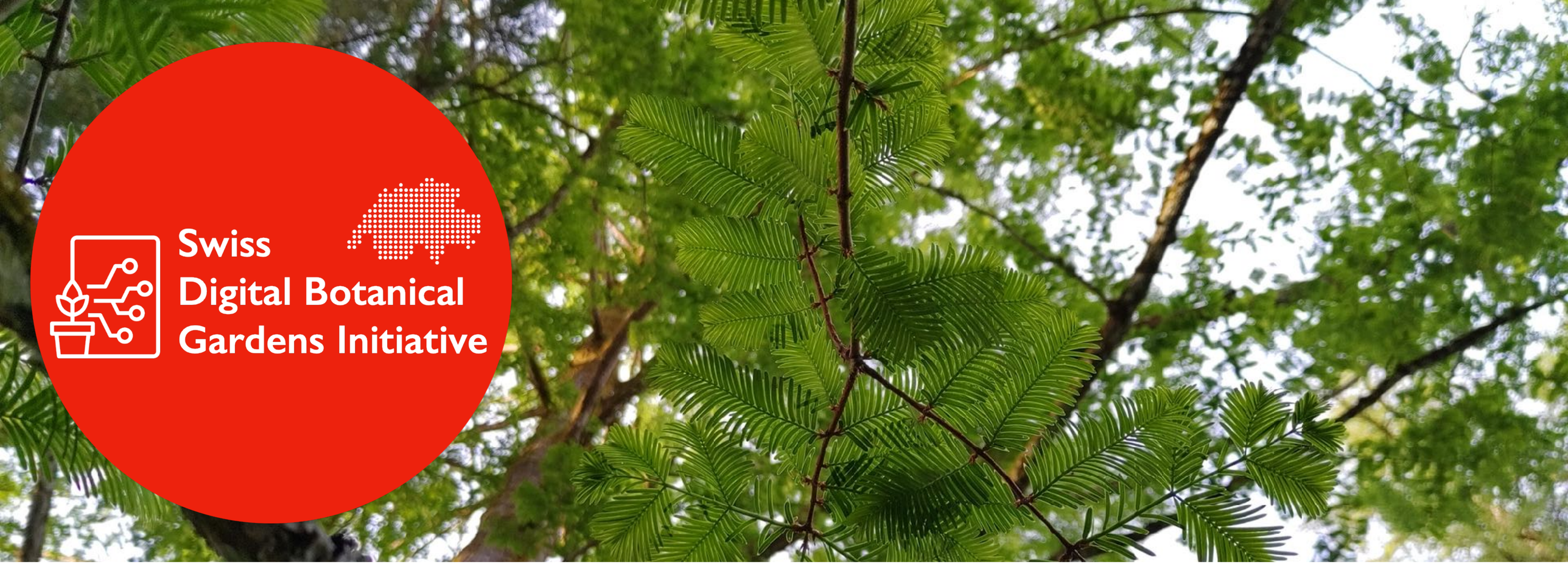


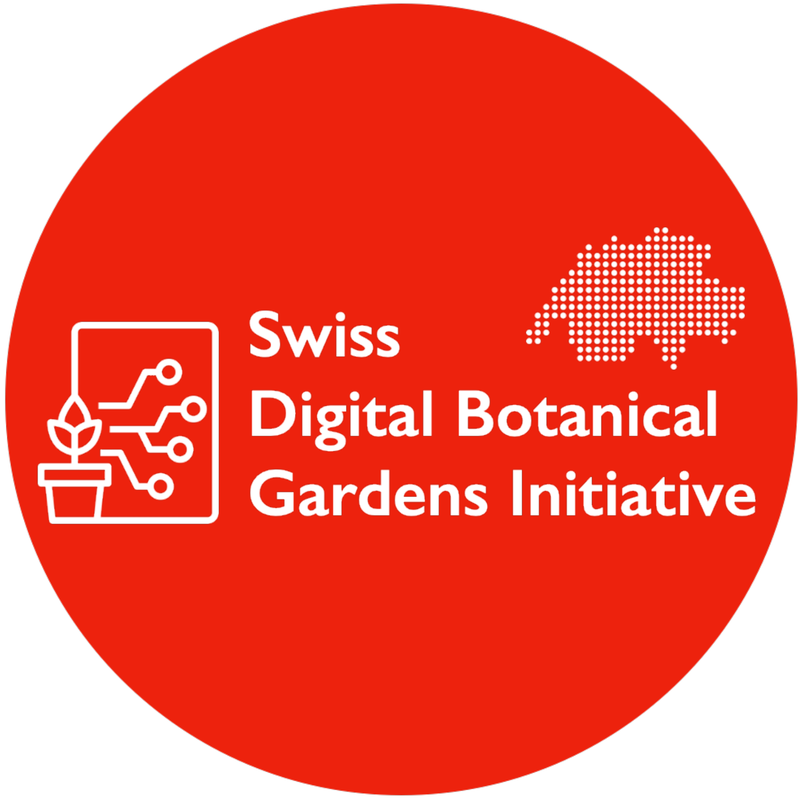
Swiss Digital Botanical Gardens Initiative

A brief presentation of the initiative

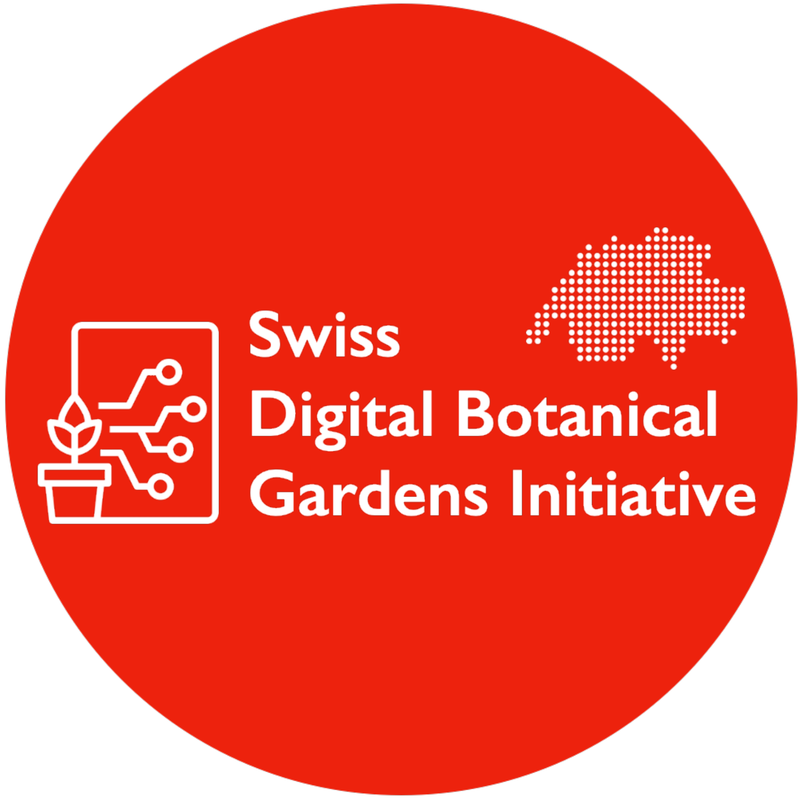
https://doi.org/10.5281/zenodo.7260068

28.10.2022

The DBGI Consortium, Emmanuel Defossez, Pierre-Marie Allard



Biodiversity conservation



- Document biodiversity at alternative granularities
- Provide "molecular arguments" for conservation

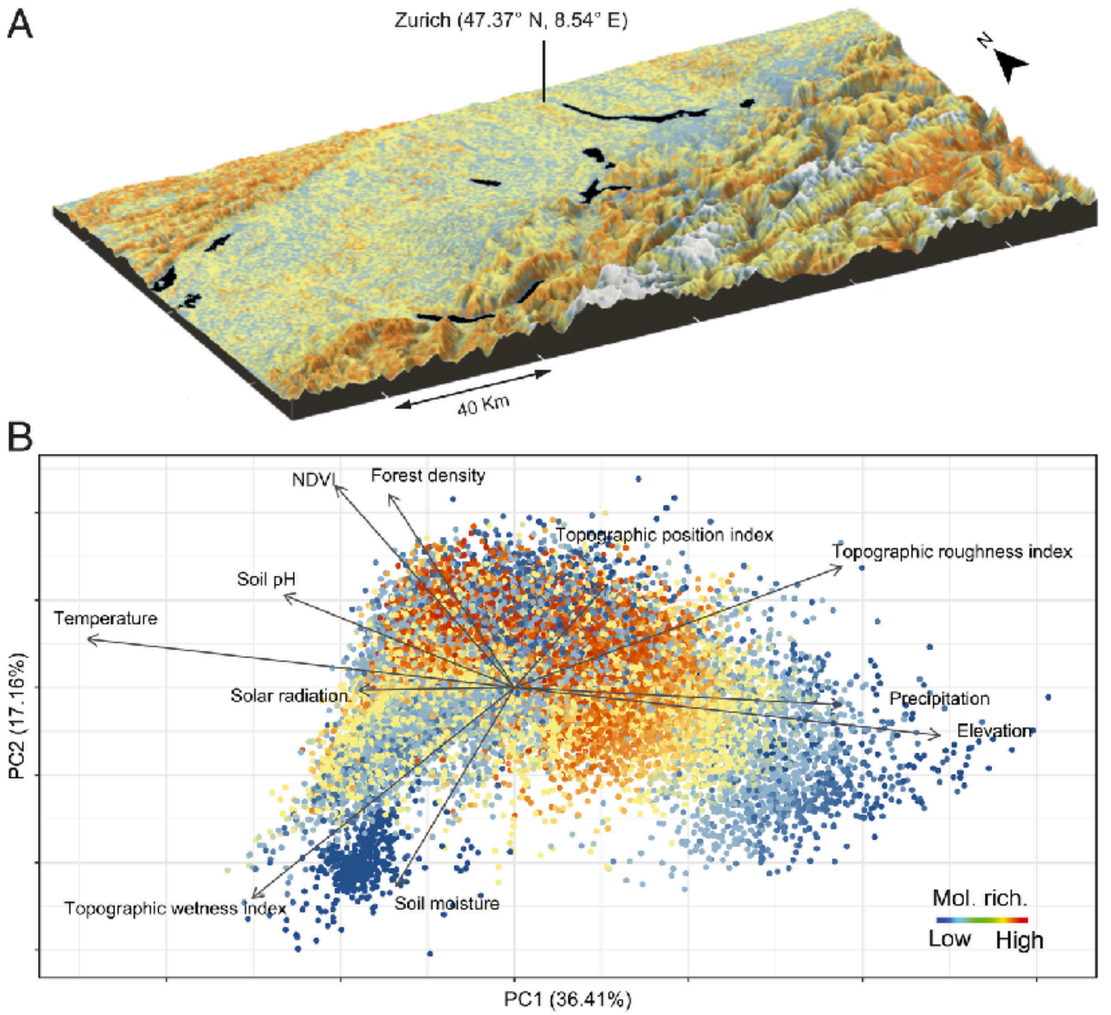
RESEARCH ARTICLE | BIOLOGICAL SCIENCES |

Spatial and evolutionary predictability of phytochemical diversity

Emmanuel Defossez, Camille Pitteloud, Patrice Descombes, Gaétan Glauser, Pierre-Marie Allard, Tom W. N. Walker, Pilar Fernandez-Conradi, Jean-Luc Wolfender, Loïc Pellissier, and Sergio Rasmann -6 Authors Info & Affiliations

Edited by Robert John Scholes, University of the Witwatersrand, Wits, South Africa, and approved December 11, 2020 (received for review June 26, 2020)

January 11, 2021 | 118 (3) e2013344118 | https://doi.org/10.1073/pnas.2013344118



https://doi.org/10.1073/pnas.2013344118

Swiss
Digital Botanical
Gardens Initiative

"An Open Science initiative to explore and establish robust and scalable workflows for the digitization of chemo and biodiversity at a global scale in wild environments"

Wild ecosystems

Diversity (species) ●●●●●

Sampling (easiness of) ●○○○○

Functions (understanding of) ●○○○○

Conditions (control of environmental) ●○○○○

Botanical gardens

Diversity (species) ●●●○○

Sampling (easiness of) ●●●●○

Functions (understanding of) ●○○○○

Conditions (control of environmental) ●●●○○

Laboratory plants

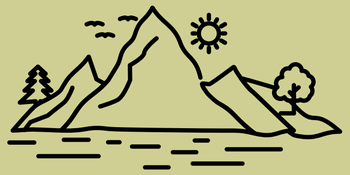
Diversity (species) ●○○○○

Sampling (easiness of) ●●●●●

Functions (understanding of) ●●●○○

Conditions (control of environmental) ●●●●●

Wild ecosystems



Diversity (species) ●●●●●

Sampling (easiness of) ●○○○○

Functions (understanding of) ●○○○○

Conditions (control of environmental) ●○○○○

Botanical gardens

Diversity (species) ●●●○○

Sampling (easiness of) ●●●●○

Functions (understanding of) ●○○○○

Conditions (control of environmental) ●●●○○

Laboratory plants

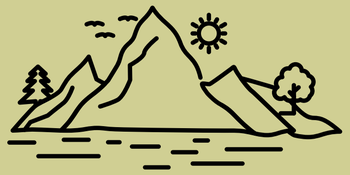
Diversity (species) ●○○○○

Sampling (easiness of) ●●●●●

Functions (understanding of) ●●●○○

Conditions (control of environmental) ●●●●●

Wild ecosystems



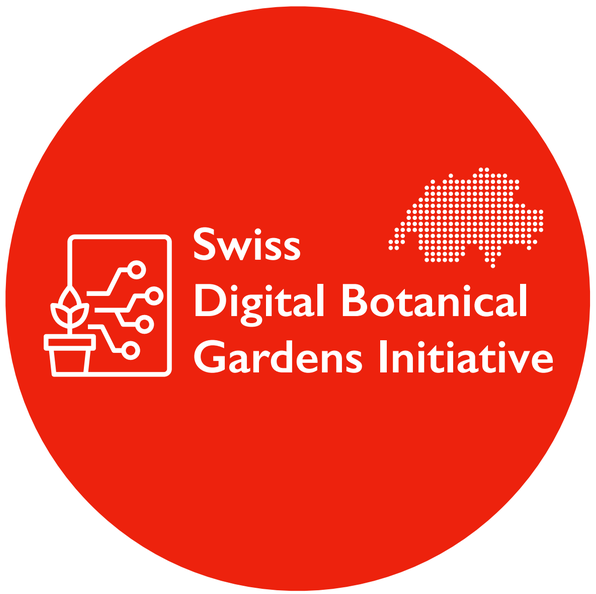
Diversity (species)	●●●●●
Sampling (easiness of)	●○○○○
Functions (understanding of)	●○○○○
Conditions (control of environmental)	●○○○○

Botanical gardens

Diversity (species)	●●●○○
Sampling (easiness of)	●●●●○
Functions (understanding of)	●○○○○
Conditions (control of environmental)	●●●○○

Laboratory plants

Diversity (species)	●○○○○
Sampling (easiness of)	●●●●●
Functions (understanding of)	●●●○○
Conditions (control of environmental)	●●●●●


Swiss
Digital Botanical
Gardens Initiative


French
Digital Botanical
Gardens Initiative


Swiss
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Gardens Initiative

French
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Swiss
Digital Botanical
Gardens Initiative

Italian
Digital Botanical
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French
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Swiss
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Italian
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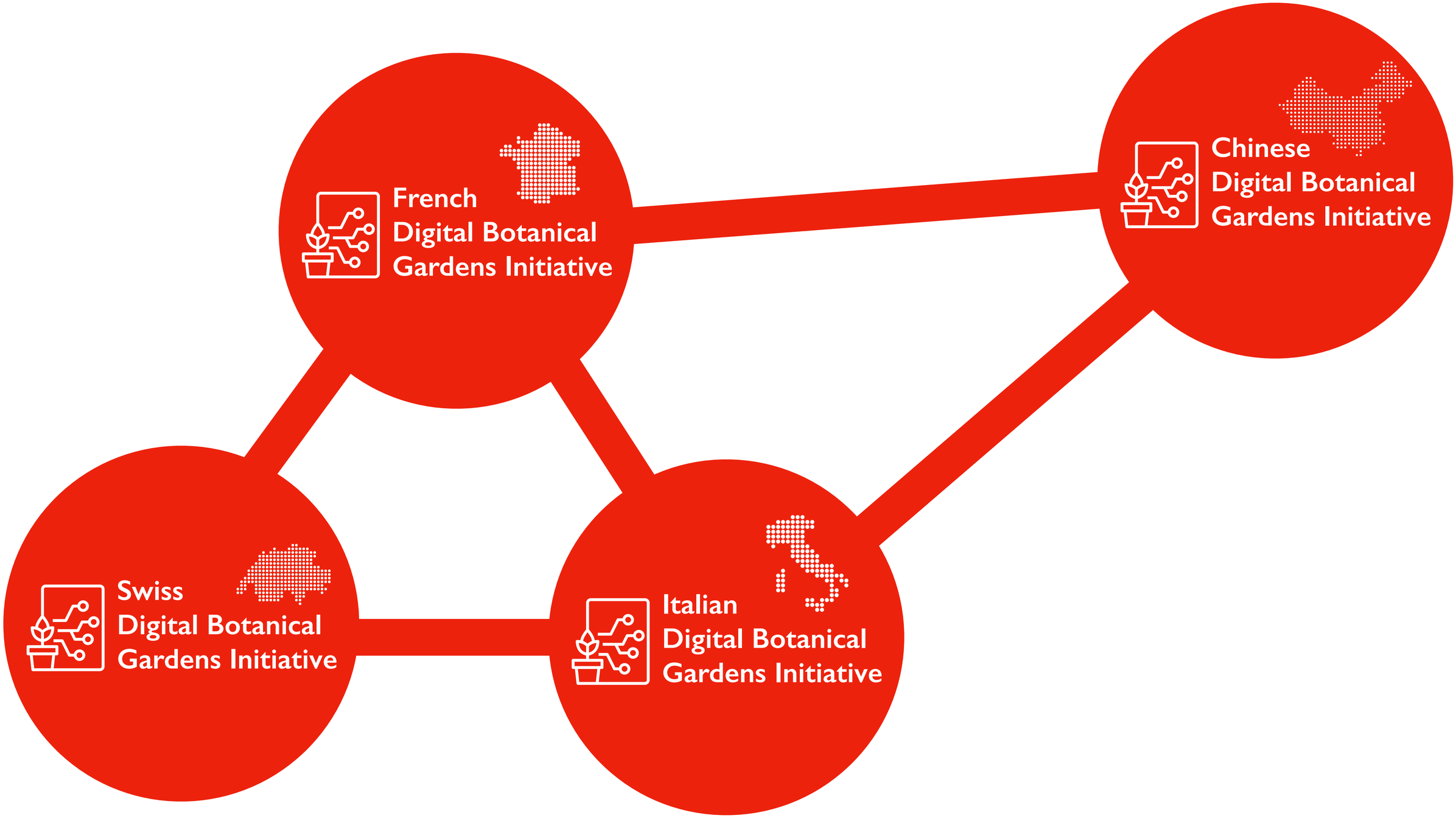
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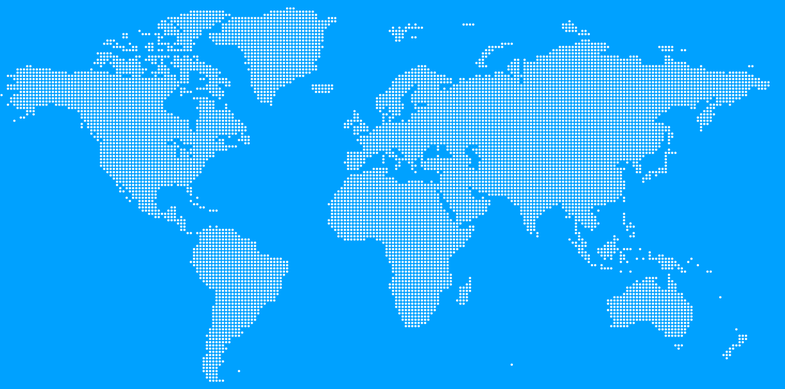
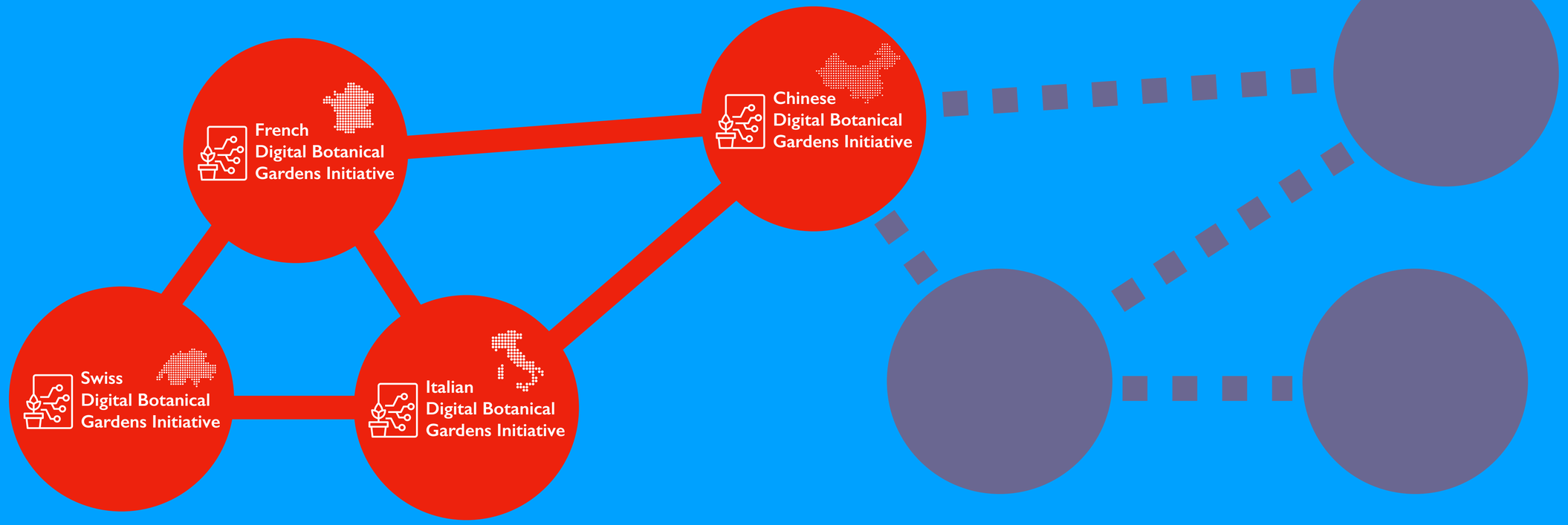
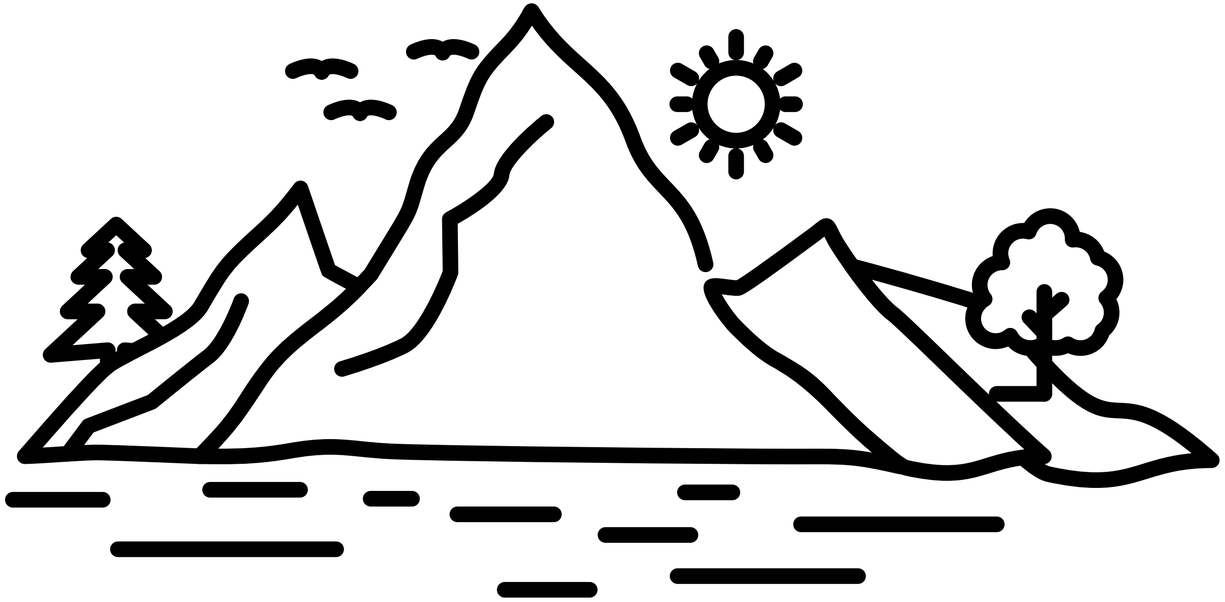
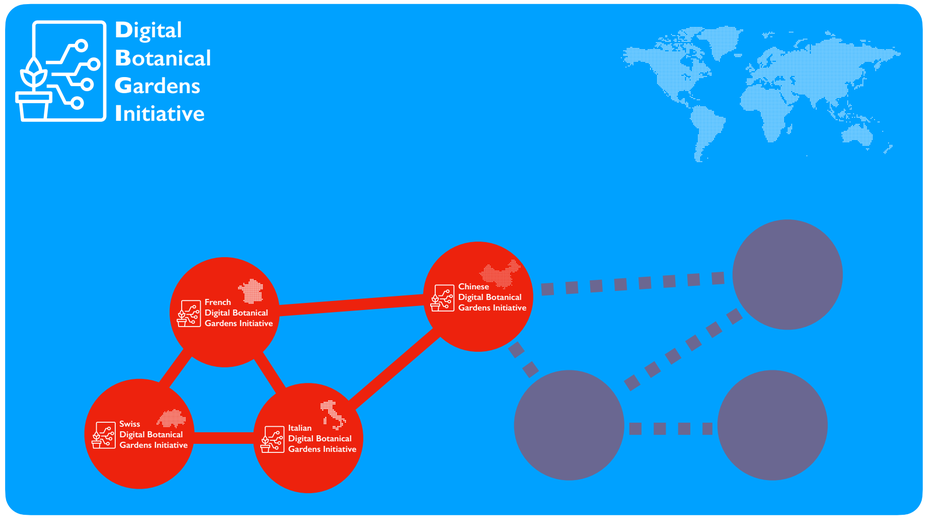
Gardens Initiative

Digital Botanical Gardens Initiative








Digital
Botanical
Gardens
Initiative
French
Digital Botanical
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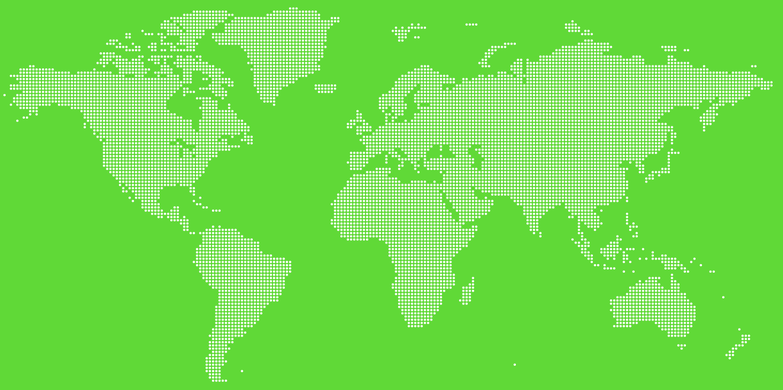
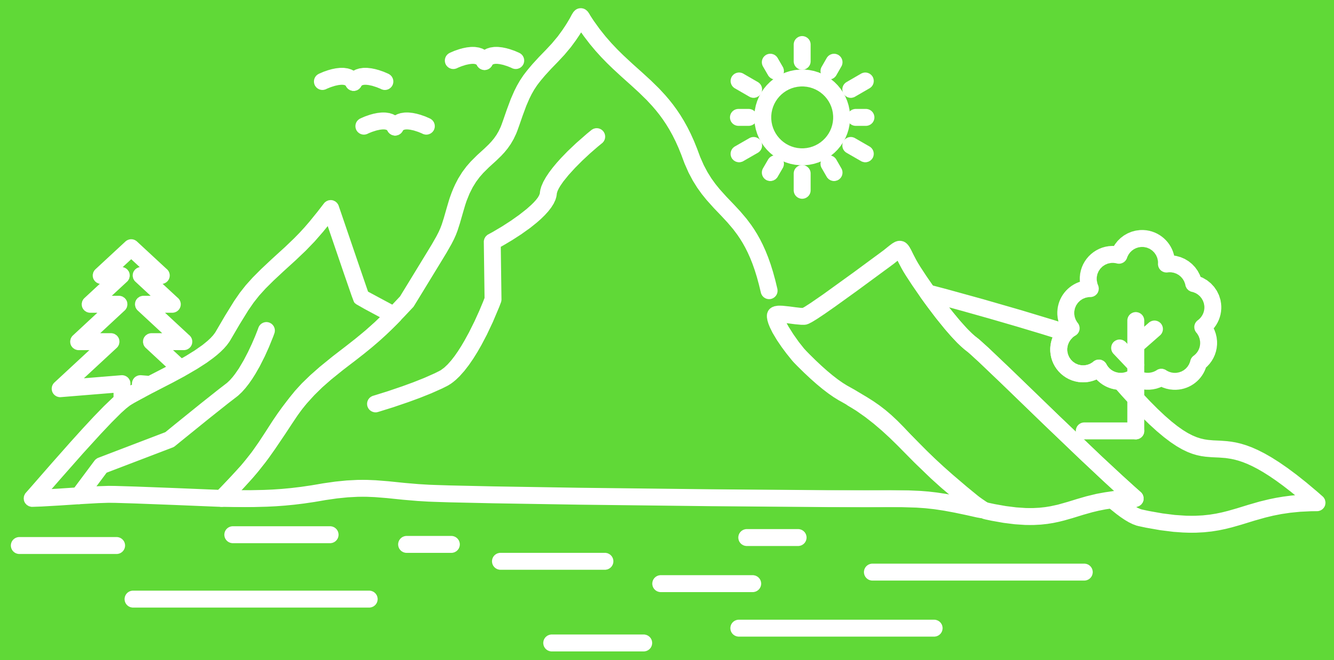
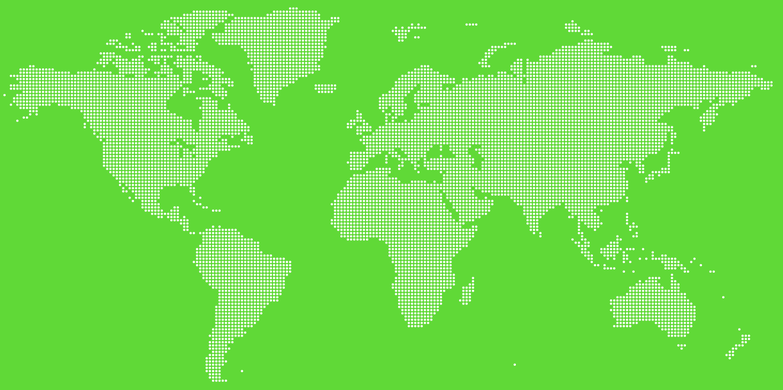
Italian
Digital Botanical
Gardens Initiative

Earth Metabolome Initiative



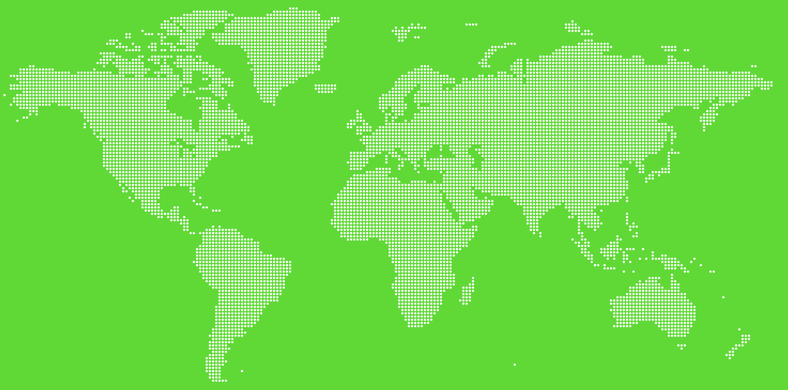


Earth
Metabolome
Initiative



Digitize the metabolome of Earth's biodiversity

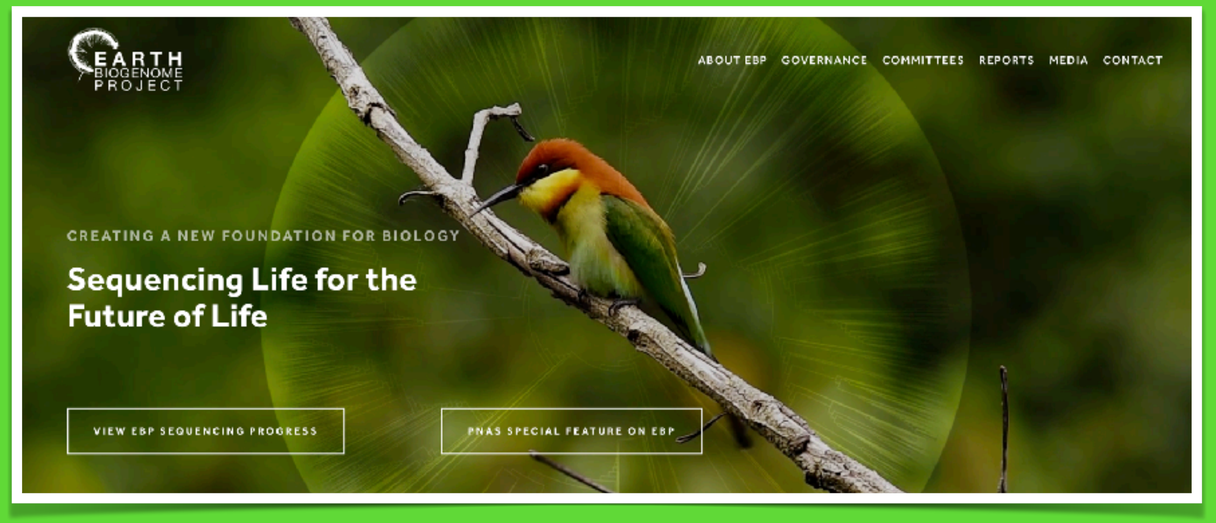
Earth Metabolome Initiative

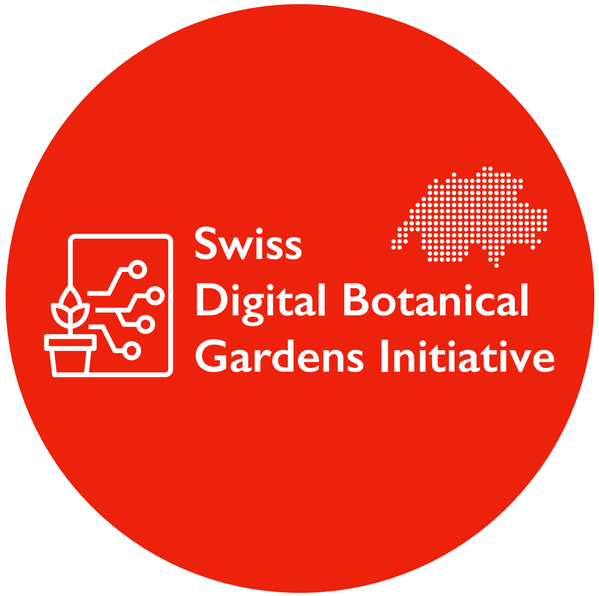


Digitize the metabolome of Earth's biodiversity

Mirror the Earth Biogenome Project

https://www.earthbiogenome.org/

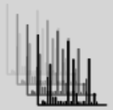



Swiss
Digital Botanical
Gardens Initiative

Establish chemical extracts libraries of Swiss botanical gardens

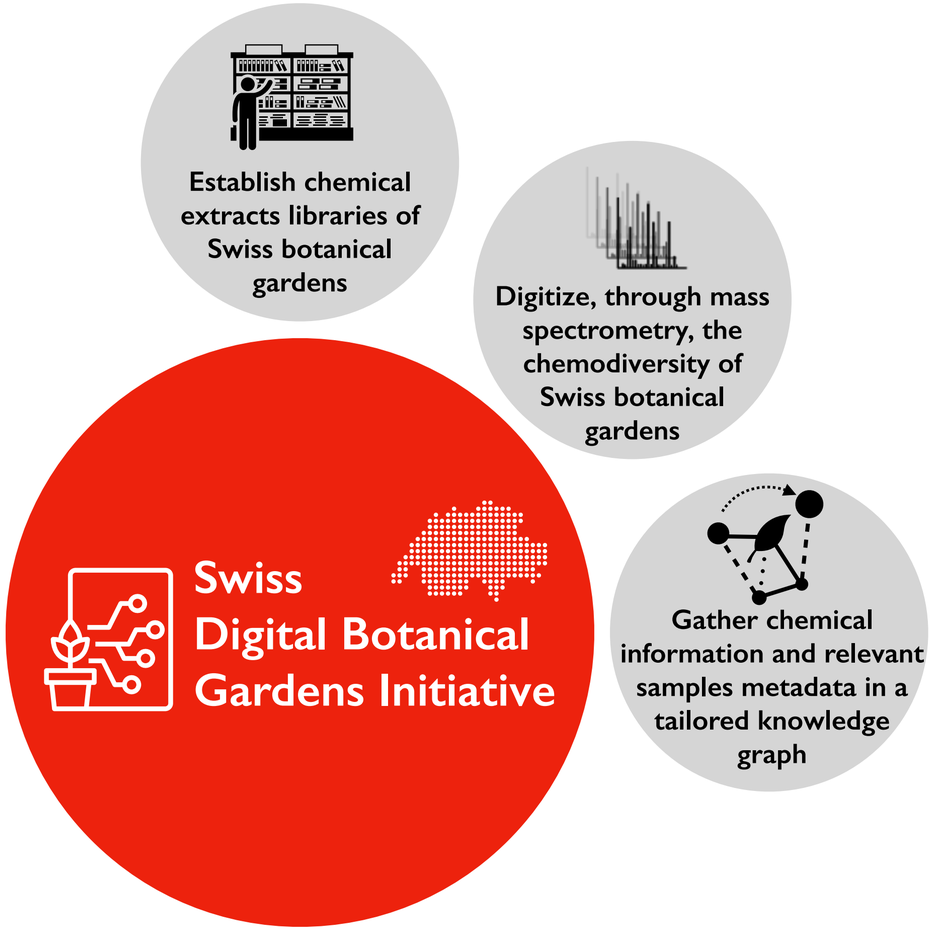
Swiss Digital Botanical Gardens Initiative

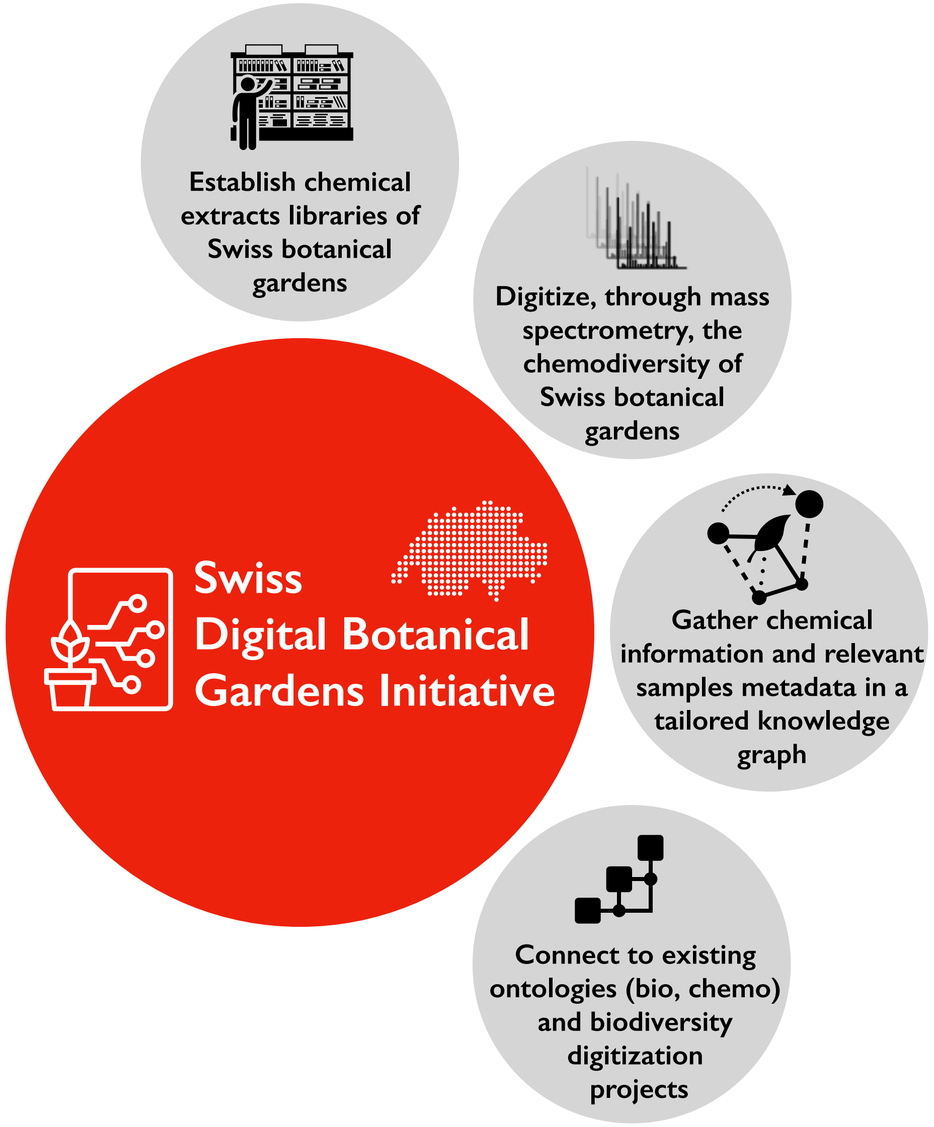
Establish chemical extracts libraries of Swiss botanical gardens



Digitize, through mass spectrometry, the chemodiversity of Swiss botanical gardens

Swiss Digital Botanical Gardens Initiative


Establish chemical extracts libraries of Swiss botanical gardens
Digitize, through mass spectrometry, the chemodiversity of Swiss botanical gardens
Gather chemical information and relevant samples metadata in a tailored knowledge graph
Swiss
Digital Botanical
Gardens Initiative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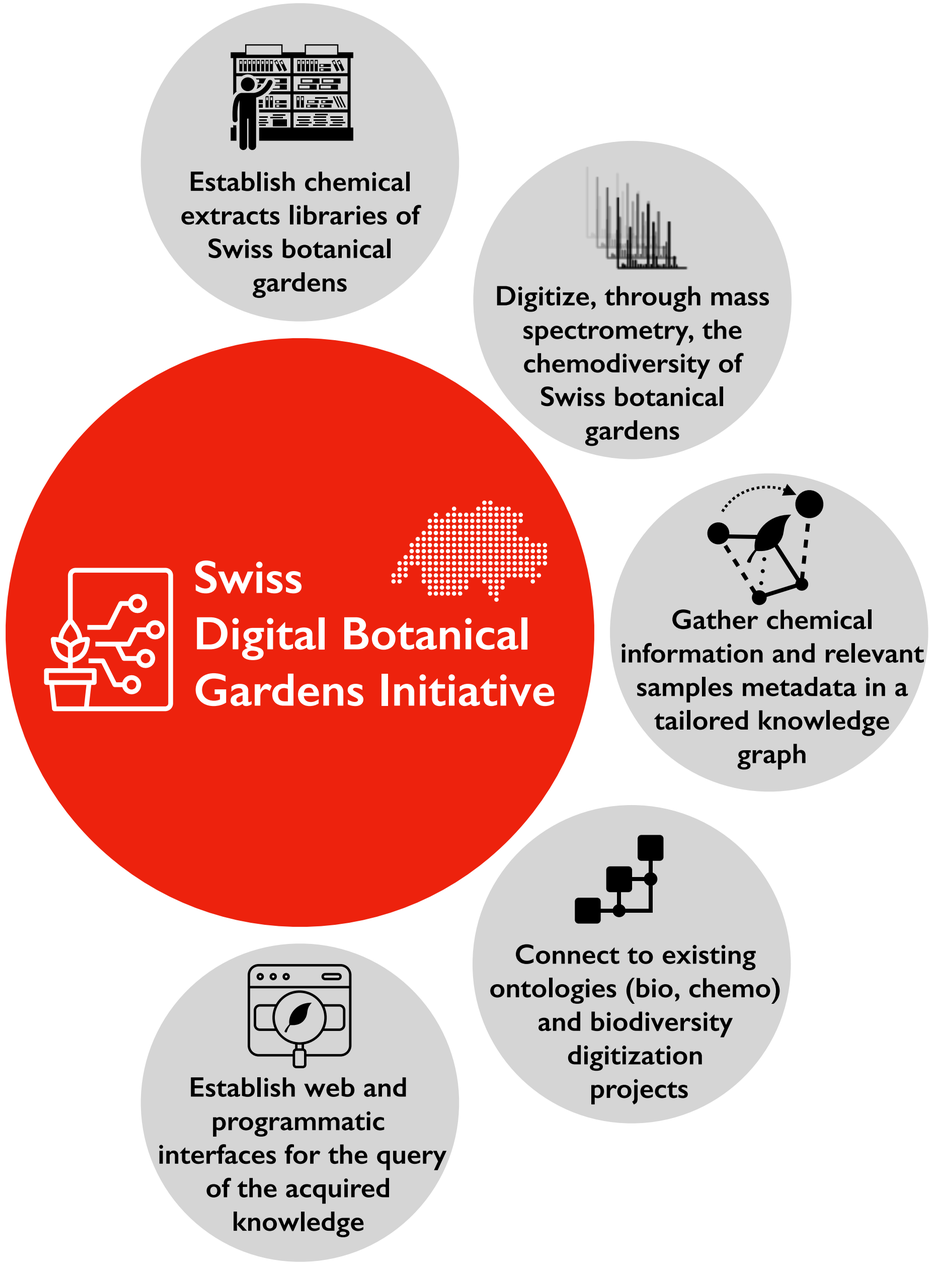
Swiss Digital Botanical Gardens Initiative
Gather chemical information and relevant samples metadata in a tailored knowledge graph
Connect to existing ontologies (bio, chemo) and biodiversity digitization projects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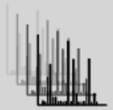
Illustrate the feasibility and advantages of an end-to-end Open Science project

Swiss Digital Botanical Gardens Initiative

Establish chemical extracts libraries of Swiss botanical gardens



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Establish robust and scalable workflows for the digitization of wildlife ecosystems biodiversity

Swiss Digital Botanical Gardens Initiative

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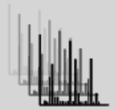

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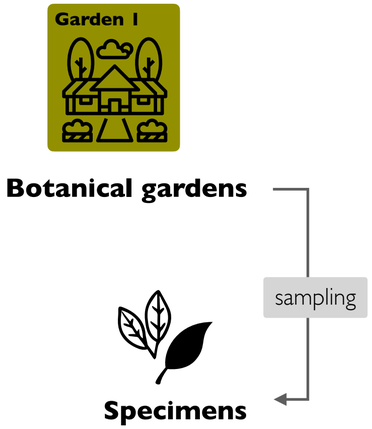
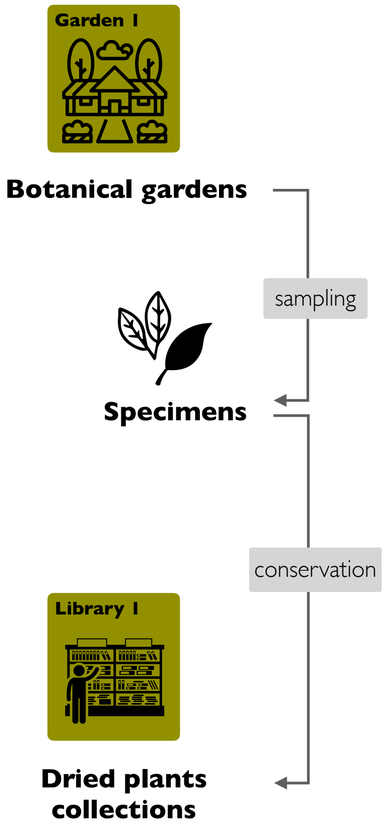
Illustrate the feasibility and advantages of an end-to-end Open Science project

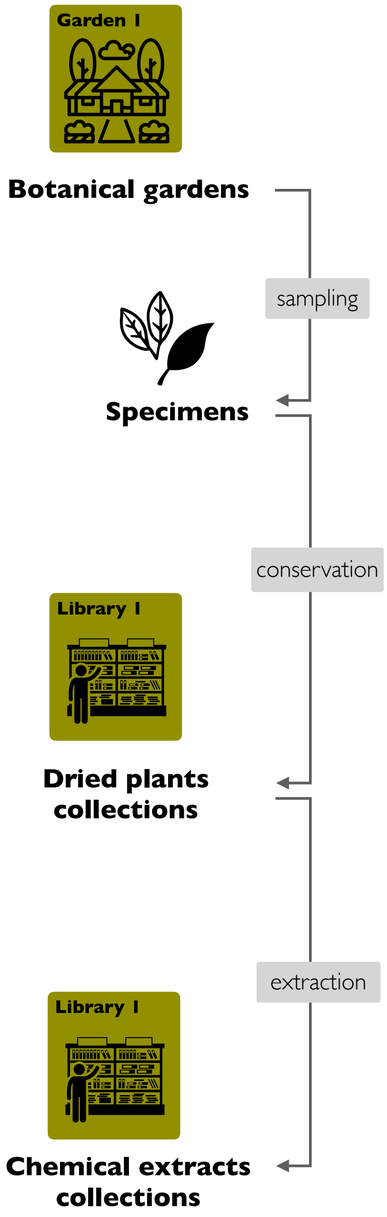
Establish robust and scalable workflows for the digitization of wildlife ecosystems biodiversity

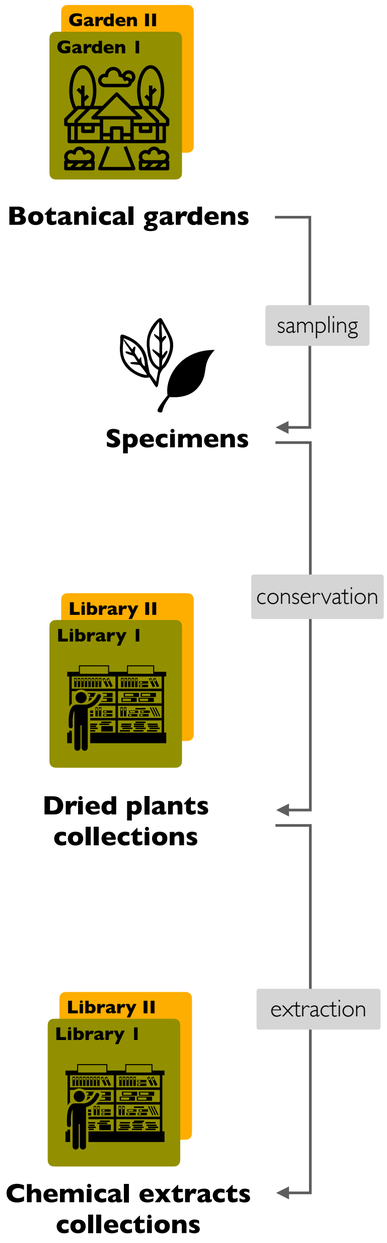
Provide "molecular arguments" for biodiversity conservation policies

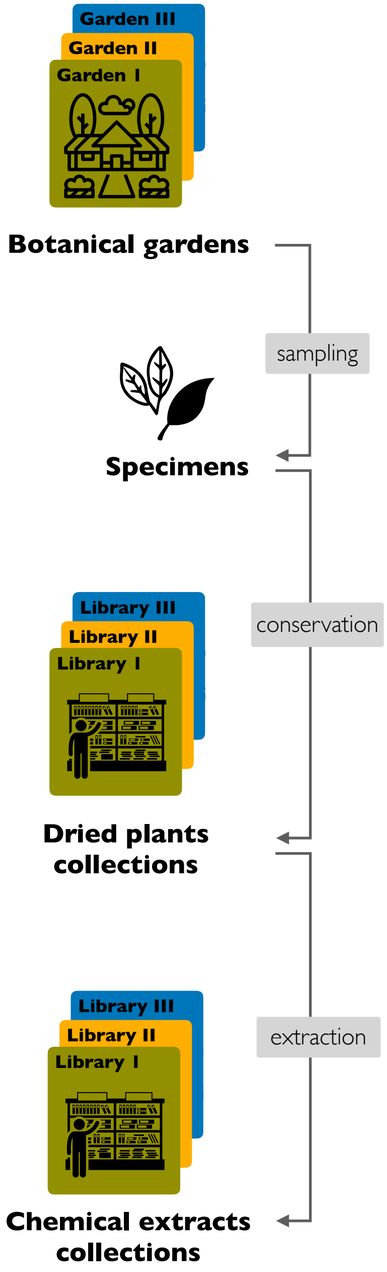
Botanical gardens

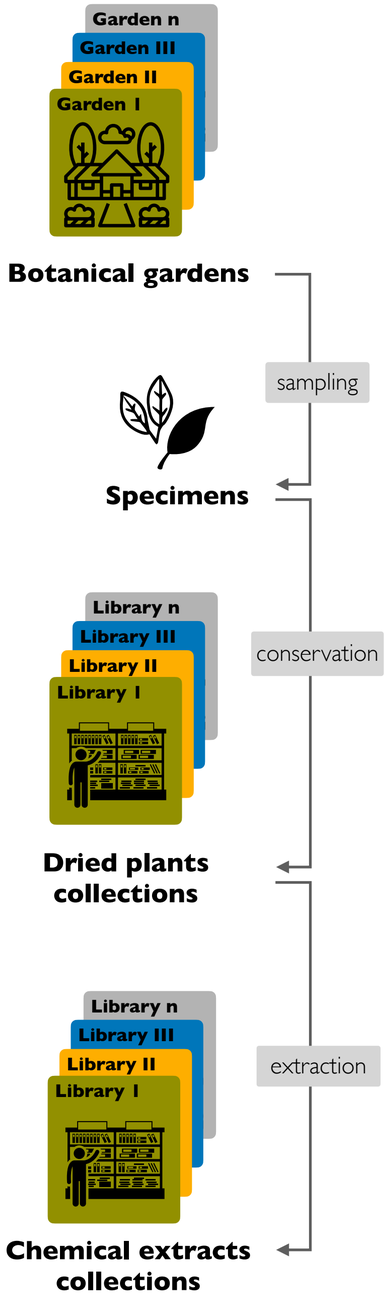

Garden 1
Botanical gardens
sampling
Specimens


Garden 1
Botanical gardens
sampling
Specimens
conservation
Library 1
Dried plants collections


Garden I
Botanical gardens
sampling
Specimens
conservation
Library I
Dried plants collections
extraction
Library I
Chemical extracts collections


Garden II
Garden I
Botanical gardens
sampling
Specimens
conservation
Library II
Library I
Dried plants collections
extraction
Library II
Library I
Chemical extracts collections


Garden III
Garden II
Garden I
Botanical gardens
sampling
Specimens
Library III
Library II
Library I
conservation
Dried plants collections
Library III
Library II
Library I
extraction
Chemical extracts collections


Garden n
Garden III
Garden II
Garden I
Botanical gardens
sampling
Specimens
Library n
Library III
Library II
Library I
conservation
Dried plants collections
Library n
Library III
Library II
Library I
extraction
Chemical extracts collections

physical objects

Botanical gardens

sampling

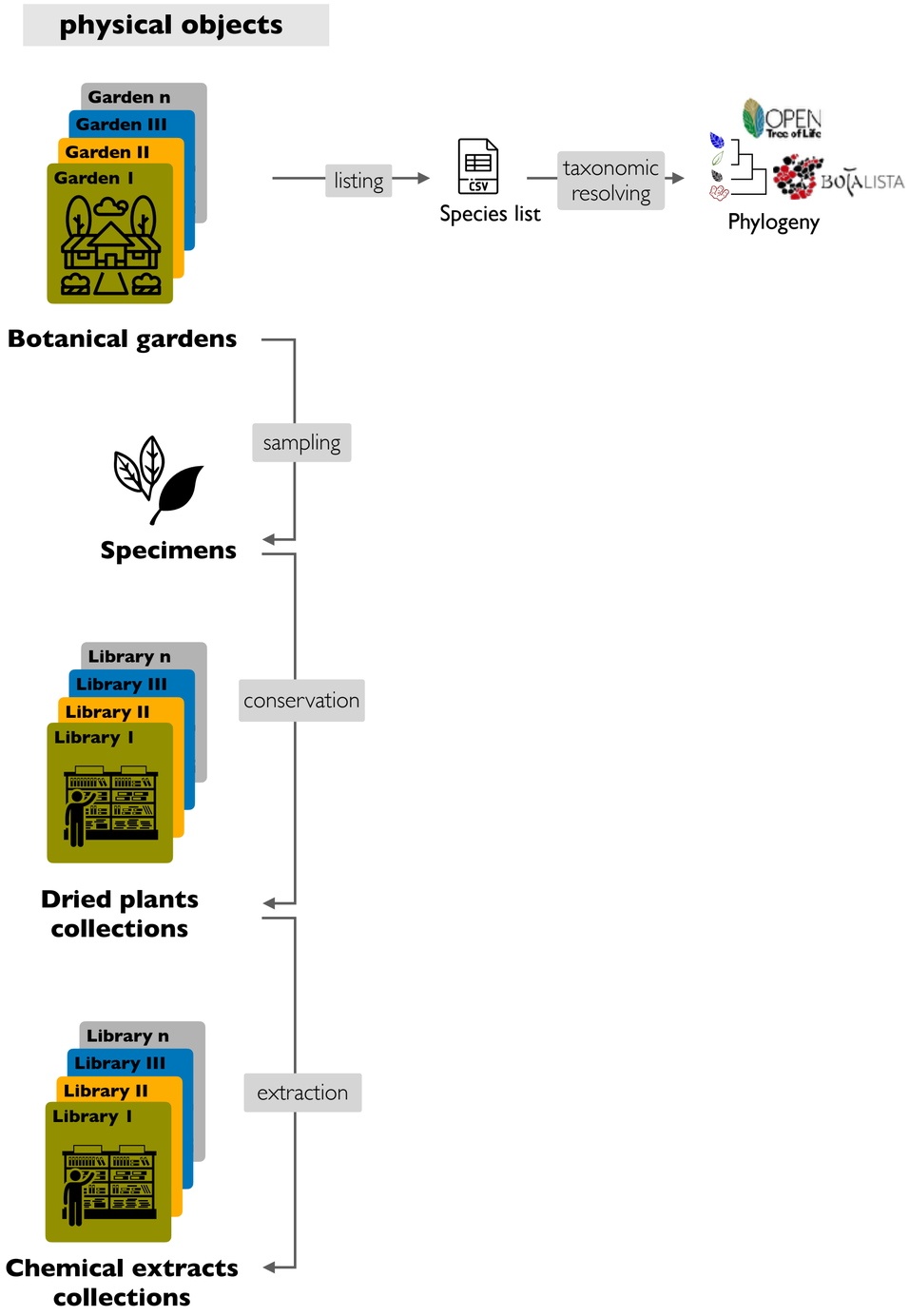
Specimens

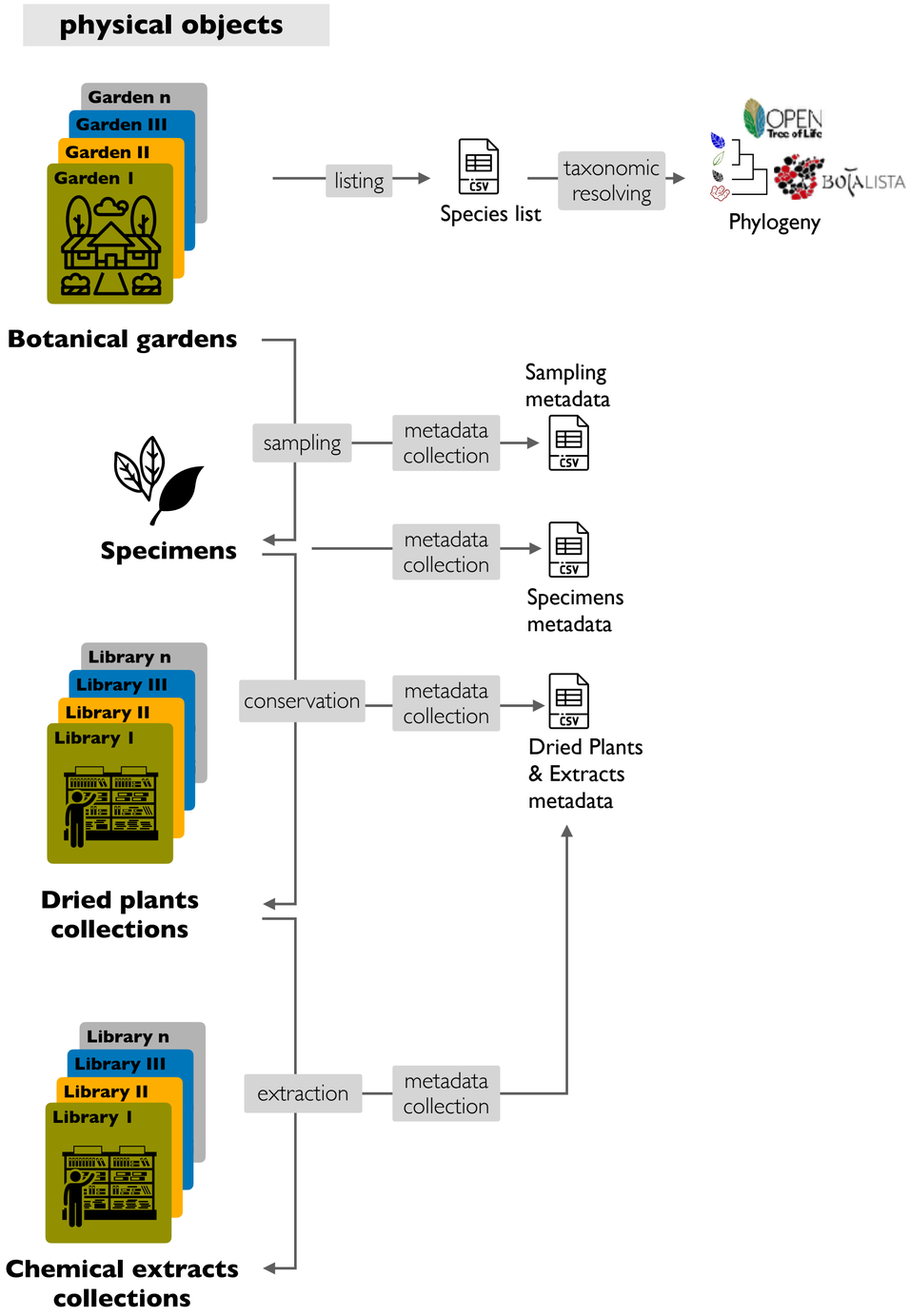
conservation

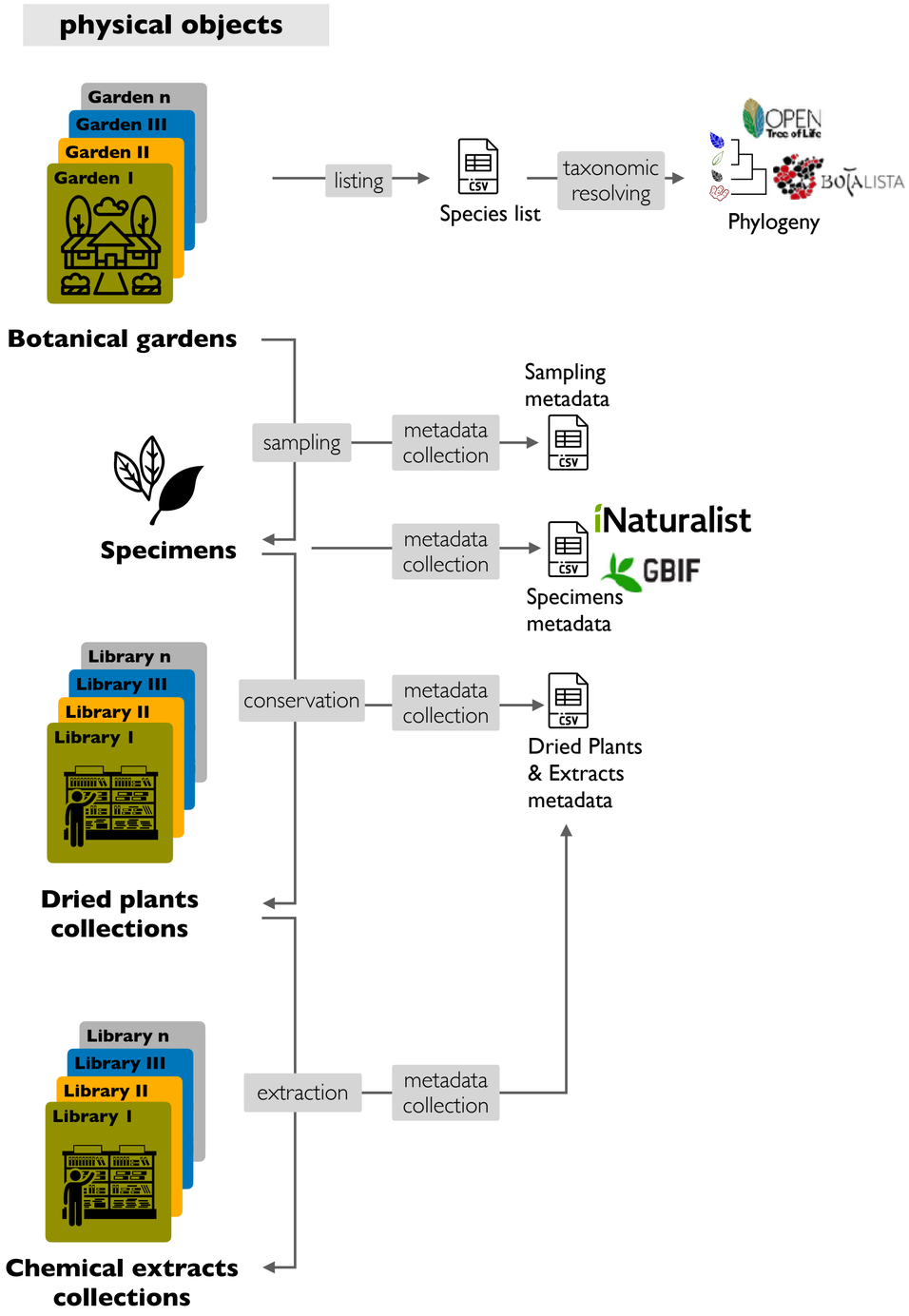
Dried plants collections

extraction

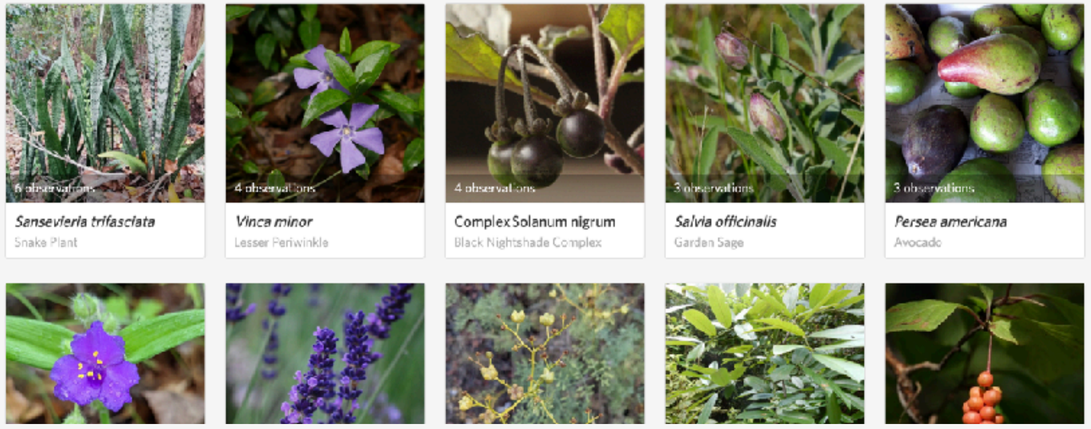
Chemical extracts collections


physical objects
Garden n
Garden III
Garden II
Garden I
listing
CSV
Species list
taxonomic resolving
OPEN Tree of Life
BOTALISTA
Phylogeny
Botanical gardens
sampling
Specimens
Library n
Library III
Library II
Library I
conservation
Dried plants collections
Library n
Library III
Library II
Library I
extraction
Chemical extracts collections


physical objects
Garden n
Garden III
Garden II
Garden I
listing
Species list
taxonomic resolving
OPEN Tree of Life
BOTALISTA
Phylogeny
Botanical gardens
sampling
metadata collection
Sampling metadata
Specimens
metadata collection
Specimens metadata
Library n
Library III
Library II
Library I
conservation
metadata collection
Dried Plants & Extracts metadata
Dried plants collections
Library n
Library III
Library II
Library I
extraction
metadata collection
Chemical extracts collections

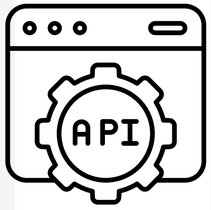

physical objects
Garden n
Garden III
Garden II
Garden I
listing
Species list
taxonomic resolving
OPEN Tree of Life
BOTALISTA
Phylogeny
Botanical gardens
sampling
metadata collection
Sampling metadata
Specimens
metadata collection
iNaturalist
GBIF
Specimens metadata
Library n
Library III
Library II
Library I
conservation
metadata collection
Dried Plants & Extracts metadata
Dried plants collections
extraction
metadata collection
Chemical extracts collections

Overview | 452 OBSERVATIONS | 353 SPECIES | 28 IDENTIFIERS | 7 OBSERVERS | Stats



Sansevieria trifasciata — Snake Plant
Vinca minor — Lesser Periwinkle
Complex Solanum nigrum — Black Nightshade Complex
Salvia officinalis — Garden Sage
Persea americana — Avocado

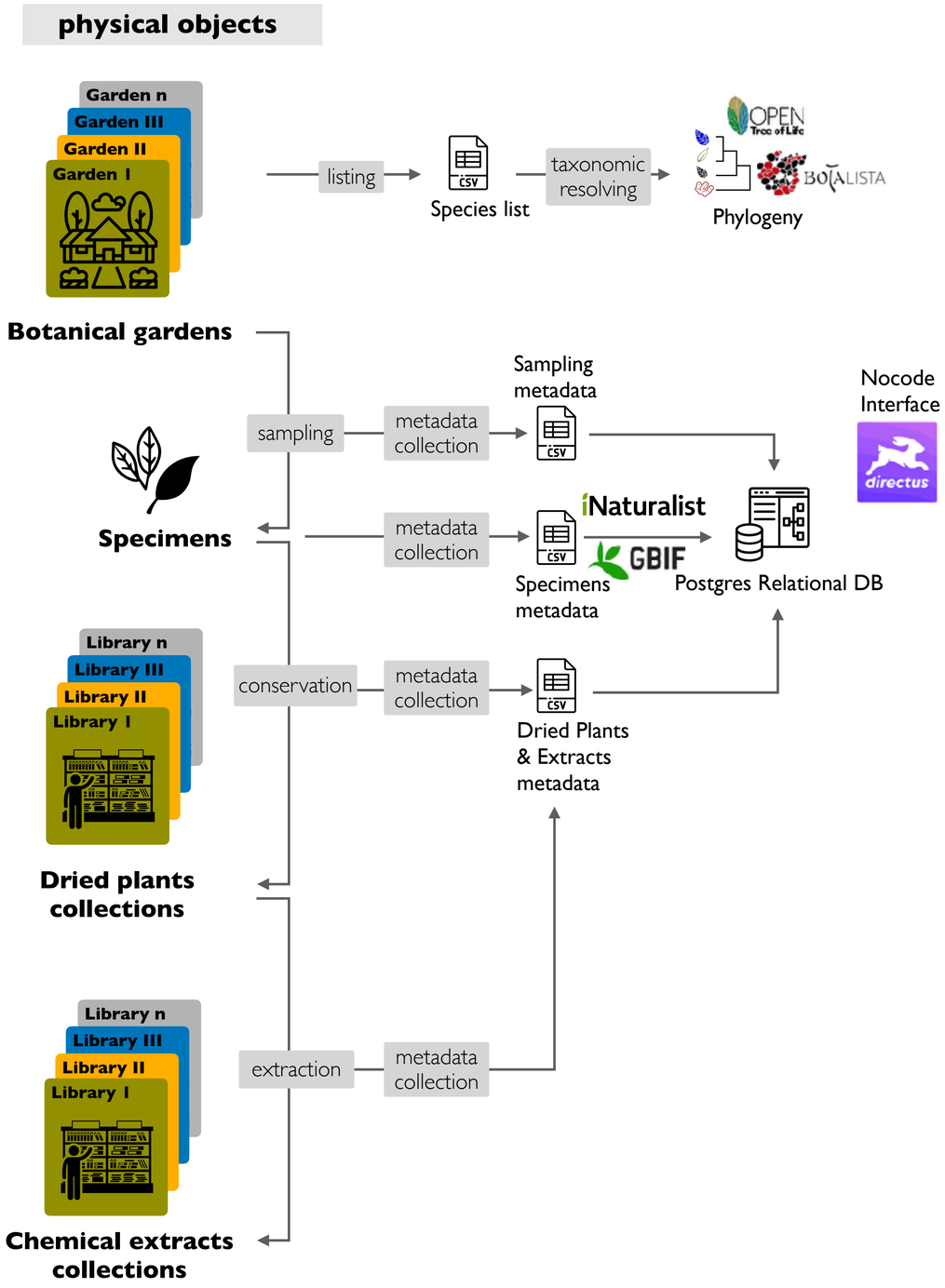
Map of Observations



https://www.inaturalist.org/projects/digital-botanical-gardens-initiative

iNaturalist

112942553	126225	Species: Allium fistulosum (Welsh Onion)	Apr 13, 2022	carolavelti	Friburgo, Svizzera
115069563	55434	Genus: Saxifraga (Saxifrages)	May 03, 2022	edouardbruelhart	Fribourg, Suisse
115515175	123159	Species: Narcissus papyraceus (Paperwhite)	May 05, 2022	pmallard	Fribourg, Suisse
117566111	71134	Species: Lavandula dentata (French lavender)	Jul 20, 2021	manu_dfz	Neuchâtel, Suisse
117566272	765426	Species: Citrus deliciosa (tangerine)	Jul 20, 2021	manu_dfz	Neuchâtel, Suisse
117706767	348735	Species: Derris elliptica	Apr 19, 2022	pmallard	Fribourg, Suisse
117770363	51988	Species: Physalis peruviana (Cape gooseberry)	Apr 19, 2022	edouardbruelhart	Fribourg, Suisse
117770364	1377067	Species: Payena leerii	Apr 19, 2022	edouardbruelhart	Fribourg, Suisse
117770366	126507	Species: Ficus elastica (rubber plant)	Apr 19, 2022	edouardbruelhart	Fribourg, Suisse
117770368	120240	Species: Carludovica palmata (toquilla palm)	Apr 19, 2022	edouardbruelhart	Fribourg, Suisse
117770371	157839	Species: Abutilon grandifolium (hairy	Apr 19, 2022	edouardbruelhart	Fribourg, Suisse
...					
		ensifolia (Sword Poker)			
139423137	75919	Species: Bulbine semibarbata (leek lily)	Oct 13, 2022	edouardbruelhart	Fribourg, Suisse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Botanical gardens
Sampling metadata
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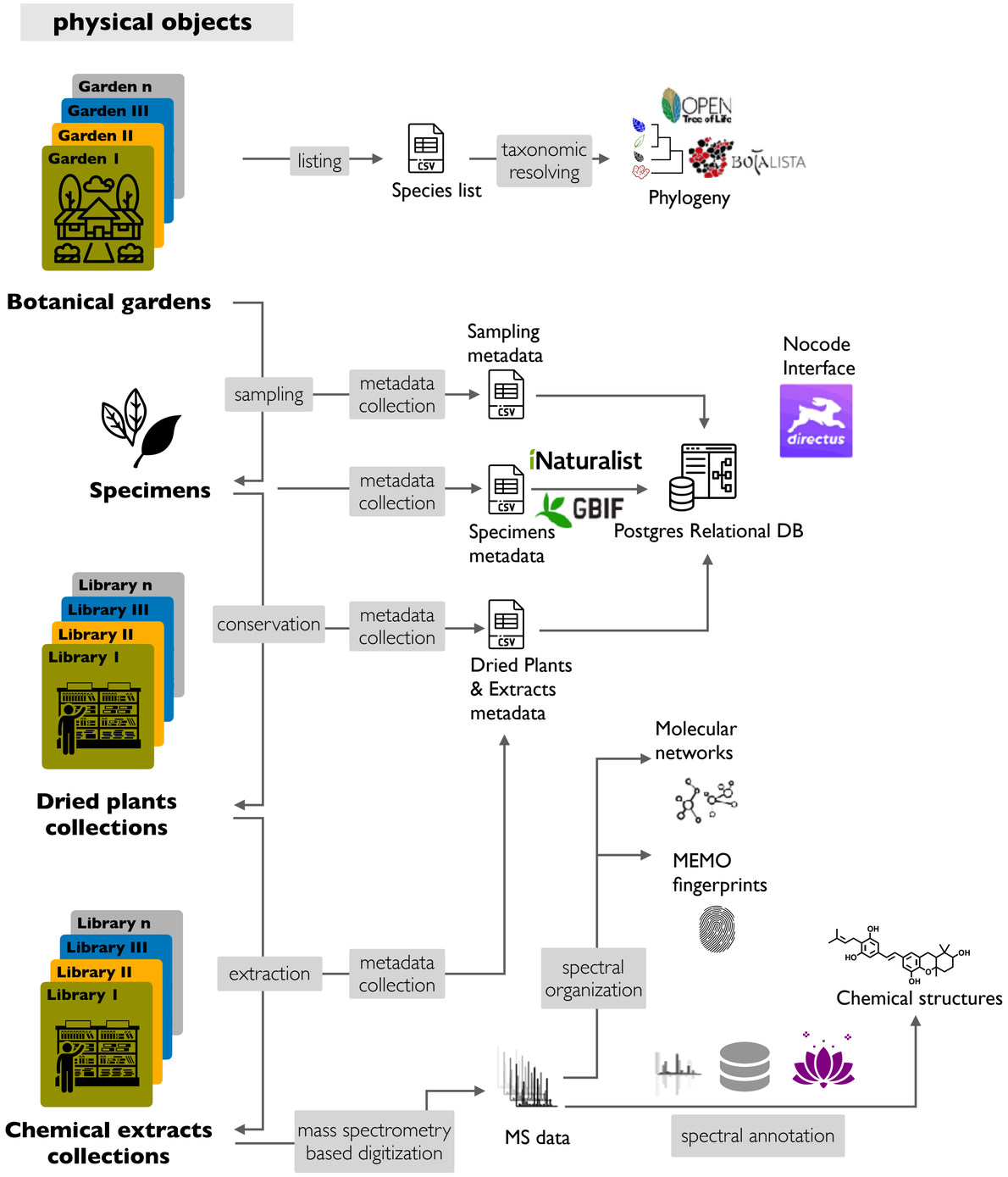
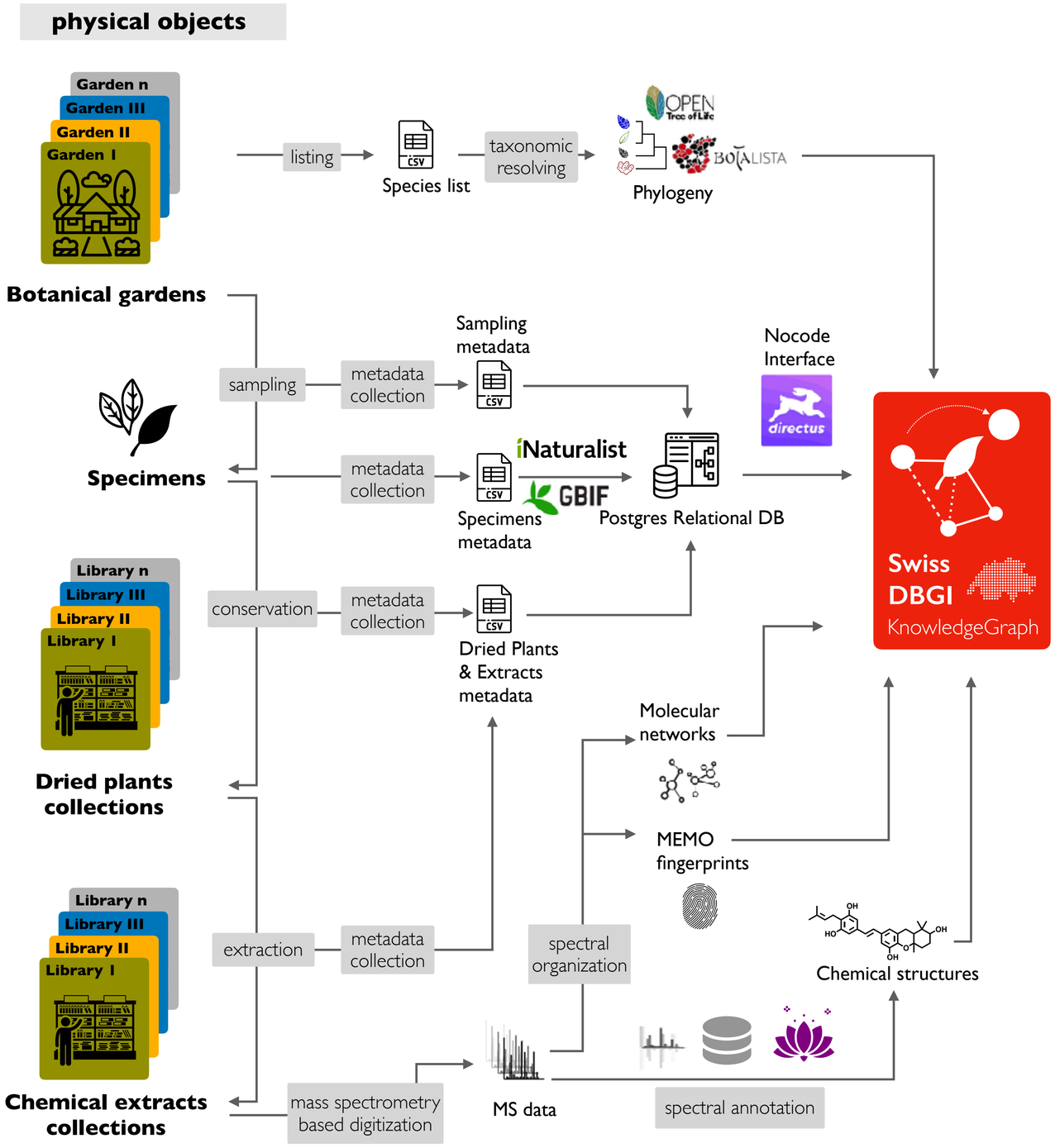
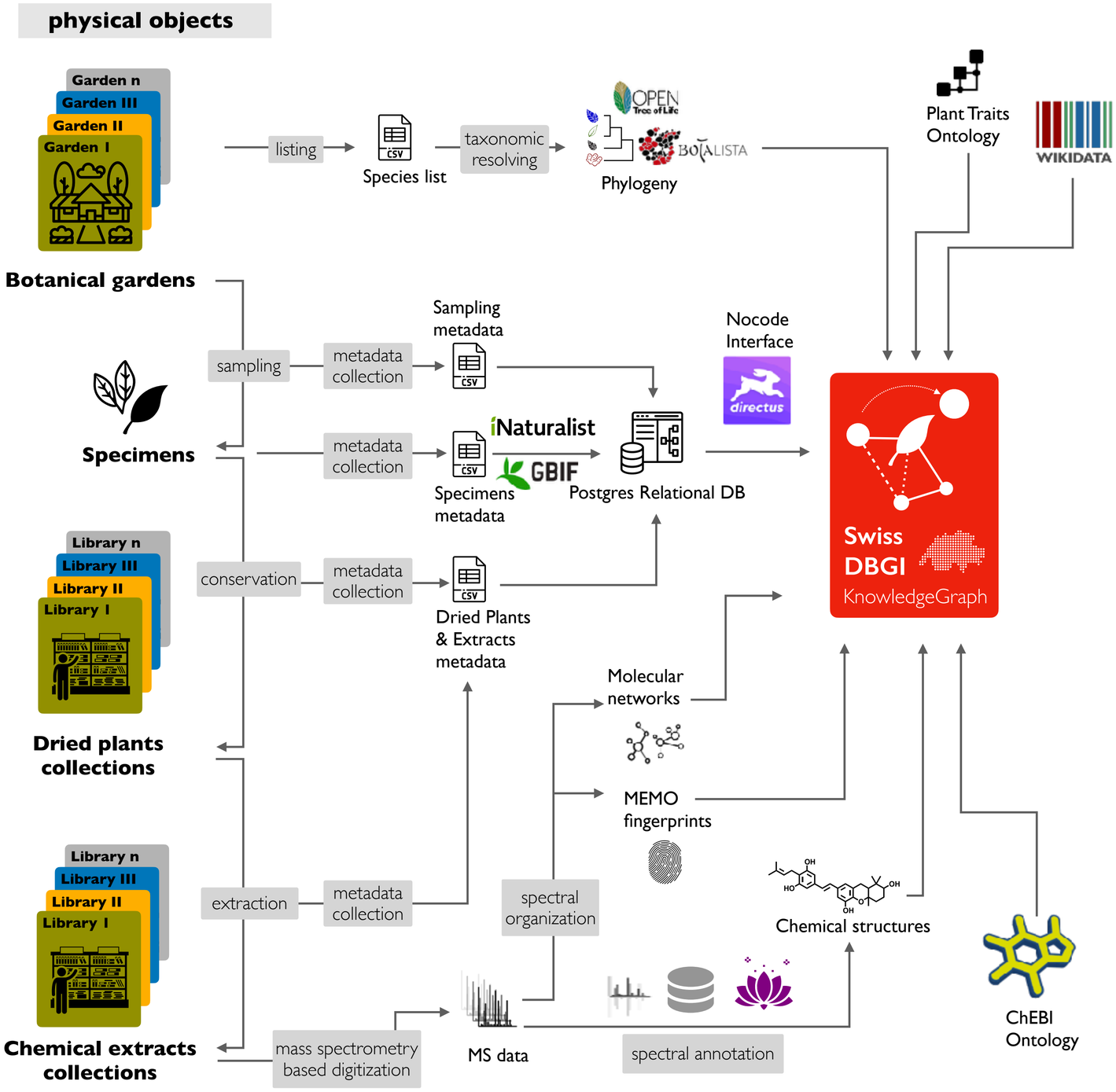
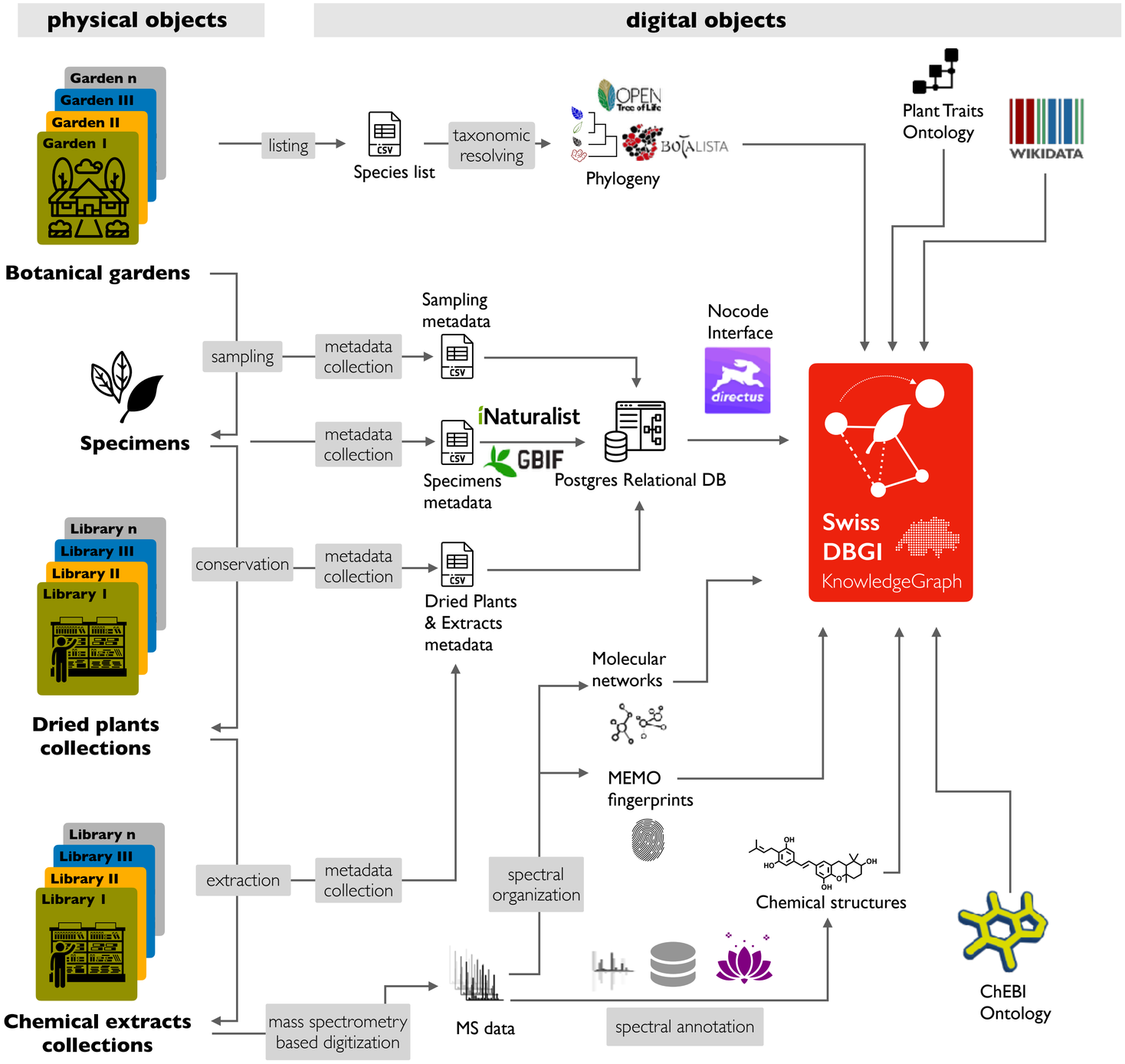
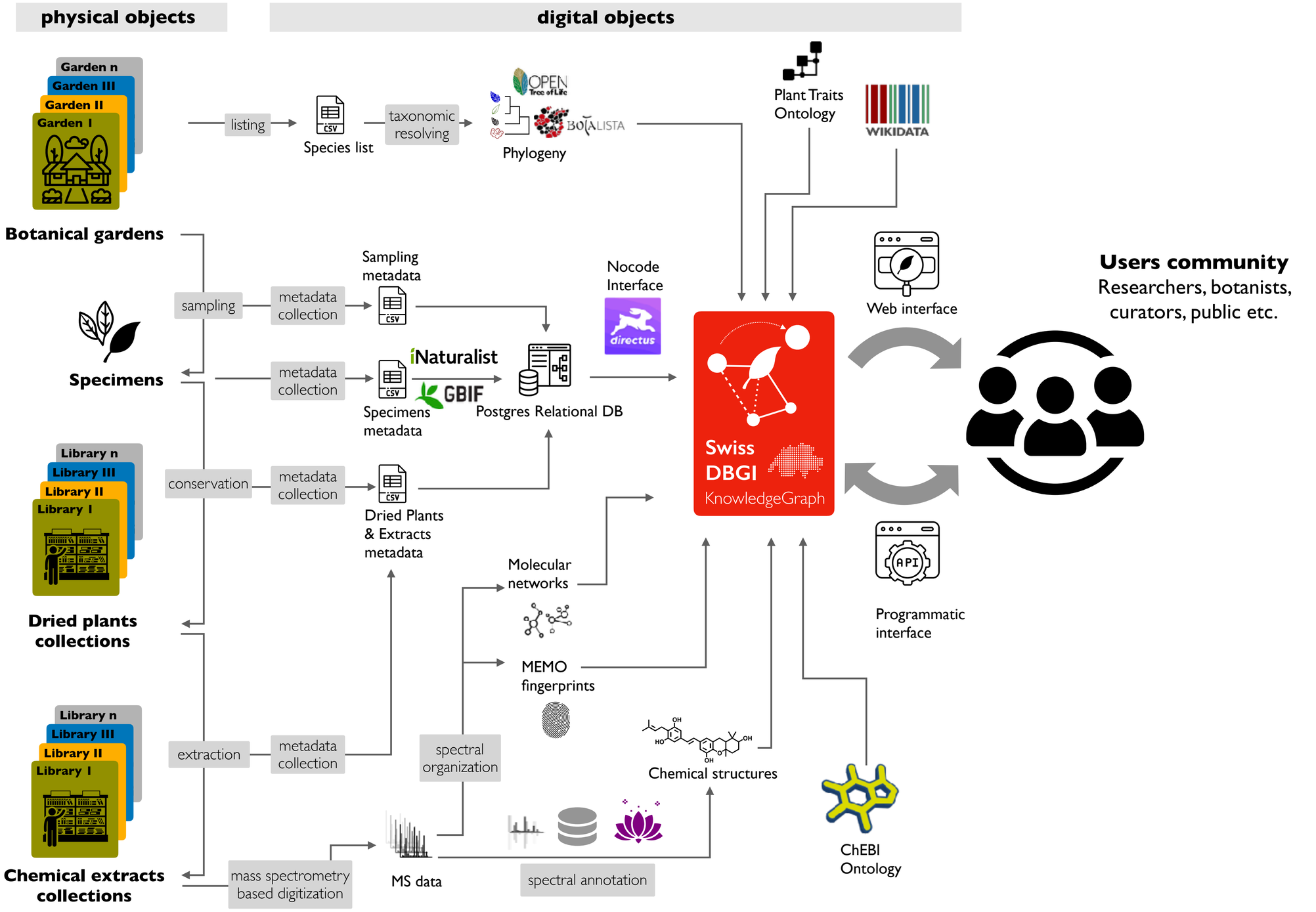
extraction
metadata collection
Chemical extracts collections


physical objects
Garden n
Garden III
Garden II
Garden I
Botanical gardens
listing
Species list
taxonomic resolving
Phylogeny
Specimens
sampling
metadata collection
Sampling metadata
Nocode Interface
directus
metadata collection
iNaturalist
GBIF
Specimens metadata
Postgres Relational DB
Library n
Library III
Library II
Library I
Dried plants collections
conservation
metadata collection
Dried Plants & Extracts metadata
Molecular networks
MEMO fingerprints
Library n
Library III
Library II
Library I
Chemical extracts collections
extraction
metadata collection
spectral organization
Chemical structures
mass spectrometry based digitization
MS data
spectral annotation


physical objects
Garden n
Garden III
Garden II
Garden I
Botanical gardens
listing
Species list
taxonomic resolving
Phylogeny
sampling
metadata collection
Sampling metadata
Nocode Interface
directus
Specimens
iNaturalist
GBIF
Specimens metadata
Postgres Relational DB
Swiss DBGI KnowledgeGraph
Library n
Library III
Library II
Library I
Dried plants collections
conservation
Dried Plants & Extracts metadata
Molecular networks
MEMO fingerprints
Chemical structures
extraction
spectral organization
Chemical extracts collections
mass spectrometry based digitization
MS data
spectral annotation


physical objects
Garden n
Garden III
Garden II
Garden I
Botanical gardens
listing
Species list
taxonomic resolving
OPEN Tree of Life
BOTALISTA
Phylogeny
Plant Traits Ontology
WIKIDATA
sampling
metadata collection
Sampling metadata
Nocode Interface
directus
Specimens
iNaturalist
GBIF
Specimens metadata
Postgres Relational DB
Swiss DBGI KnowledgeGraph
Library n
Library III
Library II
Library I
Dried plants collections
conservation
Dried Plants & Extracts metadata
Molecular networks
MEMO fingerprints
Chemical extracts collections
extraction
spectral organization
Chemical structures
mass spectrometry based digitization
MS data
spectral annotation
ChEBI Ontology

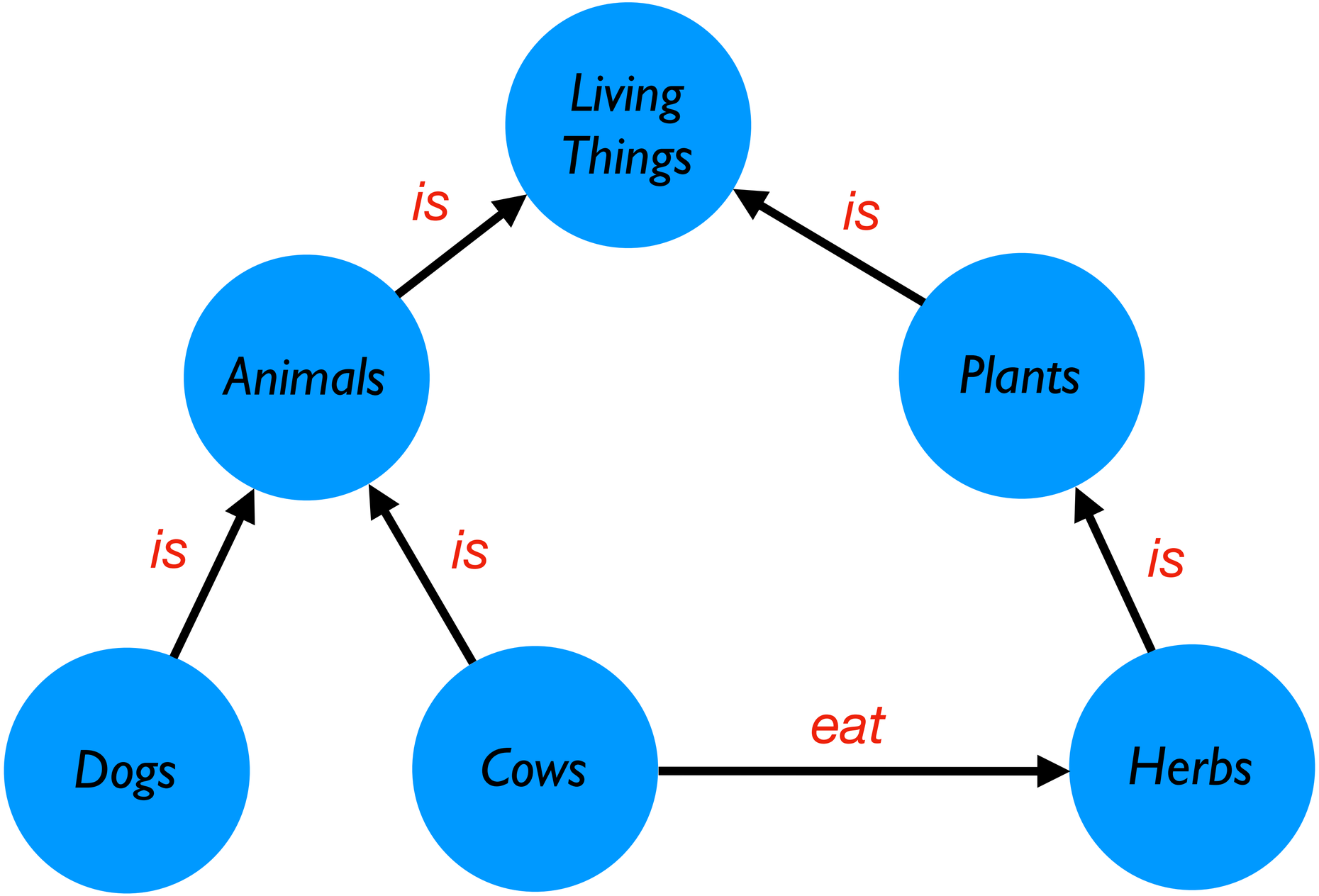

physical objects
digital objects
Garden n
Garden III
Garden II
Garden I
Botanical gardens
listing
Species list
taxonomic resolving
OPEN Tree of Life
BOTALISTA
Phylogeny
Plant Traits Ontology
WIKIDATA
sampling
metadata collection
Sampling metadata
Nocode Interface
directus
Specimens
iNaturalist
GBIF
Specimens metadata
Postgres Relational DB
Swiss DBGI KnowledgeGraph
Library n
Library III
Library II
Library I
Dried plants collections
conservation
Dried Plants & Extracts metadata
Molecular networks
MEMO fingerprints
Chemical extracts collections
extraction
spectral organization
Chemical structures
ChEBI Ontology
mass spectrometry based digitization
MS data
spectral annotation

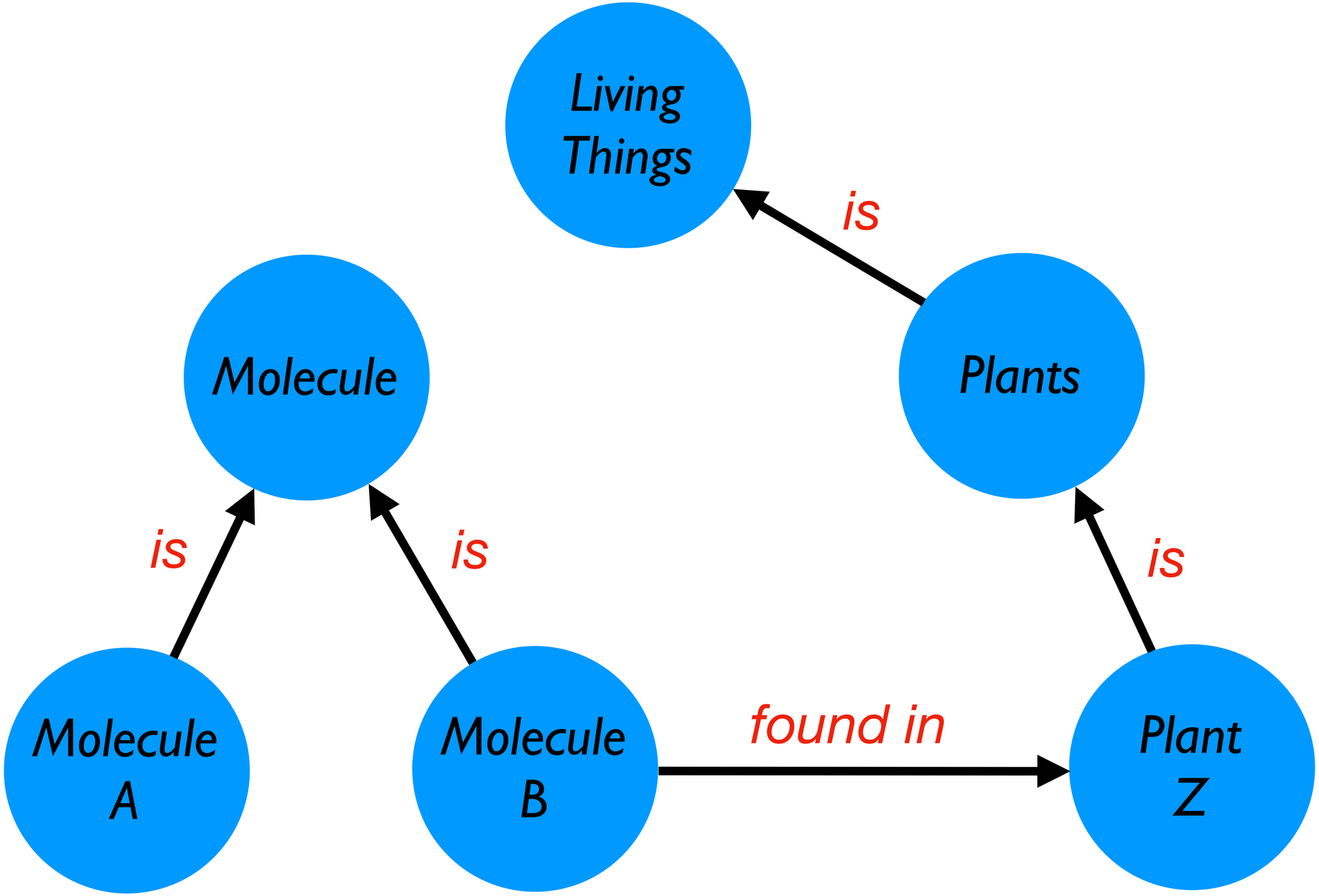

physical objects
digital objects
Garden n
Garden III
Garden II
Garden I
Botanical gardens
listing
Species list
taxonomic resolving
OPEN Tree of Life
BOTALISTA
Phylogeny
Plant Traits Ontology
WIKIDATA
Web interface
Users community
Researchers, botanists, curators, public etc.
sampling
metadata collection
Sampling metadata
Nocode Interface
directus
Specimens
iNaturalist
GBIF
Specimens metadata
Postgres Relational DB
Swiss DBGI KnowledgeGraph
Library n
Library III
Library II
Library I
Dried plants collections
conservation
metadata collection
Dried Plants & Extracts metadata
Molecular networks
MEMO fingerprints
API
Programmatic interface
extraction
metadata collection
spectral organization
Chemical structures
ChEBI Ontology
Chemical extracts collections
mass spectrometry based digitization
MS data
spectral annotation

What

is a

Knowledge Graph ?


Living Things
is
is
Animals
Plants
is
is
is
Dogs
Cows
eat
Herbs


Living Things
is
Molecule
Plants
is
is
is
Molecule A
Molecule B
found in
Plant Z

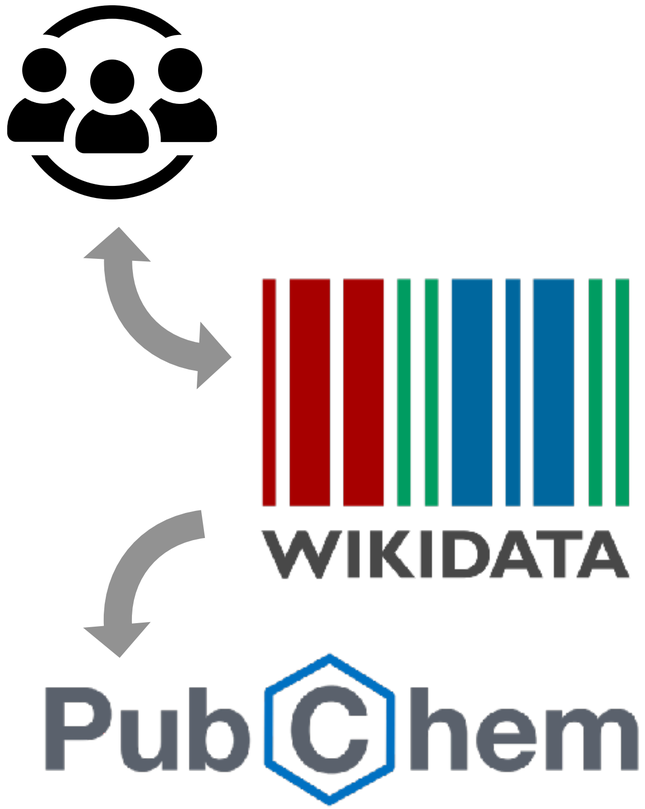
eLife

TOOLS AND RESOURCES

The LOTUS initiative for open knowledge management in natural products research

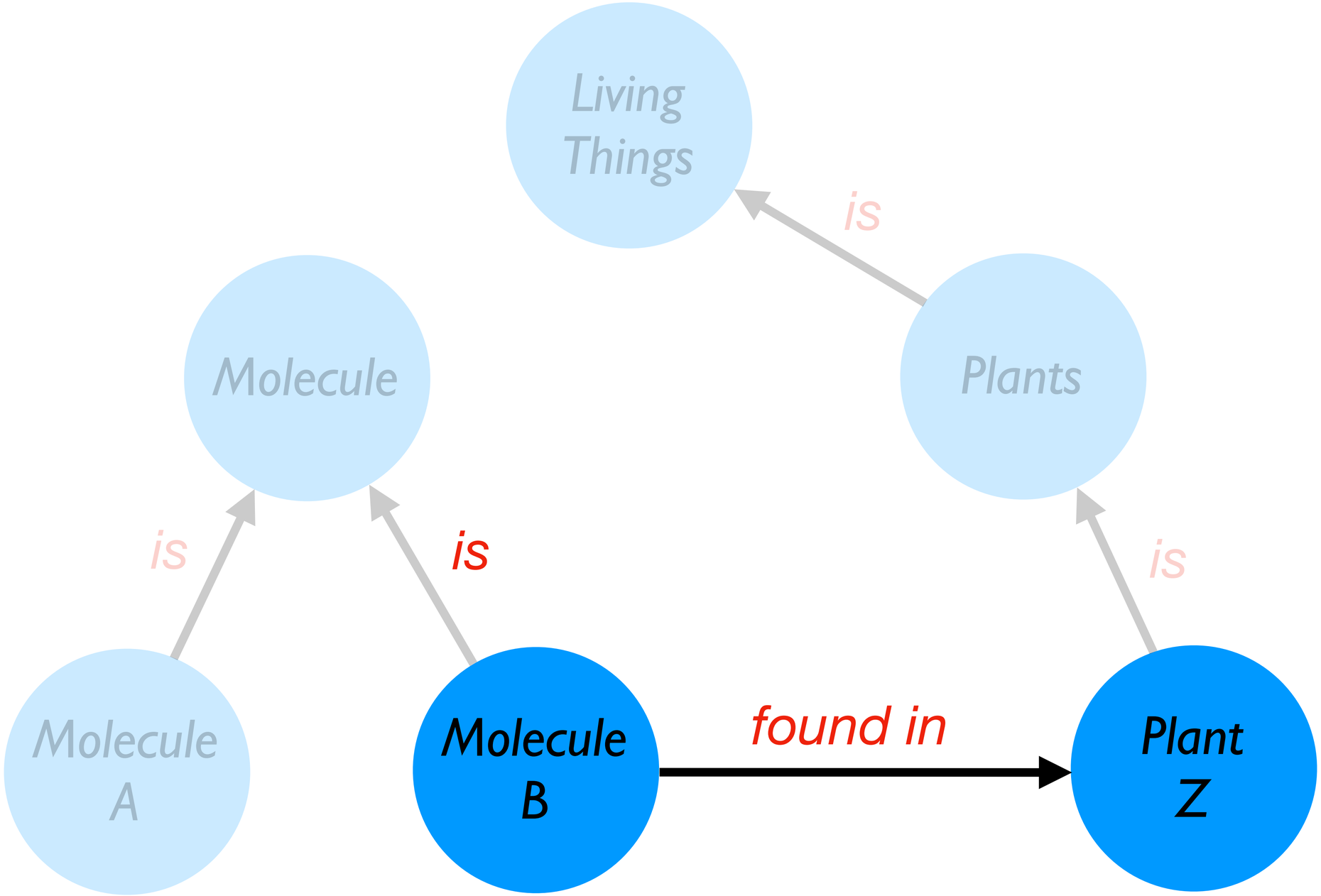
Adriano Rutz[1,2], Maria Sorokina[3], Jakub Galgonek[4], Daniel Mietchen[5,6,7], Egon Willighagen[8], Arnaud Gaudry[1,2], James G Graham[9,10], Ralf Stephan[11], Roderic Page[12], Jiří Vondrášek[4], Christoph Steinbeck[3], Guido F Pauli[9,10], Jean-Luc Wolfender[1,2], Jonathan Bisson[9,10]*, Pierre-Marie Allard[1,2,13]*

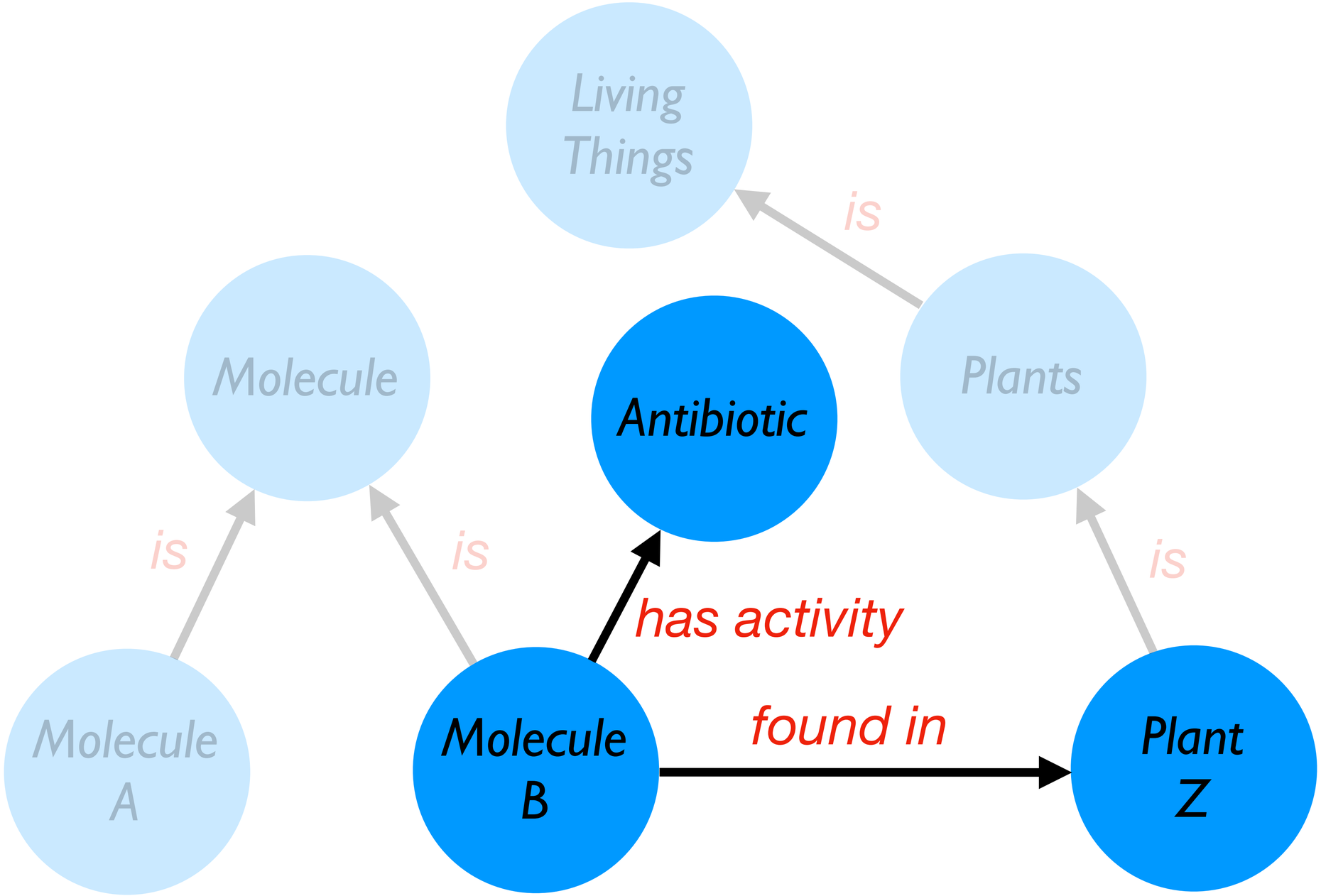
https://doi.org/10.7554/eLife.70780

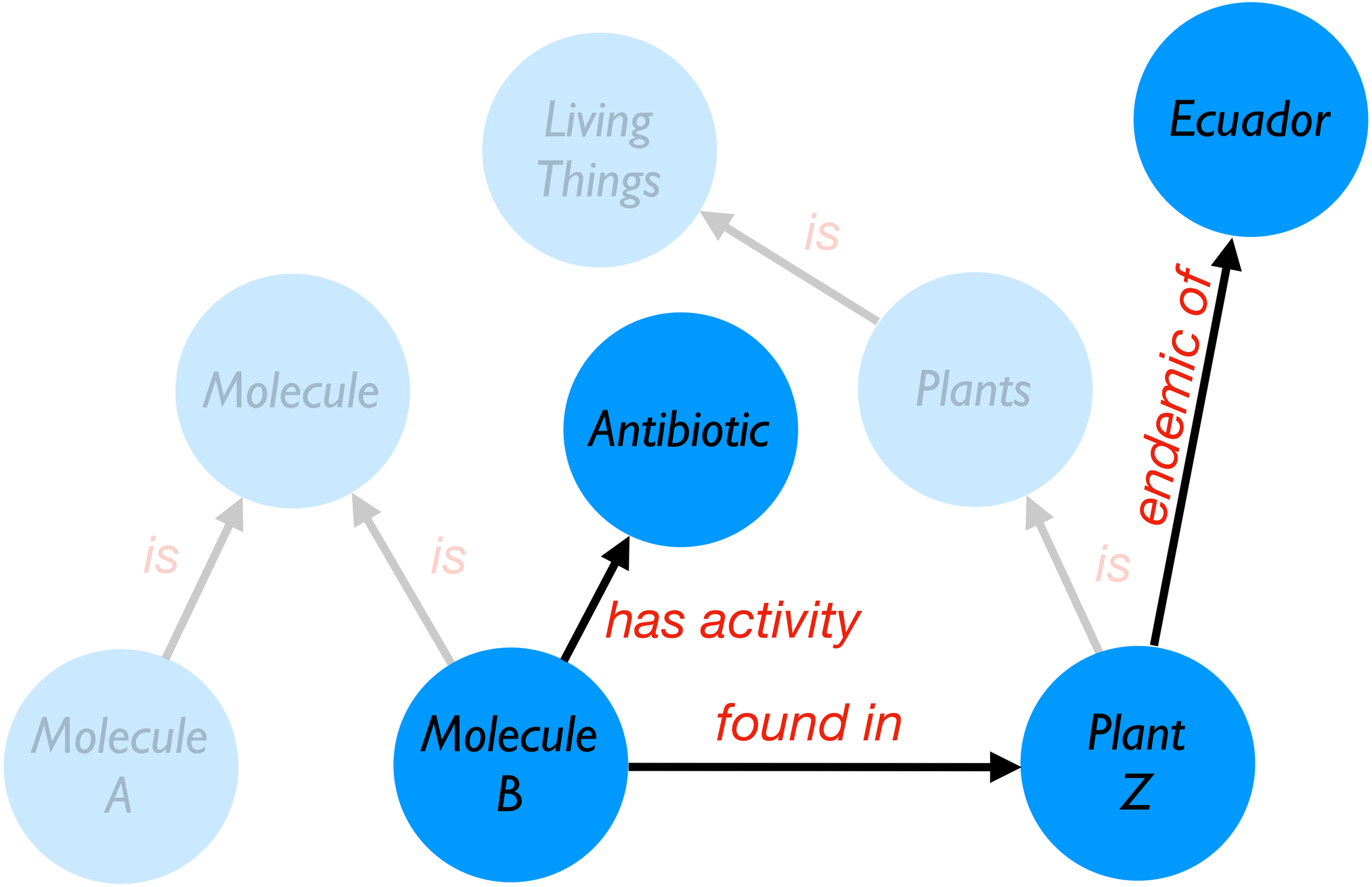


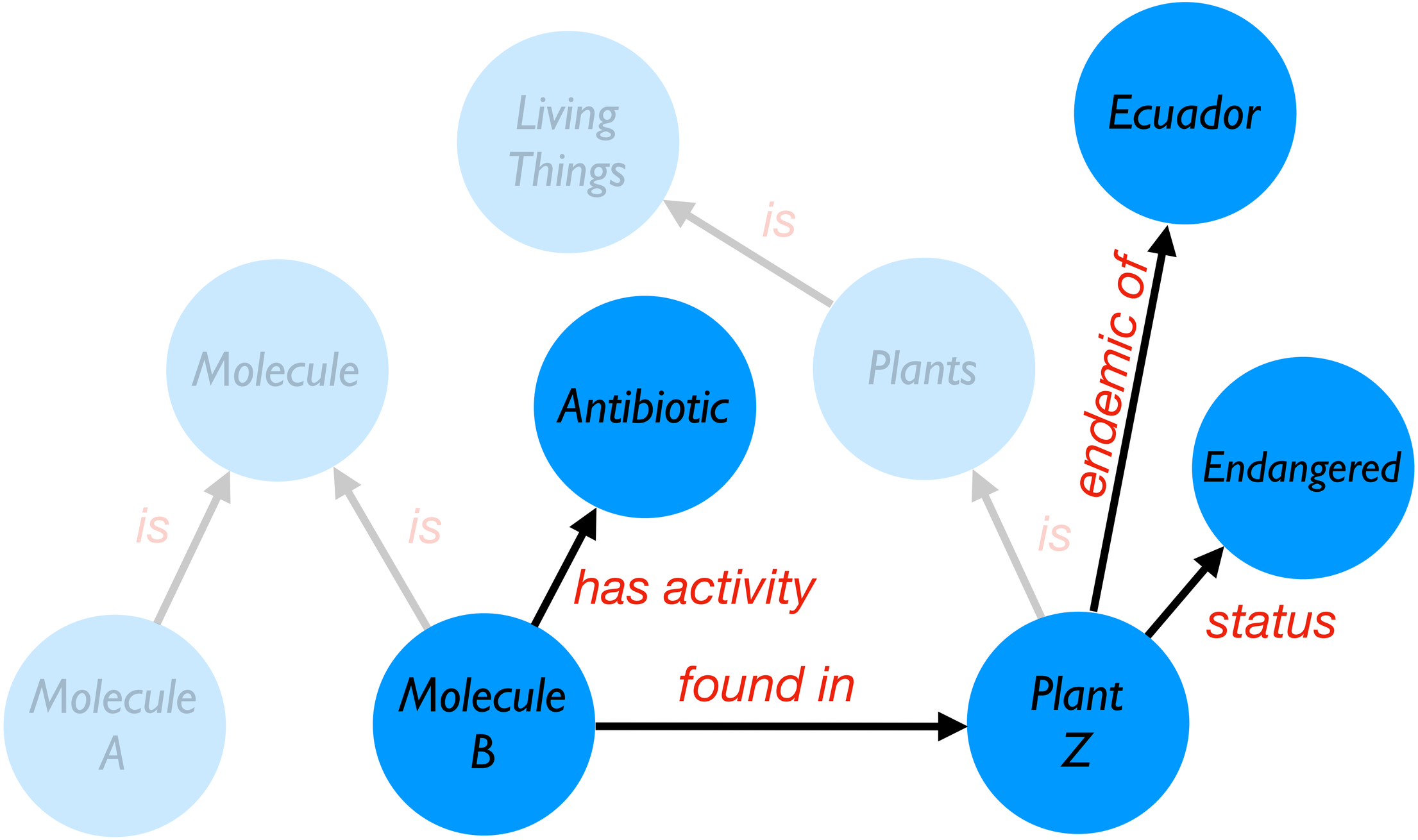

microscope
macroscope

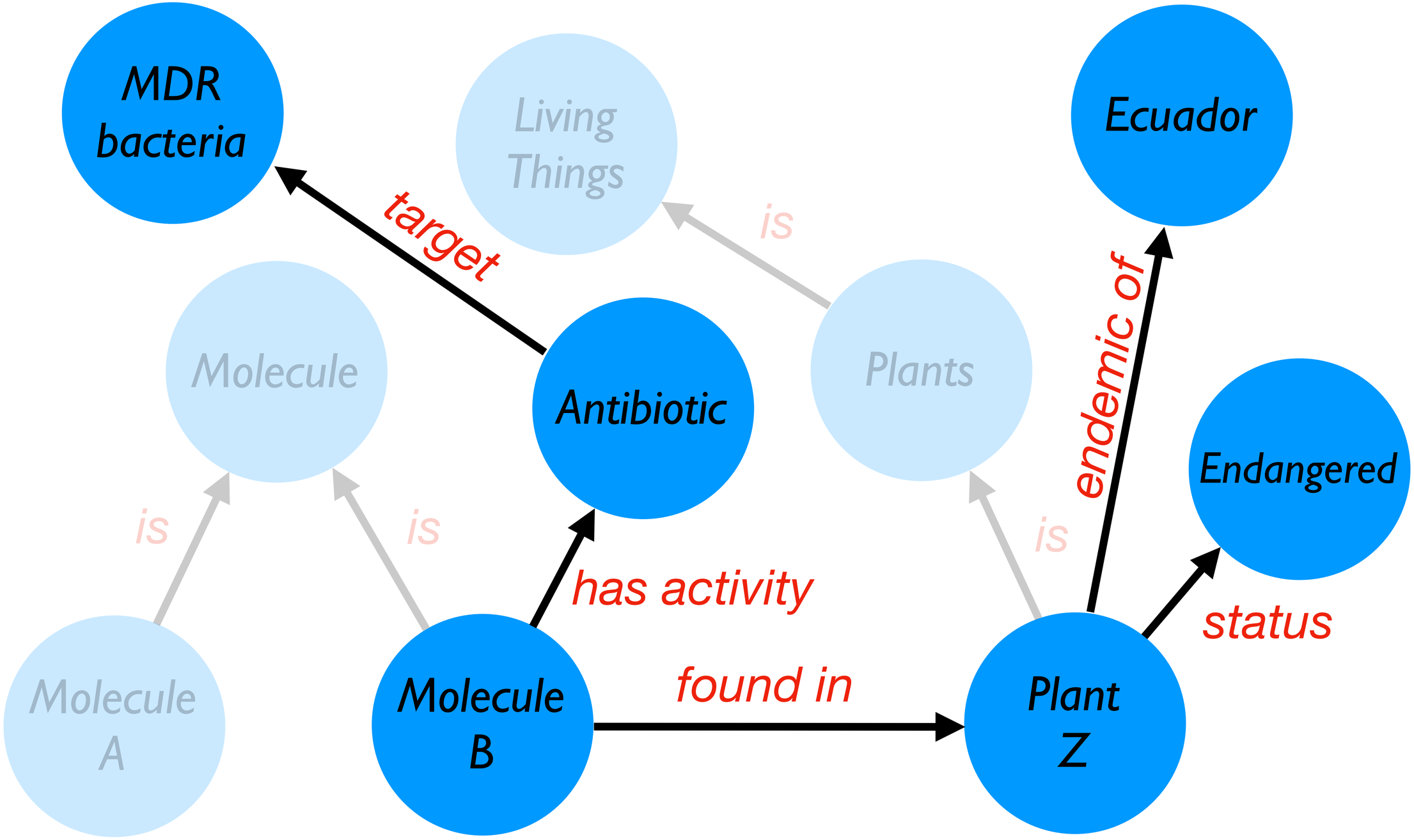

Molecule
found in
Organism

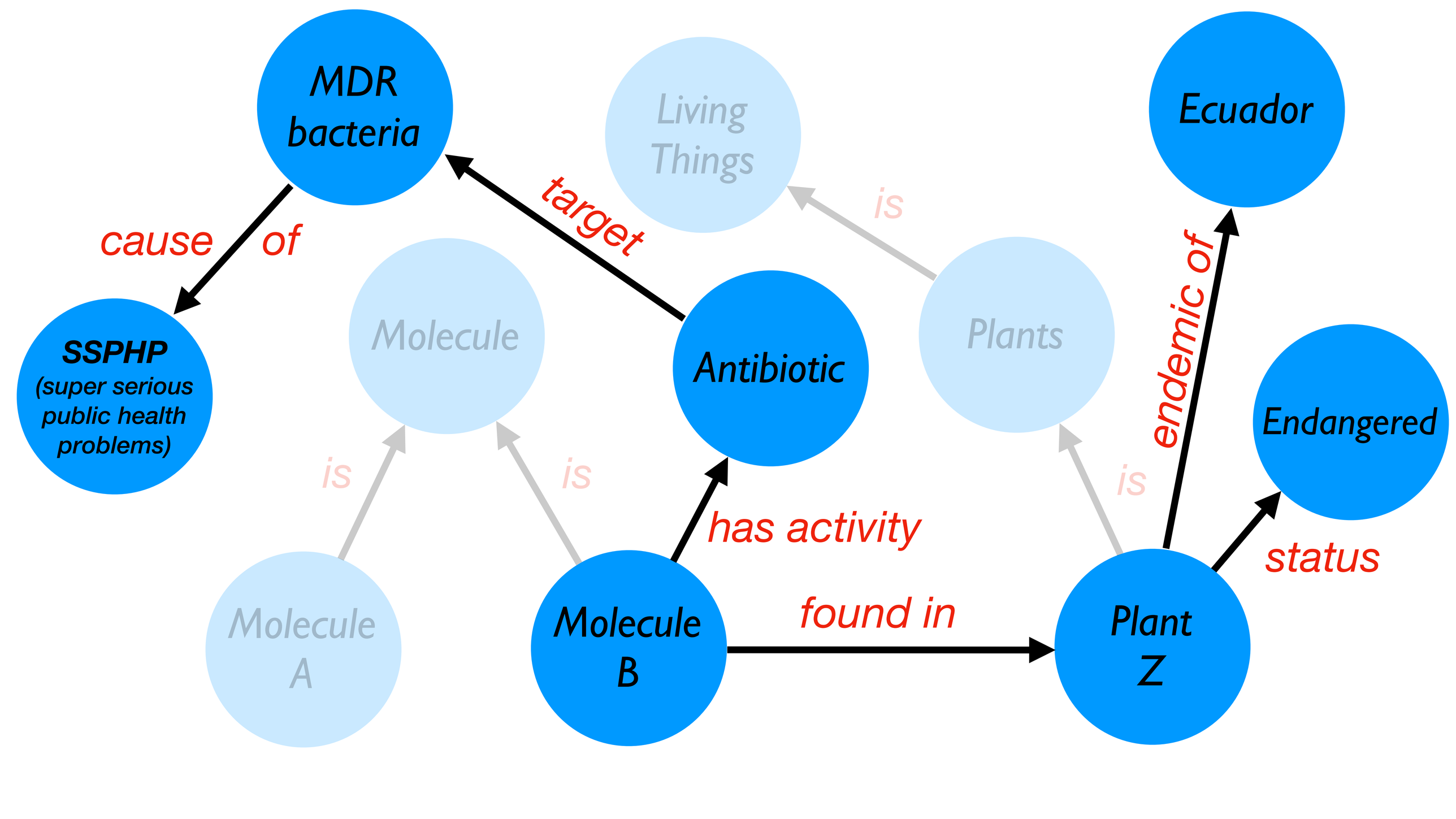

Living Things
is
Molecule
Plants
is
is
is
Molecule A
Molecule B
found in
Plant Z


Living Things
is
Molecule
Antibiotic
Plants
is
is
is
has activity
Molecule A
Molecule B
found in
Plant Z


Living Things
is
Ecuador
Molecule
Antibiotic
Plants
endemic of
is
is
is
has activity
Molecule A
Molecule B
found in
Plant Z


Living Things
is
Ecuador
Molecule
Antibiotic
Plants
endemic of
is
is
is
Endangered
has activity
status
Molecule A
Molecule B
found in
Plant Z


MDR bacteria
Living Things
Ecuador
target
is
endemic of
Molecule
Antibiotic
Plants
Endangered
is
is
is
has activity
status
Molecule A
Molecule B
found in
Plant Z


MDR bacteria
Living Things
Ecuador
cause of
target
is
endemic of
SSPHP
(super serious public health problems)
Molecule
Antibiotic
Plants
Endangered
is
is
is
has activity
status
Molecule A
Molecule B
found in
Plant Z

Active repository

Local

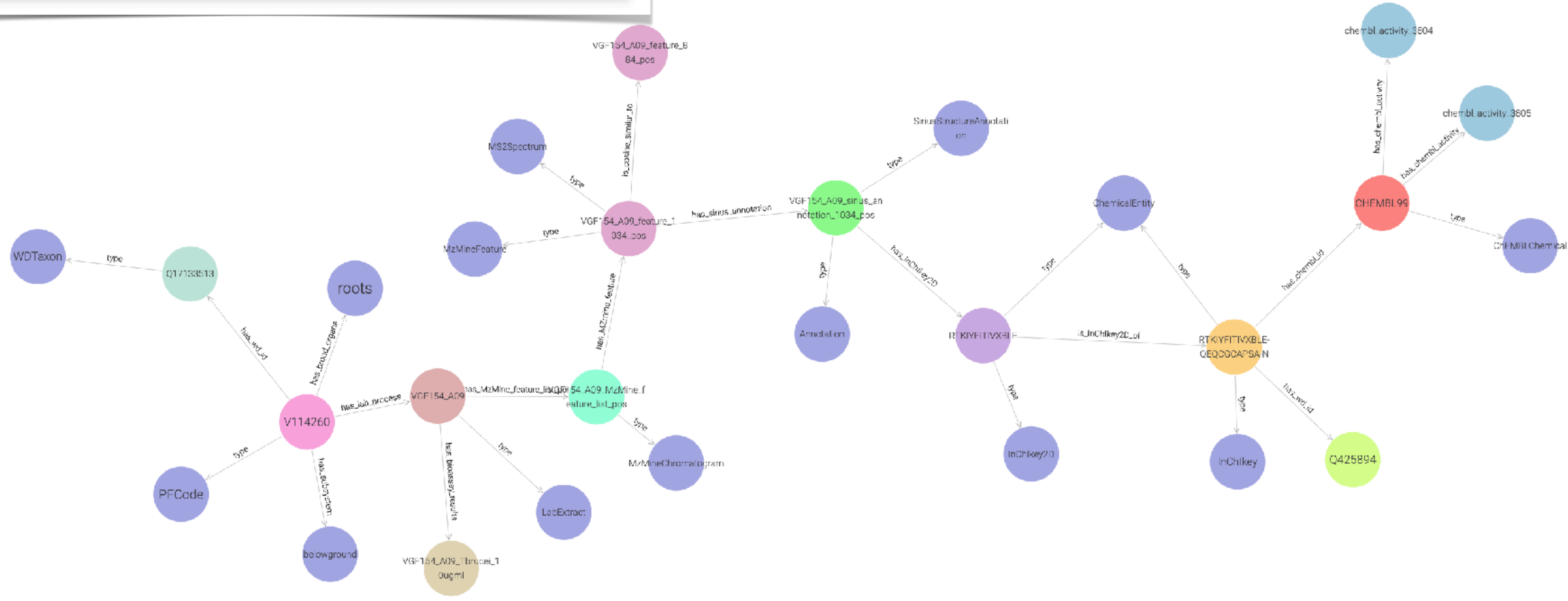
pf_dbgi · Common ENPKG KG between PF and DBGI d

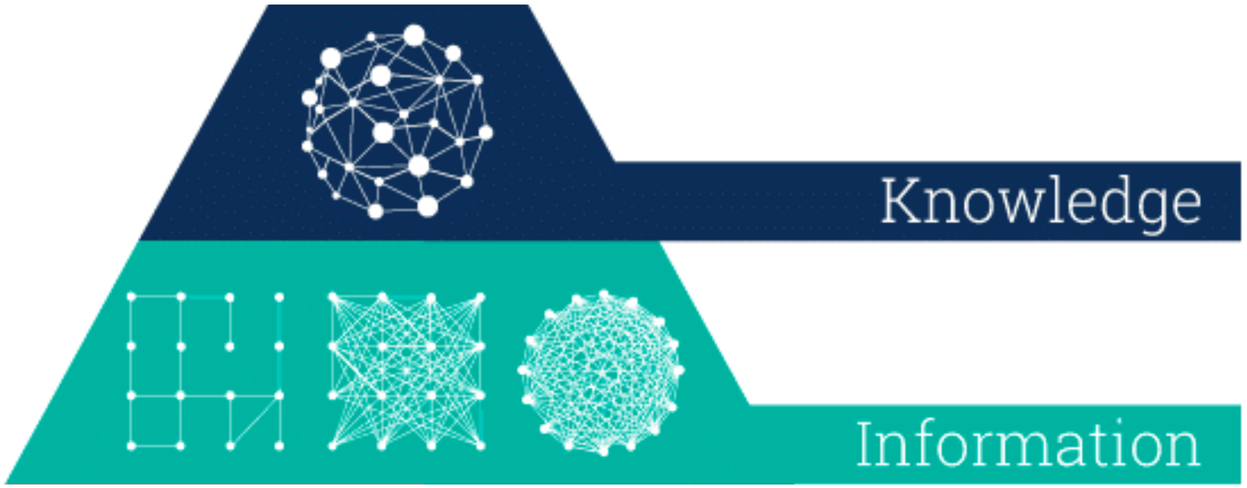
total statements
30,617,014

27,711,418 explicit
2,905,596 inferred
1.10 expansion ratio

Import RDF data

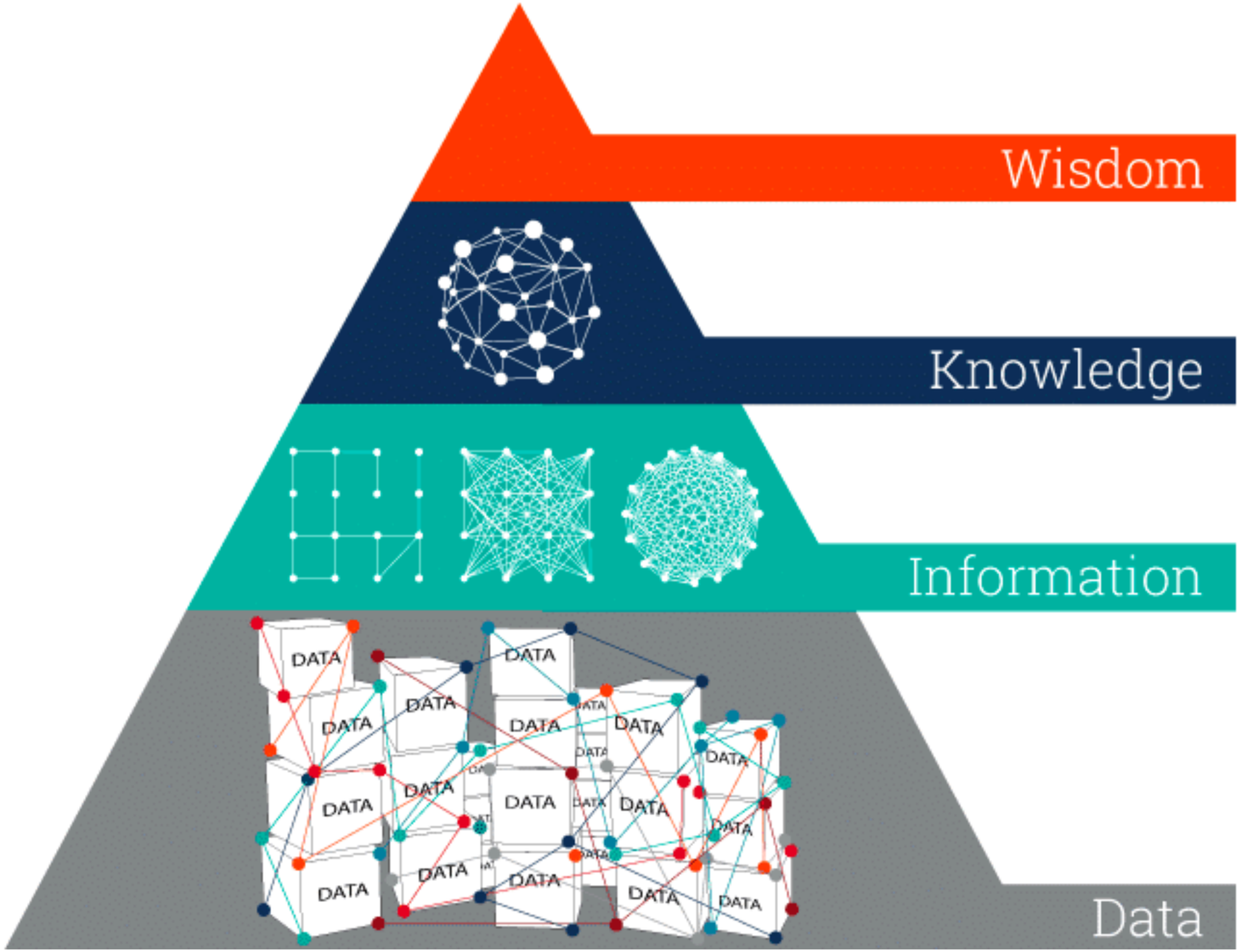
Export RDF data





e.g. all public bioactivity profiles, documented physicochemical properties of molecules and their interconnections

e.g. molecular networks, metabolites annotations, taxon identifications



Are these zones of molecular endemism ?
Should their conservation by prioritized ? Why ?

e.g. all public bioactivity profiles, documented physicochemical properties of molecules and their interconnections

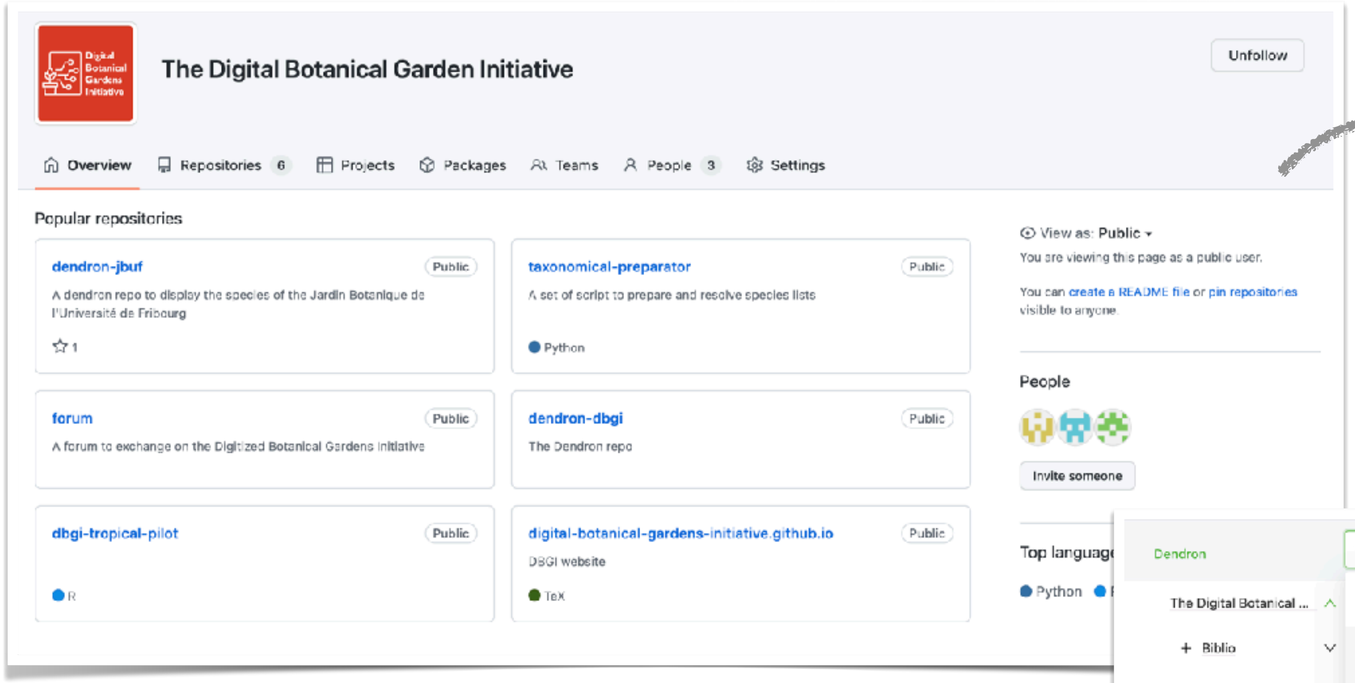
e.g. molecular networks, metabolites annotations, taxon identifications

e.g. MSMS spectra, exact masses, RT, bioassay results, sample labels, geolocalisations etc.

https://notes.andymatuschak.org/z21cgR9K3UcQ5a7yPsj2RUim3oM2TzdBByZu

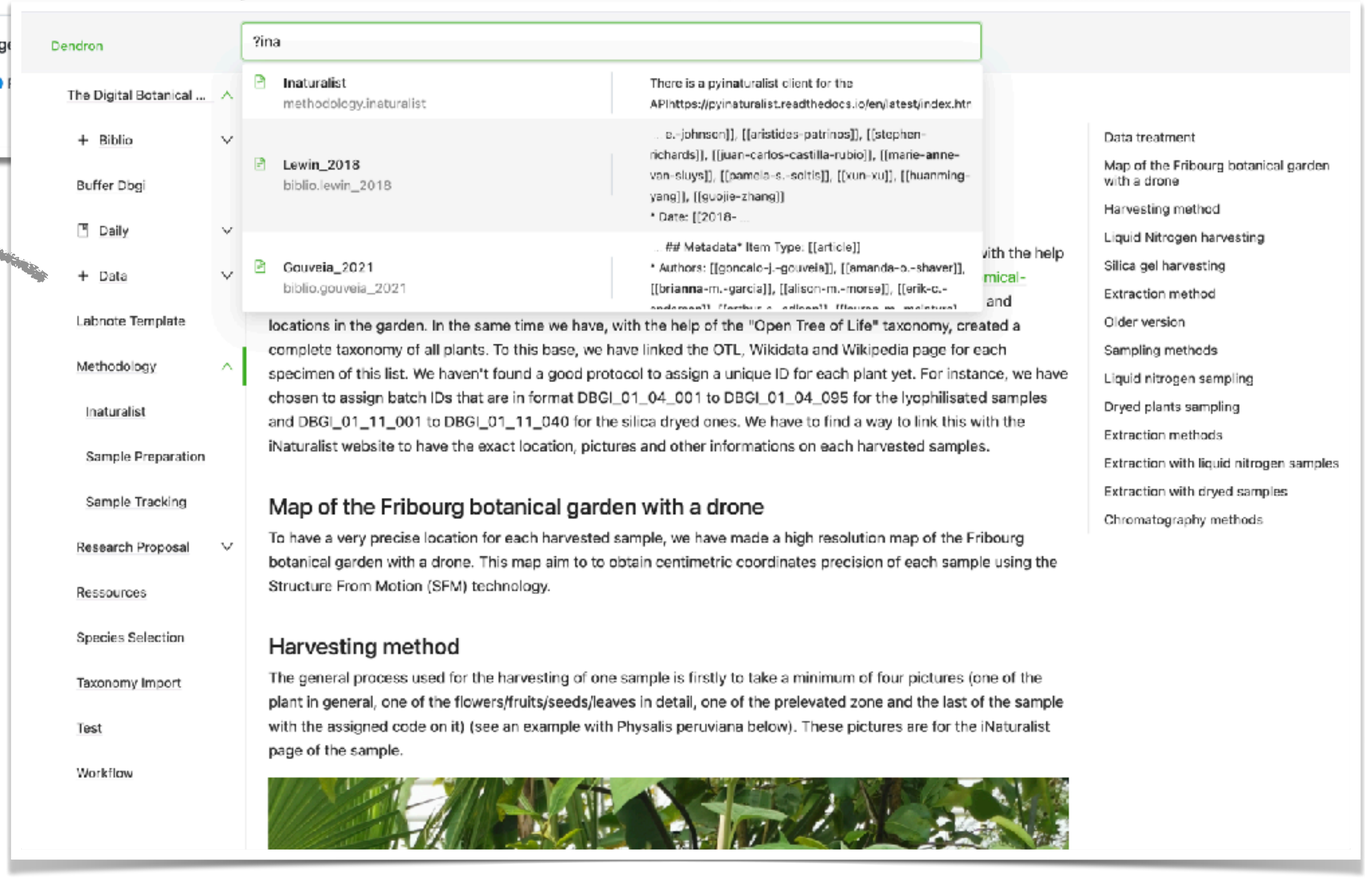
"*Working with the garage door up*" is a good definition of the concept of Open Notebook Science.

Everything is shared from the beginning of the research project.
Early ideas.
Early results.
Every bit of code.
Of course this will also imply that poorly written code and sketchy ideas will be shared.



Code versioning on Github

👉 https://github.com/digital-botanical-gardens-initiative



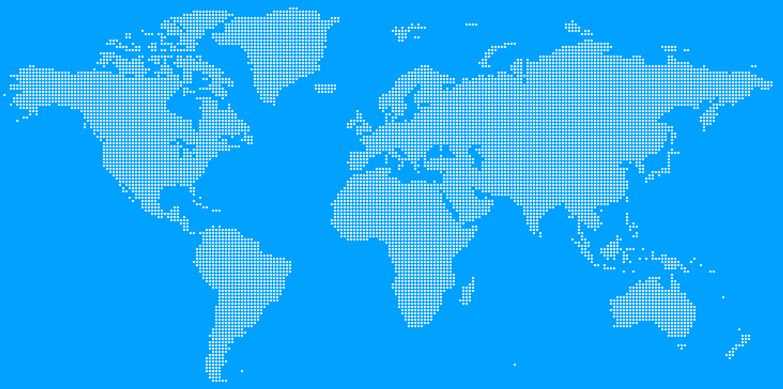
Notes organization via Dendron

- shareable across collaborators
- versioned on Github
- published as website

👉 https://www.dbgi.org/dendron-dbgi/

DENDRON

Digital
Botanical
Gardens
Initiative



Get in touch :

👉 https://github.com/digital-botanical-gardens-initiative

👉 dbgi@protonmail.com

Thank you !