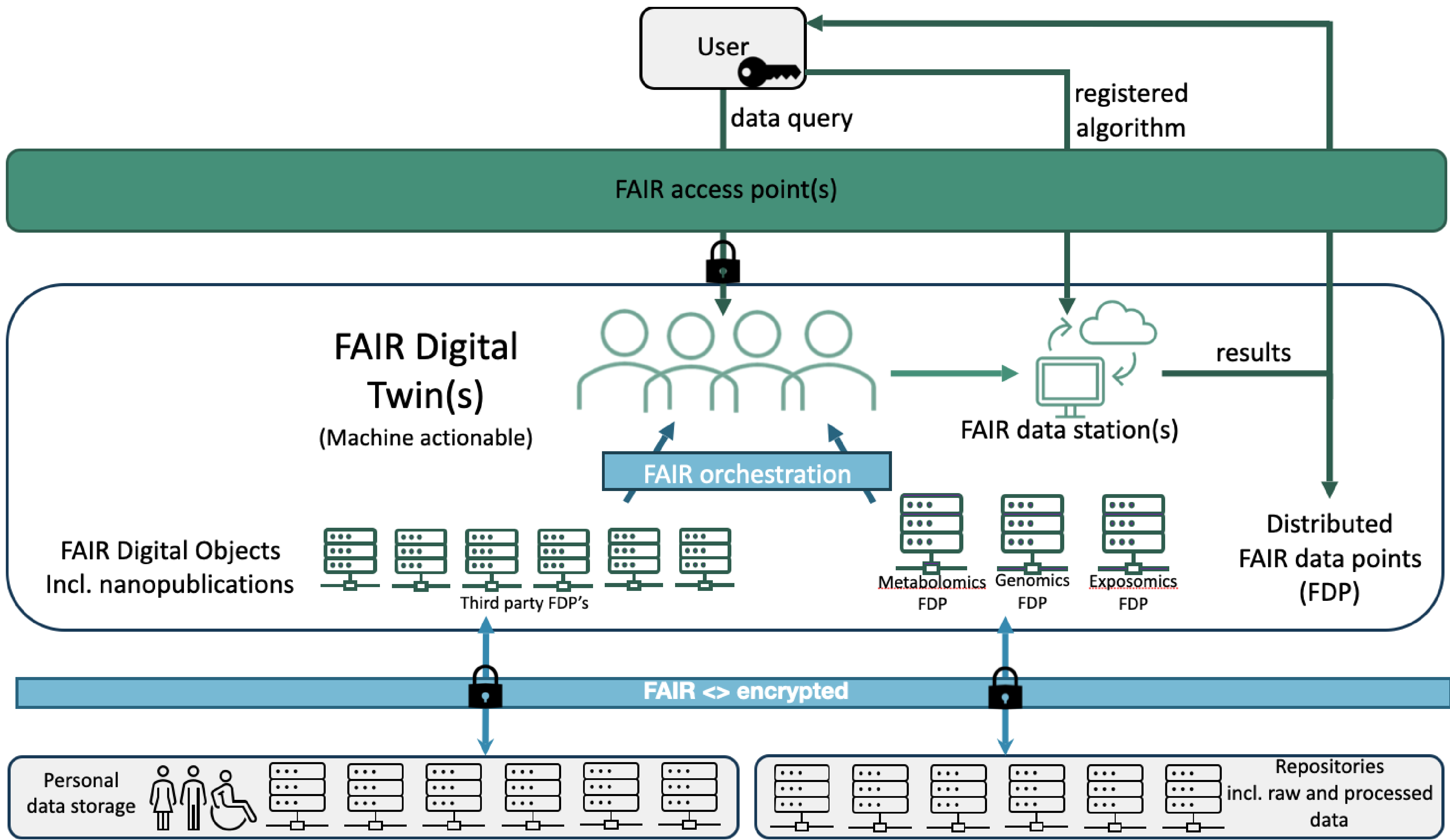


Fig.13



# FAIR Digital Twins





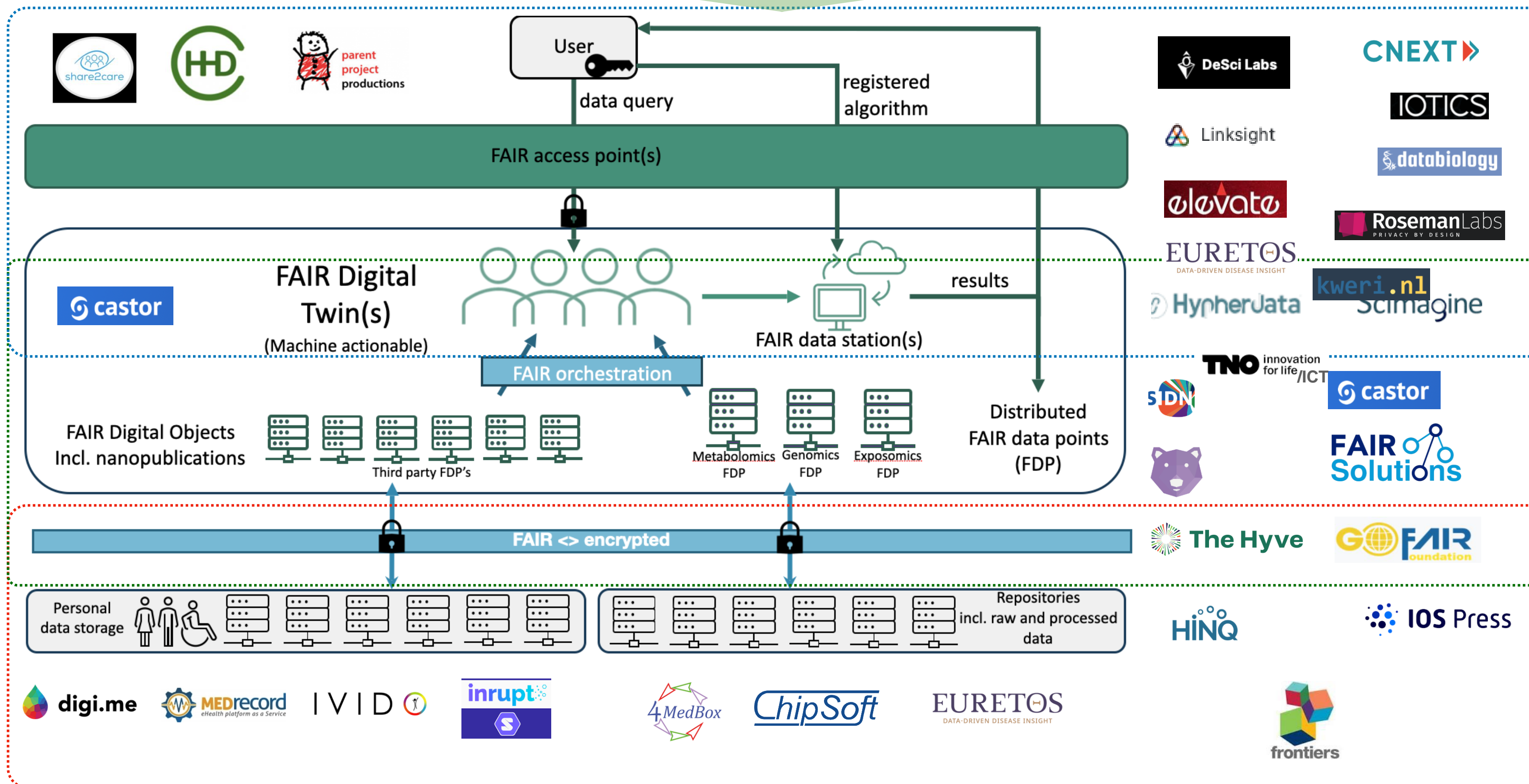


With Frontiers as 'one of many'

# LIFES: basic data stewardship and analytics infrastructure



Co-Founders and exemplar users



Access control and re-analytics (App Store)

High performance re-analytics environment(s)

FAIR compliant Data Orchestration

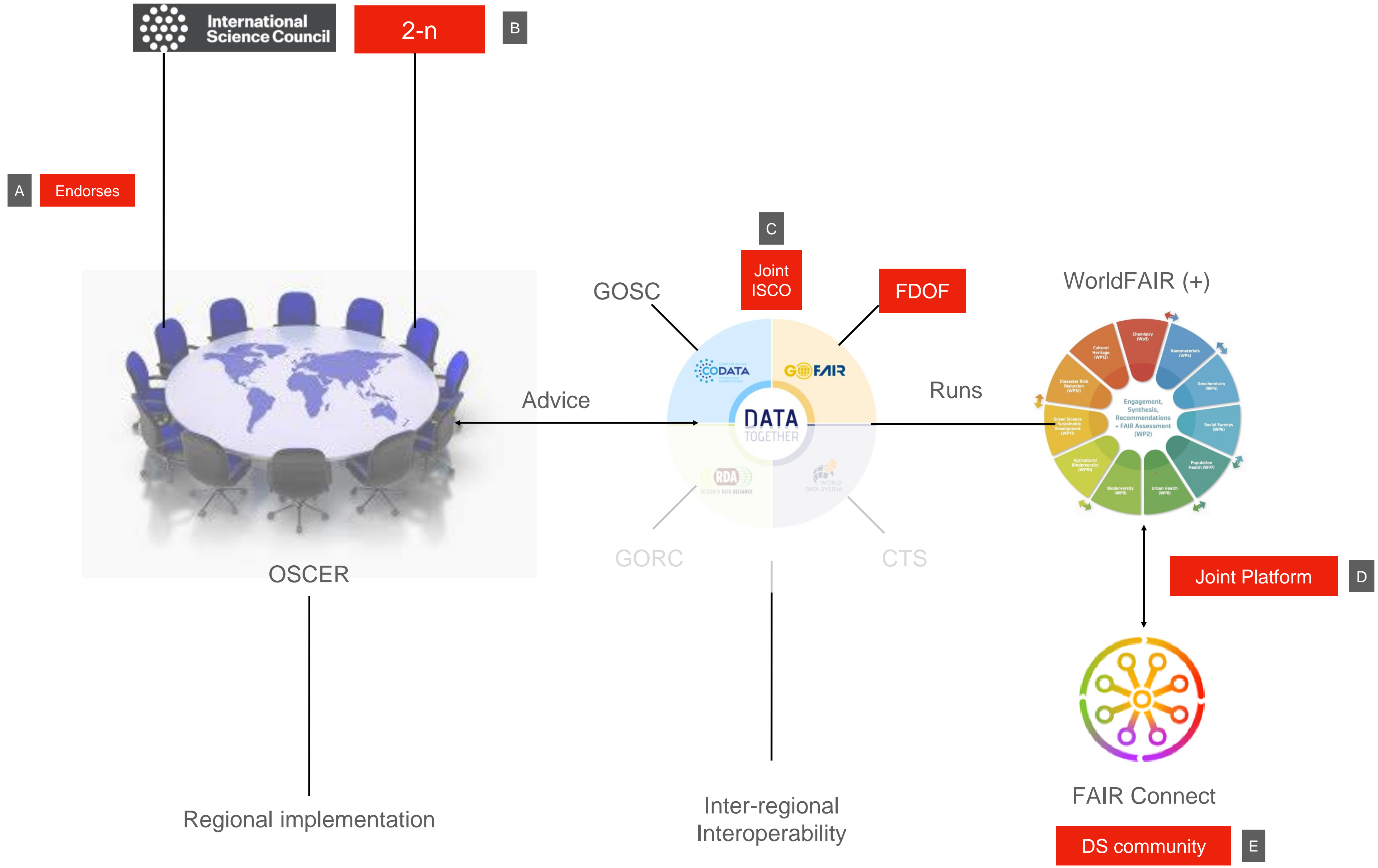
Two-way Data FAIRification

Data storage in closed repositories

Policies

Support




Execution (examples)



# Towards Data Visiting

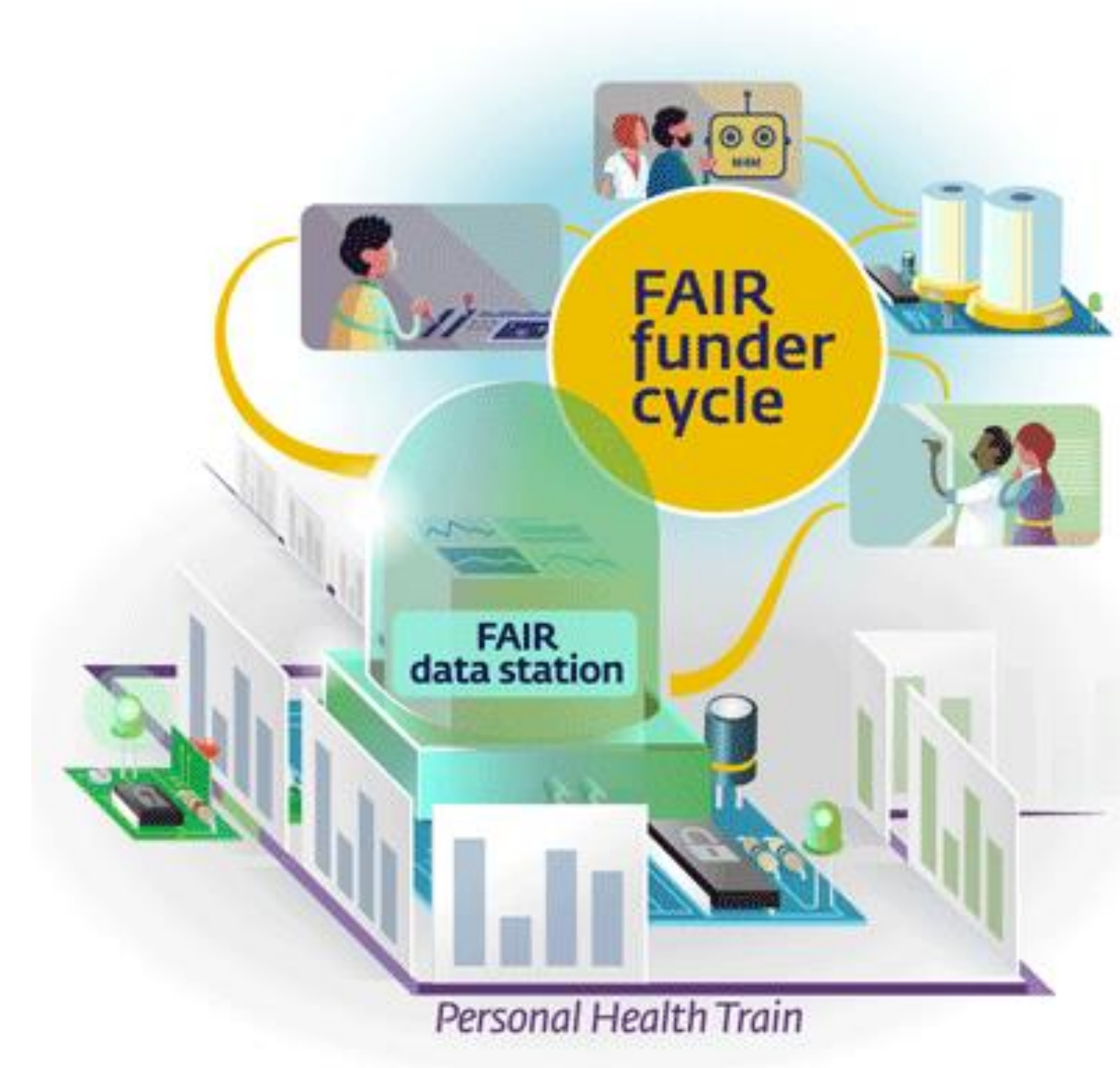
<https://vimeo.com/143246458>



-  FAIR reference (EK) data
-  FAIR RVO data
-  Trains - FAIR algorithms



# Start Data Visiting!



Barend Mons 08-03-2023



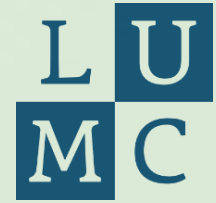
# FAIR Connect

*Empowering Data Stewardship*

FAIR Connect is an Open Access publishing platform for the development and dissemination of good practices for professional FAIR-Data stewardship.

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**And consider to join LIFES**