



Archiving, preserving, sharing



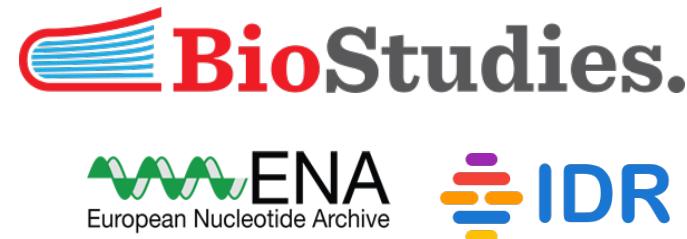
CENTRE FOR
DIGITAL LIFE
NORWAY

Korbinian Bösl
Data management coordinator
ELIXIR Norway/Digital Life Norway
9th of March 2021



NeLS

Norwegian e-Infrastructure for Life Sciences



Why should I deposit my data?

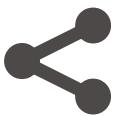


Increased Visibility (SEO) → 25% more citations

Why should I deposit my data?

-  Increased Visibility (SEO) → 25% more citations
-  Value added Databases → more citations

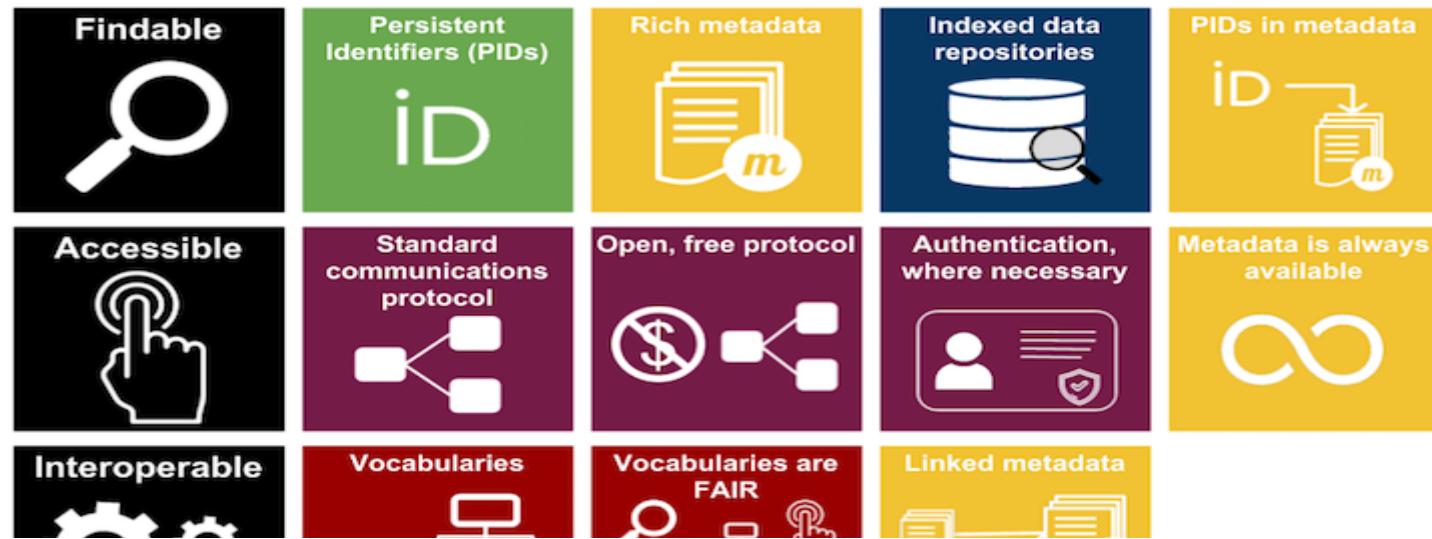
Why should I deposit my data?

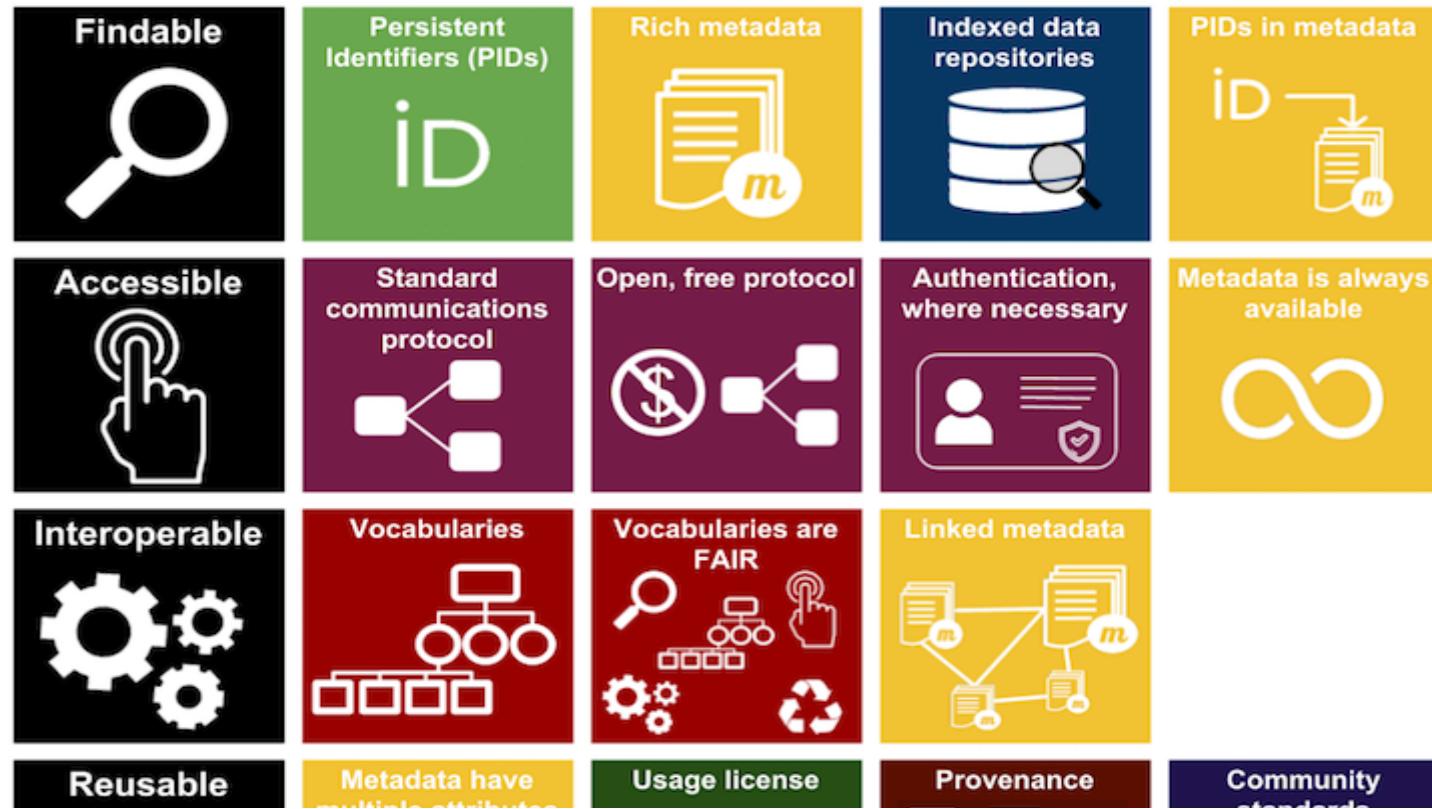
-  Increased Visibility (SEO) → 25% more citations
-  Value added Databases → more citations
-  FAIRification – Funding requirements ✓✓

Why should I deposit my data?

-  Increased Visibility (SEO) → 25% more citations
-  Value added Databases → more citations
-  FAIRification – Funding requirements ✓✓
-  Safe money on storage

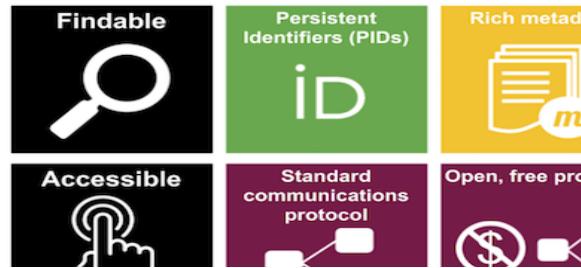




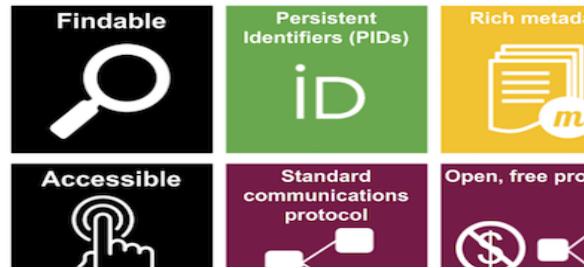




What is a PID and why do we need it?



What is a PID and why do we need it?



A PID consists of 2 components:

a unique identifier

a service that locates the resource over time
even when it's location changes

Examples for digital objects

Digital Object Identifiers



Handles



Identifiers.org<

Archival Resource Keys (ARK)

Persistent Uniform Resource Locator (PURL)

Universal Resource Name (URN)

PIDs exists also for



Persons

ORCID

PIDs exists also for



Persons

ORCID



Funding bodies



PIDs exists also for



Persons

ORCID



Funding bodies



Institutions

PIDs exists also for



Persons

ORCID



Funding bodies



Institutions



Instruments (soon)

Why do we need standard vocabularies?



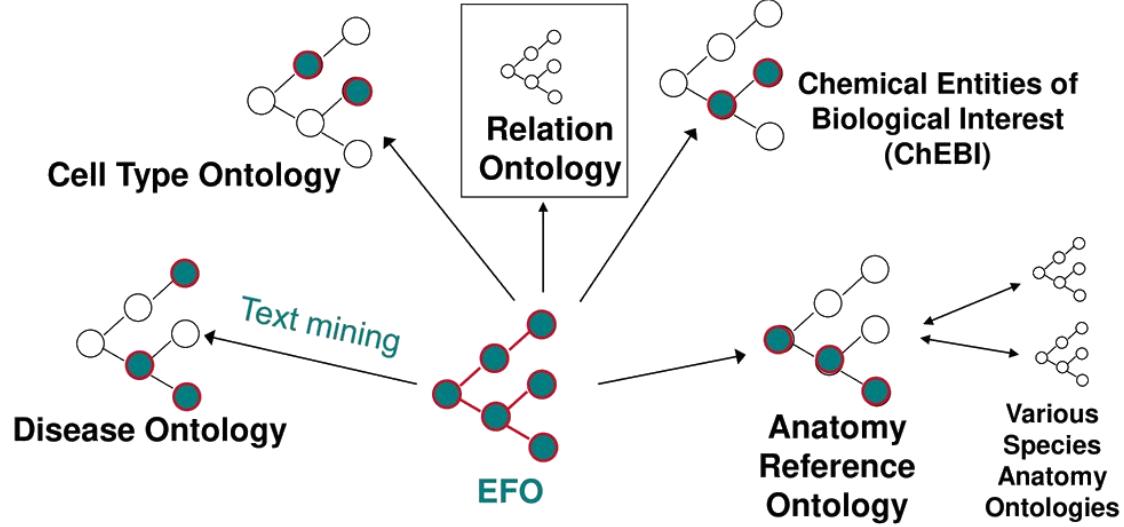
How many way can you say “female”?

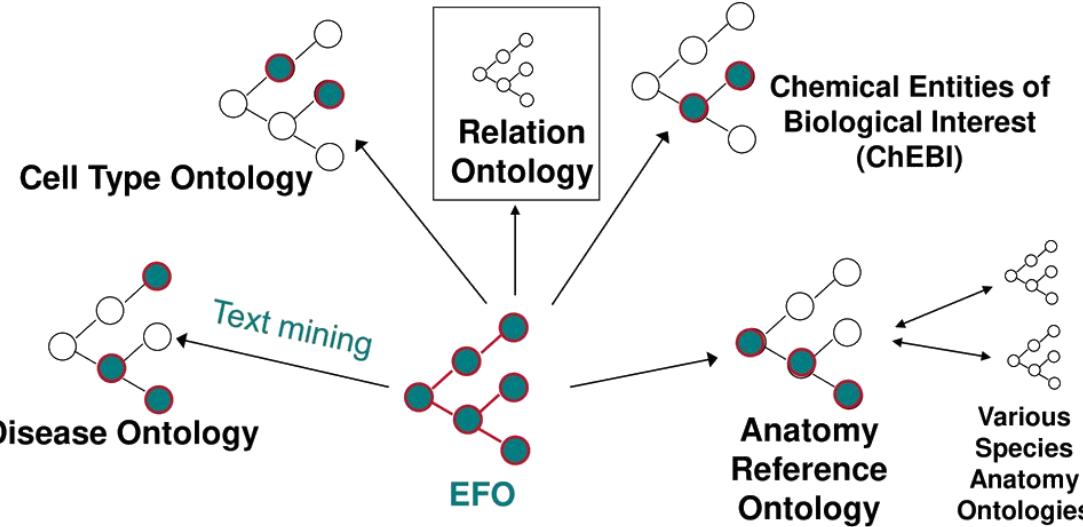
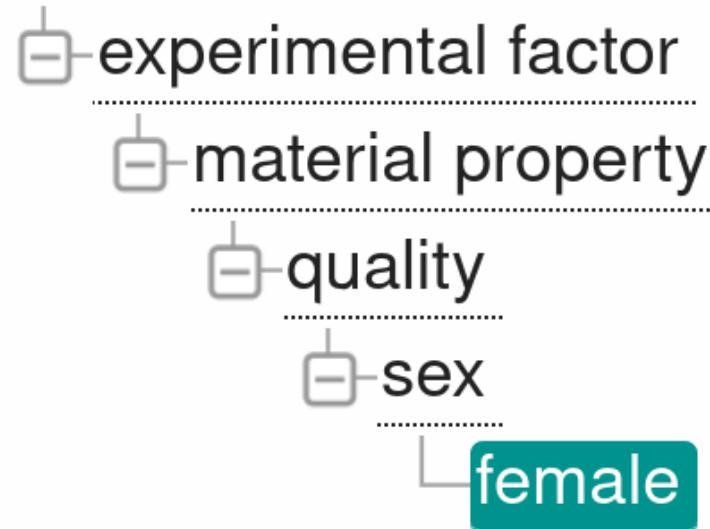
How many ways can you say “female”?

18-day pregnant females	female (lactating)	individual female	worker caste (female)
2 yr old female	female (pregnant)	lgb*cc females	sex: female
400 yr. old female	female (outbred)	mare	female, other
adult female	female parent	female (worker)	female child
asexual female	female plant	monosex female	femal
castrate female	female with eggs	ovigerous female	3 female
cf.female	female worker	oviparous sexual females	female (phenotype)
cystocarpic female	female, 6-8 weeks old	worker bee	female mice
dikaryon	female, virgin	female enriched	female, spayed
dioecious female	female, worker	pseudohermaphroditic female	femlale
diploid female	female(gynoecious)	remale	metafemale
f	femele	semi-engorged female	sterile female
famale	female, pooled	sexual oviparous female	normal female
femail	femalen	sterile female worker	sf
female	females	strictly female	vitellogenic replete female
female - worker	females only	tetraploid female	worker
female (alate sexual)	gynoecious	thelytoky	hexaploid female
female (calf)	healthy female	female (gynoecious)	female (f-o)
hen	probably female (based on morphology)		

female (note: this sample was originally provided as a \"male\" sample to us and therefore labeled this way in the brawand et al. paper and original geo submission; however, detailed data analyses carried out in the meantime clearly show that this sample stems from a female individual")





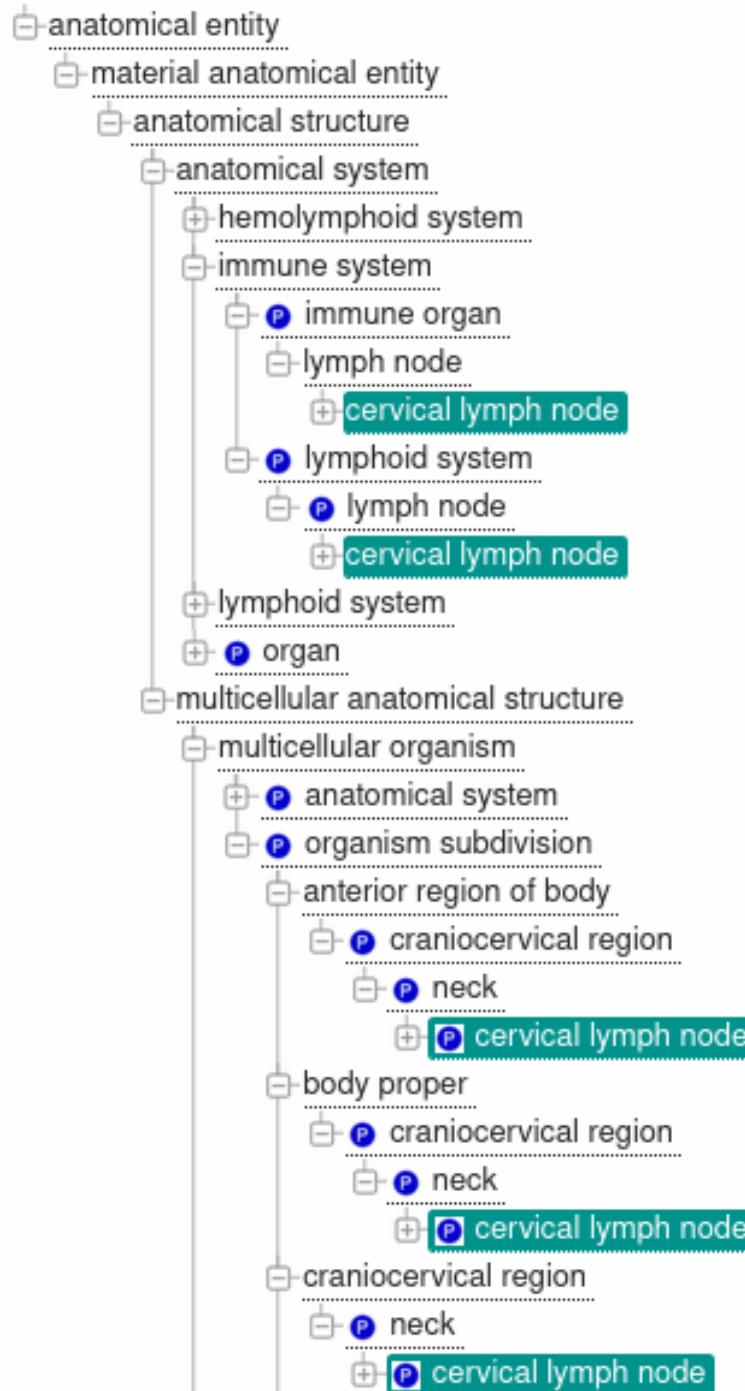


database cross reference

- MSH:D005260
- MO:506
- NCIt:C16576
- SNOMEDCT:248152002
- CARO:0000028
- PATO:0000383



Ontologies
enable hierarchical searches



Meta data standards



Meta data standards



ArrayExpress

Organism

MINSEQE

Experimental factors

Tissue

Sequencing data - e.g. FASTQ

Processed data

Linked publications, contact data, general information

sample - data relationships

Experimental + data processing protocols



Taxonomy



. Ü Uberon



Controlled vocabulary & Ontologies

Metadata standards – controlled vocabulary for



Structured comment name	Item	Description	Examples	Expected value	Value syntax	Preferred units / suffix
alt_elev	Geographic location (altitude/elevation)	Sample taken at given elevation above sea level, defined in meters(m) as a positive floating number with two decimals.	Ex 1: 3.06 Ex 2: 1.80-2.15	-	{float} or {range}	meters (m)
collection_date	Collection date	The time of sampling, either as an instance (single point in time) or interval. In case no exact time is available, the date/time can be right truncated.	Ex 1: 2008-01-23T19:23:10+00:00 Ex 2: 2011-11-10 Ex 3: 2001-12 Ex 7: 2015 Ex 4: 2003--2006 Ex 5: 2010-01--2011-03 Ex 6: 2011-05-28--2011-08-10	date and time, range	{timestamp}	-
depth	Depth	Please refer to the definitions of depth in the environmental packages. Water: Sample taken at given depth below sea level, defined in meters(in) as a positive floating number or as a range, both with two decimals.	Ex 1: 355.20 Ex 2: 2.00-5.00	-		meters (m)
env_biome	Environment (biome)	In environmental biome level are the major classes of ecologically similar communities of plants, animals, and other organisms. Biomes are defined based on factors such as plant structures, leaf types, plant spacing, and other factors like climate. Examples include: desert, taiga, deciduous woodland, or coral reef. EnvO (v1.53) terms listed under environmental biome can be found from the link:(http://www.environmentontology.org/Browse-EnvO)	Ex 1: coral reef Ex 2: tropical	EnvO	{free text}	-
env_biome_ENVO	Environment (biome_id)	Corresponding ENVO identifier related to the term name of Environment (biome).	Ex 1: ENVO:00000150 Ex 2: ENVO:01000204	EnvO	{accession}	-

Not collected	->	missing
250 M	->	250
Not applicable	->	NA
Superficial	->	missing
-1 m	->	1
-2 m	->	2
-2901.0	->	2901
0 m.	->	0
1912 ft	->	582.80
40 mm from surface	->	0.04
0.75 m above seafloor	->	missing
700meters	->	700
Intracellular	->	missing
Surface water of 0 meter	->	0
Zero	->	0
Below surface	->	Missing

Controlled vocabulary & Ontologies

Ontology Lookup Service (OLS) is a resource for biomedical ontologies



Structured comment name	Item	Description	Examples	Expected value	Value syntax	Preferred units / suffix
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collection_date	Collection date	The time of sampling, either as an instance (single point in time) or a range (start date to end date).	Ex 1: 2008-01-01 Ex 2: 2008-01-01/2008-01-02	date and time, range	{timestamp}	-

marine biome

http://purl.obolibrary.org/obo/ENVO_00000447

An aquatic biome that comprises systems of open-ocean and unprotected coastal habitats, characterized by exposure to wave action, tidal fluctuation, and ocean currents as well as systems that largely resemble these. Water in the marine biome is generally within the salinity range of seawater: 30 to 38 ppt. [MA:ma ISBN-10:0618455043 ORCID:0000-0002-4366-3088 <https://en.wikipedia.org/wiki/Ocean>]

Tree view Term history

entity

material entity

biome

aquatic biome

marine biome

Graph view

Reset tree

Show all siblings

Term info

database cross reference

SPIRE:Marine

has obo namespace

ENVO

has related synonym

marine realm

id

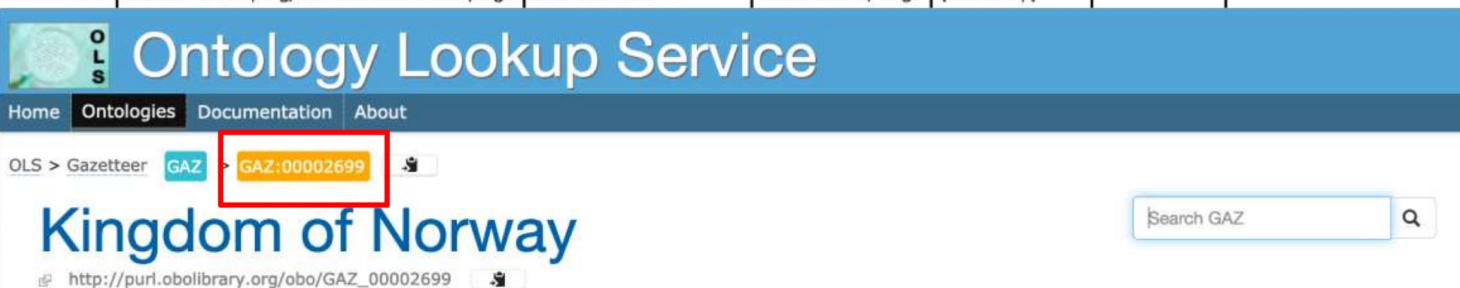
ENVO:00000447

The ENVO ontology describes the environment of the sampling

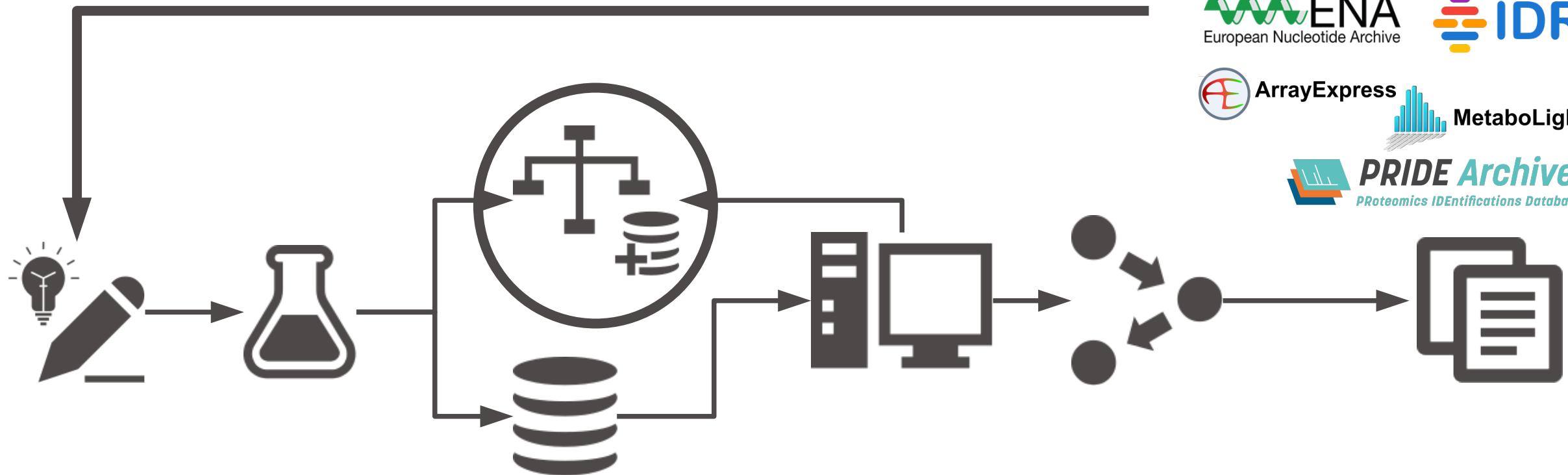
Controlled vocabulary & Ontologies

Ontology Lookup Service (OLS) is a resource for biomedical ontologies



Structured comment name	Item	Description	Examples	Expected value	Value syntax	Preferred units / suffix
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collection_date	Collection date	The time of sampling, either as an instance (single	Ex 1: 2008-01-	date and time, range	{timestamp}	-
depth	D	 The screenshot shows the OLS homepage with a navigation bar for Home, Ontologies, Documentation, and About. Below the navigation is a breadcrumb trail: OLS > Gazetteer > GAZ > GAZ:00002699. A red box highlights the URL 'GAZ:00002699'. The main content area displays the term 'Kingdom of Norway' with its definition: 'A country and constitutional monarchy in Northern Europe that occupies the western portion of the Scandinavian Peninsula. It is bordered by Sweden, Finland, and Russia. The Kingdom of Norway also includes the Arctic island territories of Svalbard and Jan Mayen. Norwegian sovereignty over Svalbard is based upon the Svalbard Treaty, but that treaty does not apply to Jan Mayen. Bouvet Island in the South Atlantic Ocean and Peter I Island and Queen Maud Land in Antarctica are external dependencies, but those three entities do not form part of the kingdom.' [url: http://en.wikipedia.org/wiki/Norway]'. Below the definition is a section for synonyms: 'Synonyms: Kongeriket Norge {language: Norwegian}, Norway, Kongeriket Noreg {language: Norwegian}'.				
env_biome	E	 This row continues the table from the previous one. It shows the 'Term info' panel for the 'Kingdom of Norway' term, which includes a 'database cross reference' list: ISO3166-1:NO, ISO3166-2:NO, ISO3166-1:578, and ISO3166-1:NOR. The 'ABBREVIATION' field is listed as 'Norway'.				
env_biome_ENVO	E					

The GAZ ontology describes the geographical location of the sampling



 ENA
European Nucleotide Archive

 IDR

 ArrayExpress

 MetaboLights

 PRIDE Archive
PRoteomics IDEntifications Database

 EUROPEAN
GENOME-PHENOME
ARCHIVE

Meta data standards



ArrayExpress

MINSEQE
MIAME

...

Meta data standards



ArrayExpress

MINSEQE
MIAME

...



HUPO-PSI TraML
MIAPE

...

Meta data standards



ArrayExpress

MINSEQE
MIAME

...



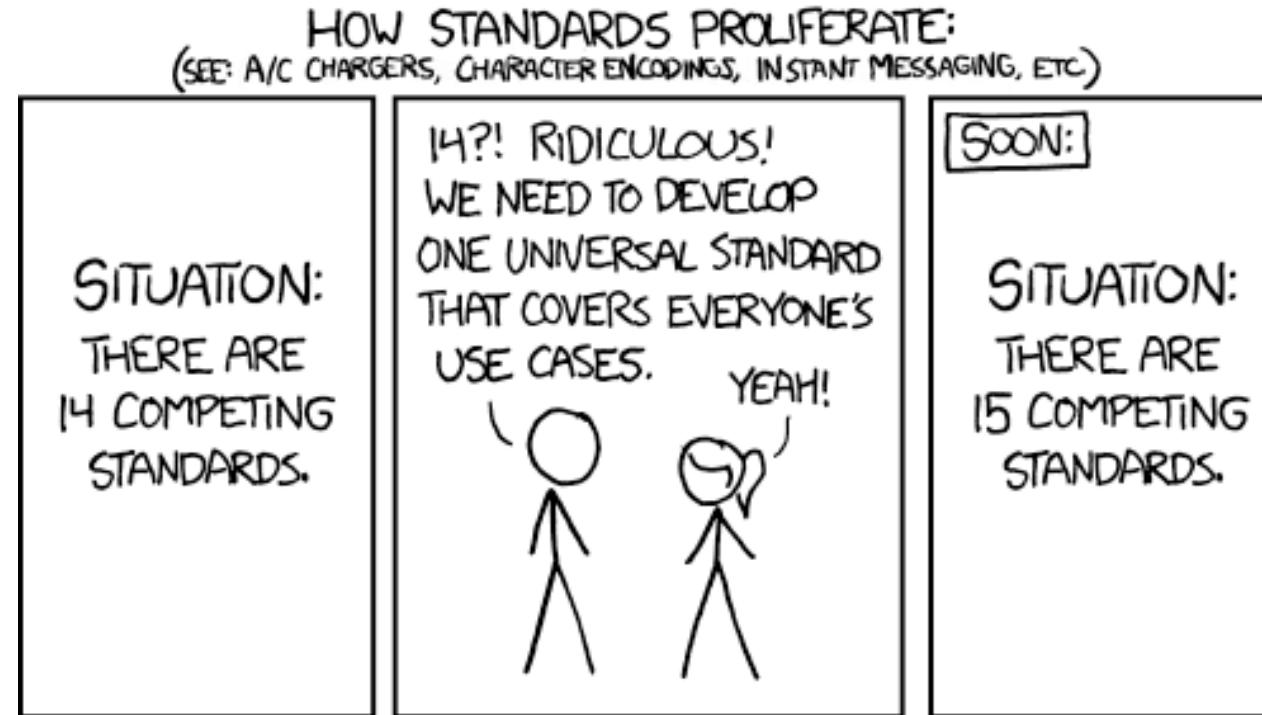
SRA-XML



HUPO-PSI TraML
MIAPE

...

Community standards vs. formal ISO standards



Which metadata standard?



Data format standards

Common formats

Non-proprietary formats (accessible with open source tools)

Avoiding binary data formats (data corruption)

Examples: FASTQ, TIFF, mzML,...

Data format standards



ArrayExpress
FASTQ
MAGE-ML

...



ENA
FASTA
FASTQ

...



mzML
mzQuantML

...

Where should I deposit my data?

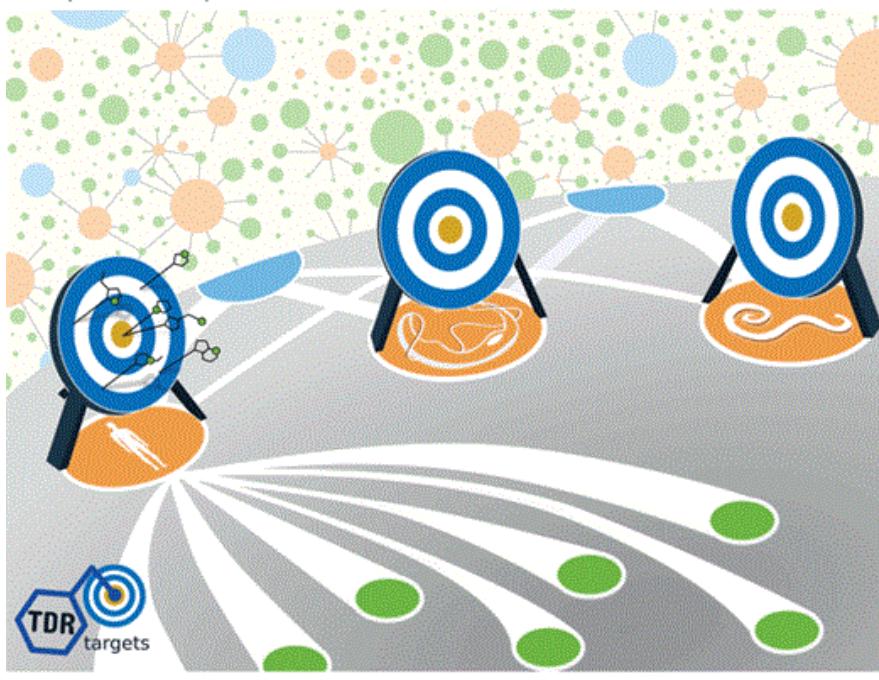
Preferably somewhere
where most things are taken care of?

How to choose?

Nucleic Acids Research

VOLUME 48 DATABASE ISSUE JANUARY 8, 2020

<https://academic.oup.com/nar>



OXFORD
UNIVERSITY PRESS

Open Access

No barriers to access – all articles freely available online



Rigden, D. J. & Fernández, X. M. licensed under Creative Commons Attribution 4.0 International License

The 27th annual Nucleic Acids Research database issue and molecular biology database collection. Nucleic Acids Res 48, D1–D8 (2020).

molecular biology
1637 databases



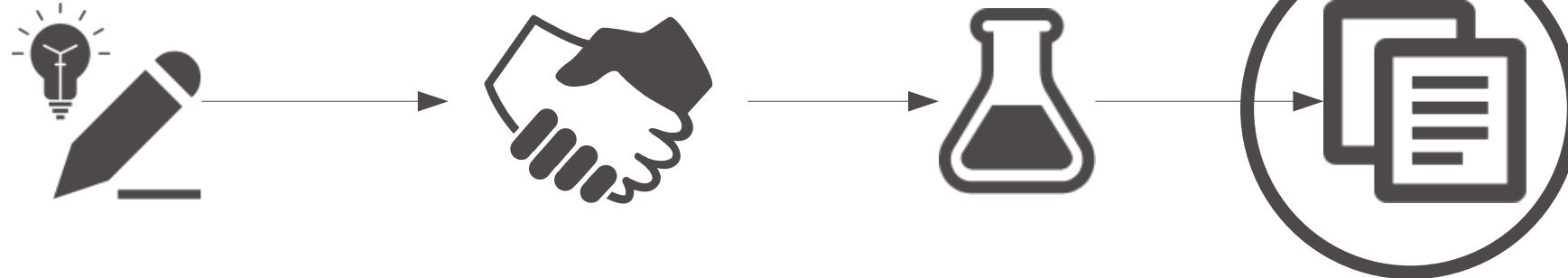
Taylor & Francis
Taylor & Francis Group

nature



SCIENTIFIC
DATA

1101110
01111101
110111110
0111101101



Deposition

Where should I deposit my data?



Where should I deposit my data?

Fits?

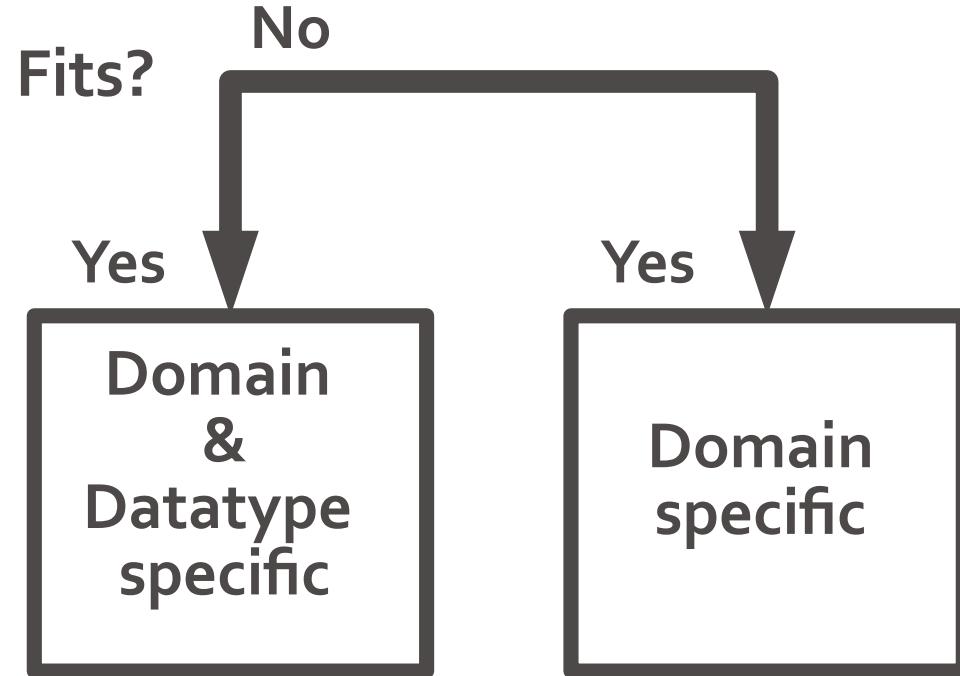


Yes

Domain
&
Datatype
specific



Where should I deposit my data?

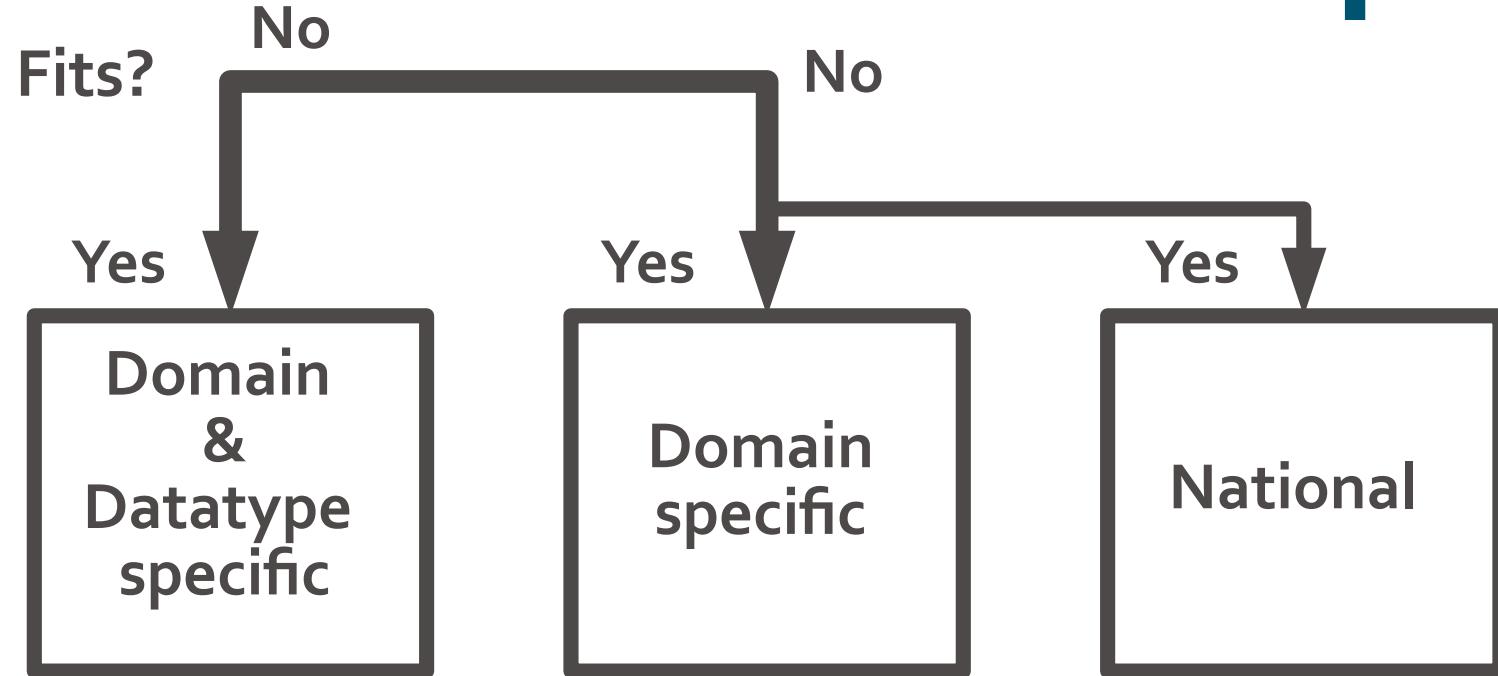


 ENA
European Nucleotide Archive

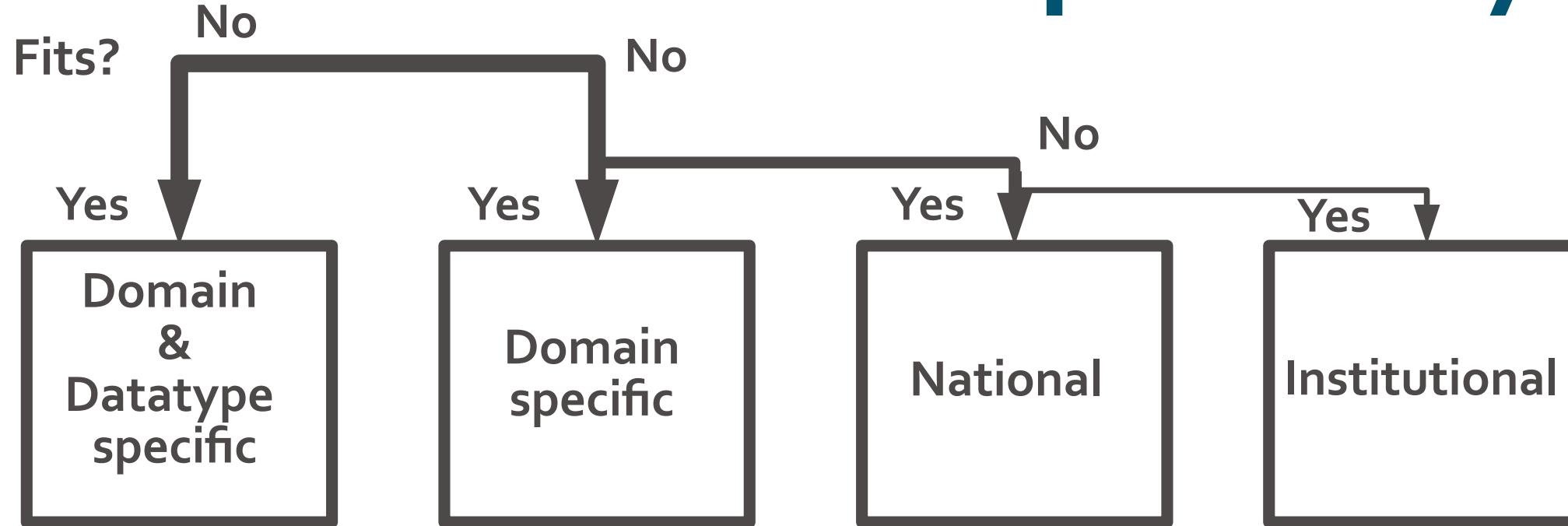
 BioStudies.

 SRA
NCBI

Where should I deposit my data?



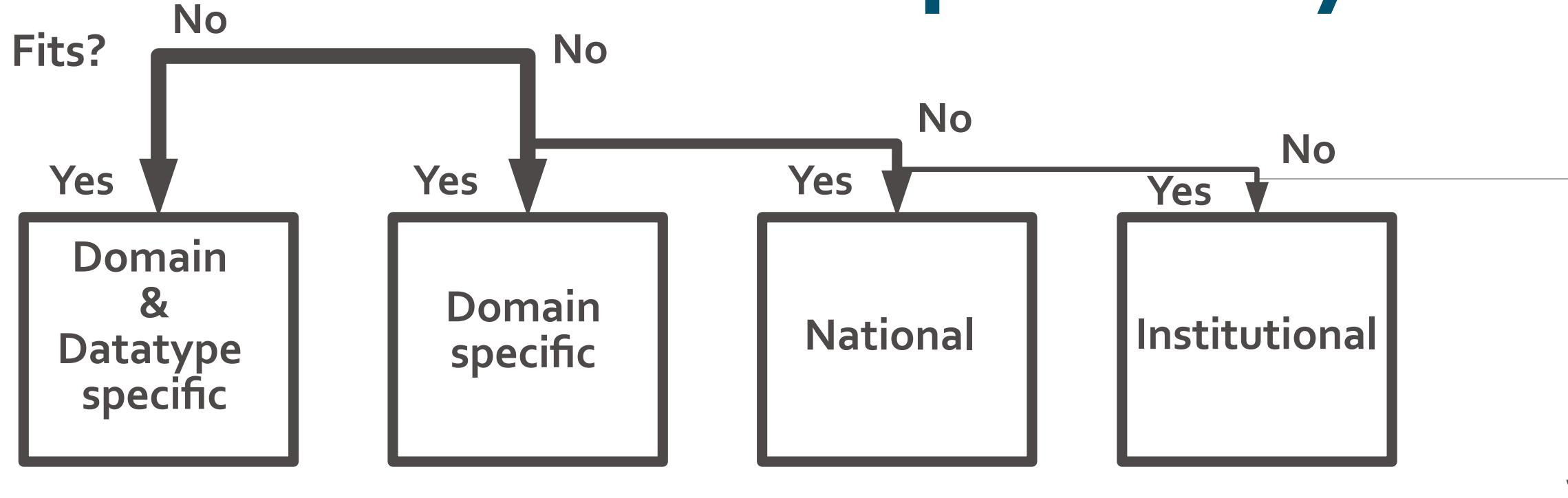
Where should I deposit my data?



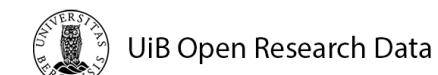
NIRD RESEARCH DATA ARCHIVE



Where should I deposit my data?



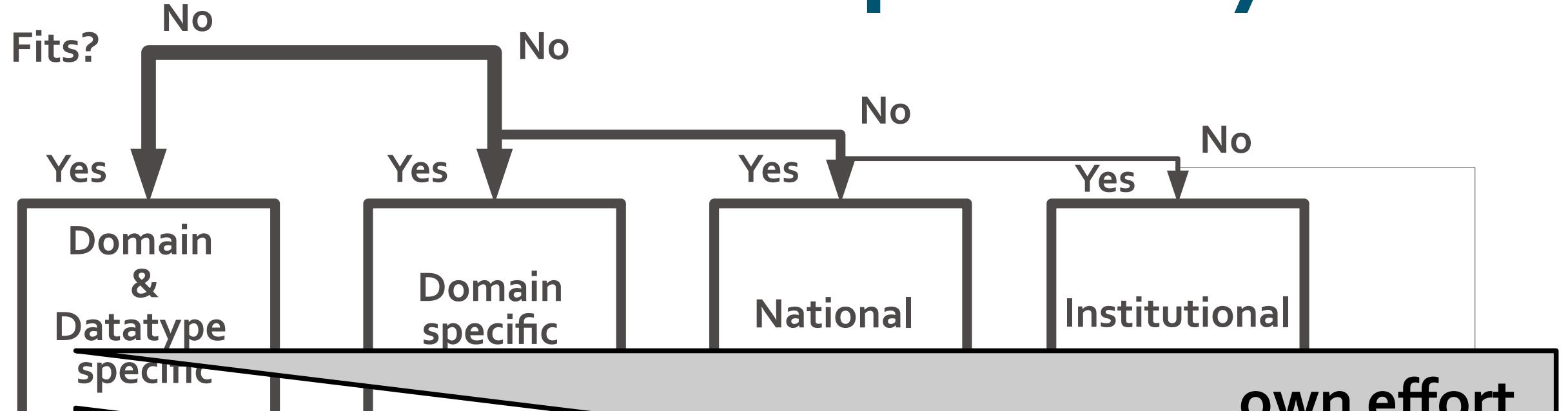
NIRD RESEARCH DATA ARCHIVE



generic



Where should I deposit my data?



NCBI

Standardization

DataverseNO
Dataverse Network Norway

NTNU Open Research Data

zenodo

Norwegian University of Life Sciences



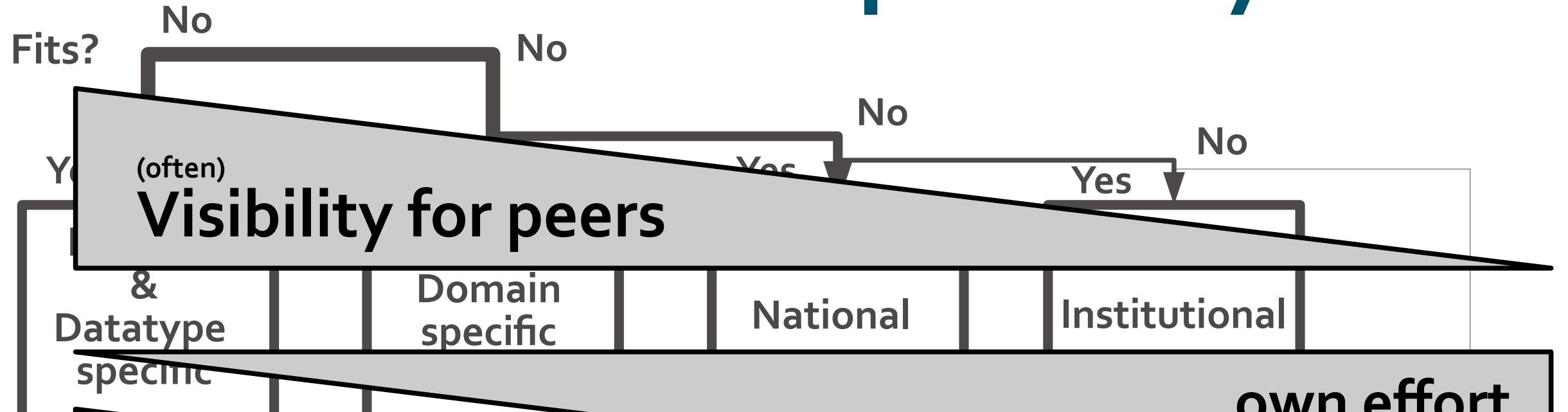
UiB Open Research Data

UiT Open Research Data

EUDAT

figshare

Where should I deposit my data?



NCBI

Standardization

DataverseNO
Dataverse Network Norway

NTNU Open Research Data

zenodo

NM
Norwegian University of Life Sciences



UiB Open Research Data

UiT Open Research Data

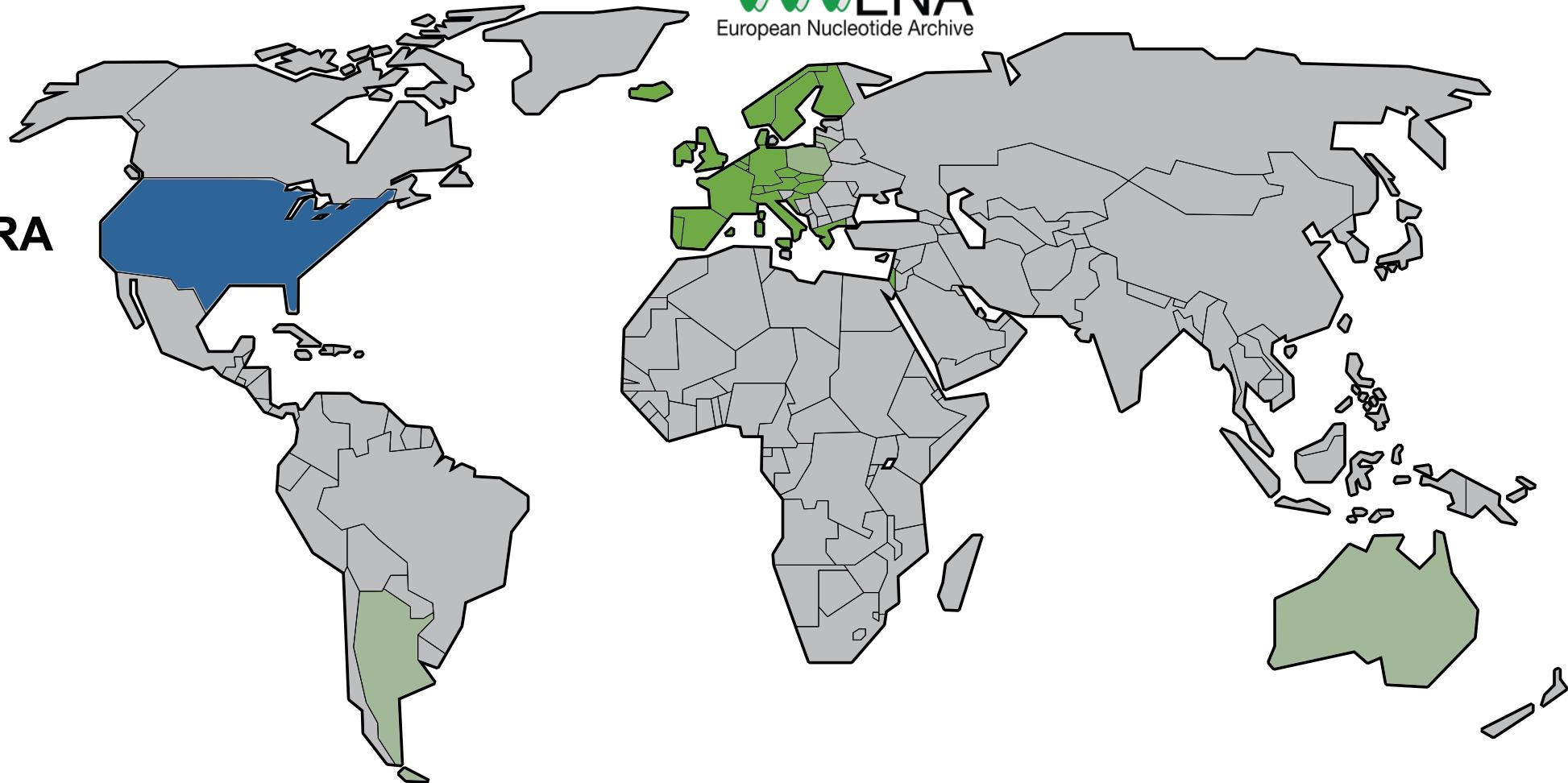
EUDAT

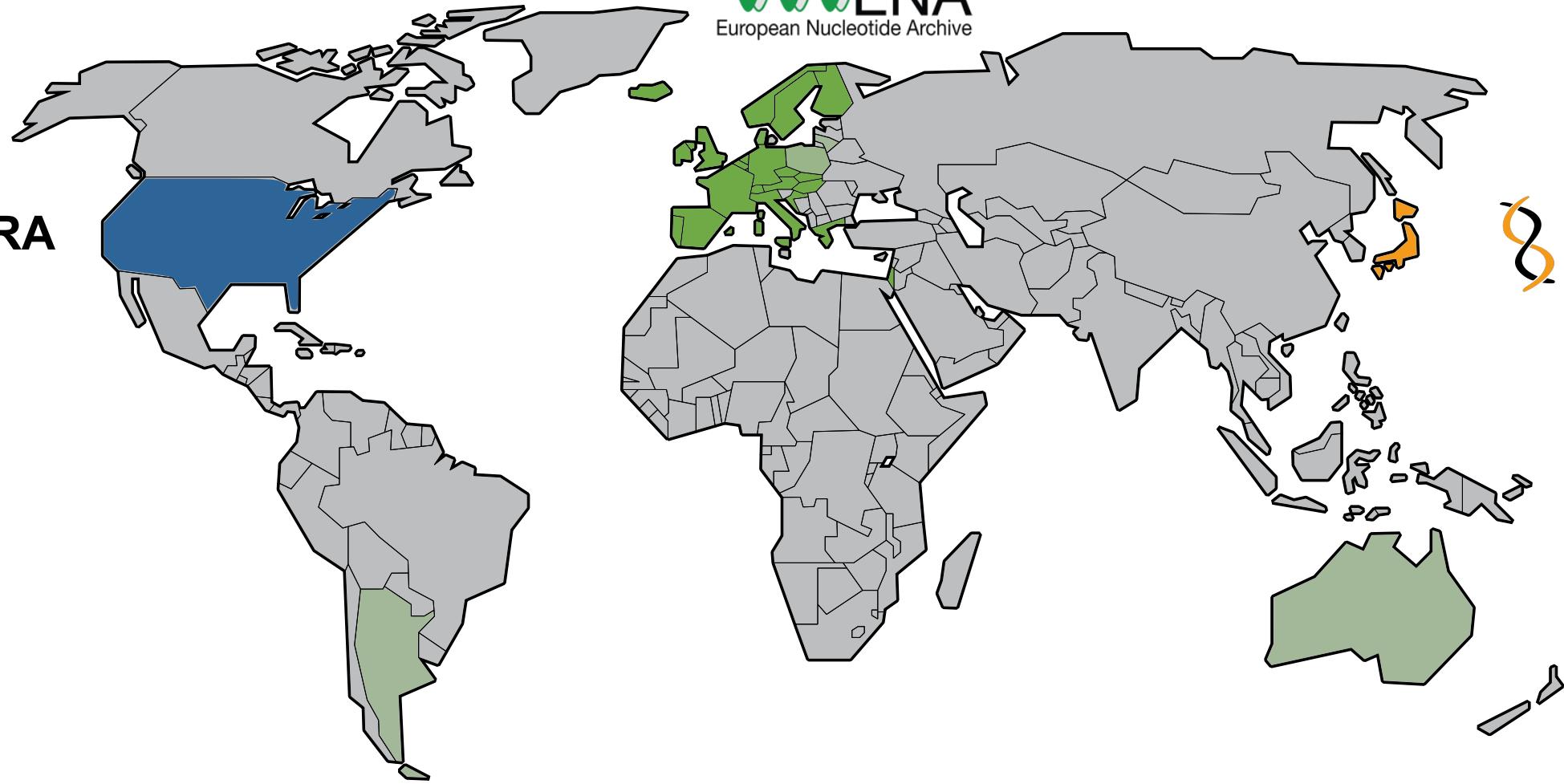
figshare

Multiple Repositories – similar datatypes



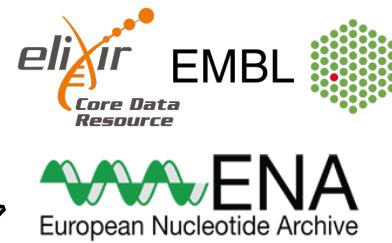
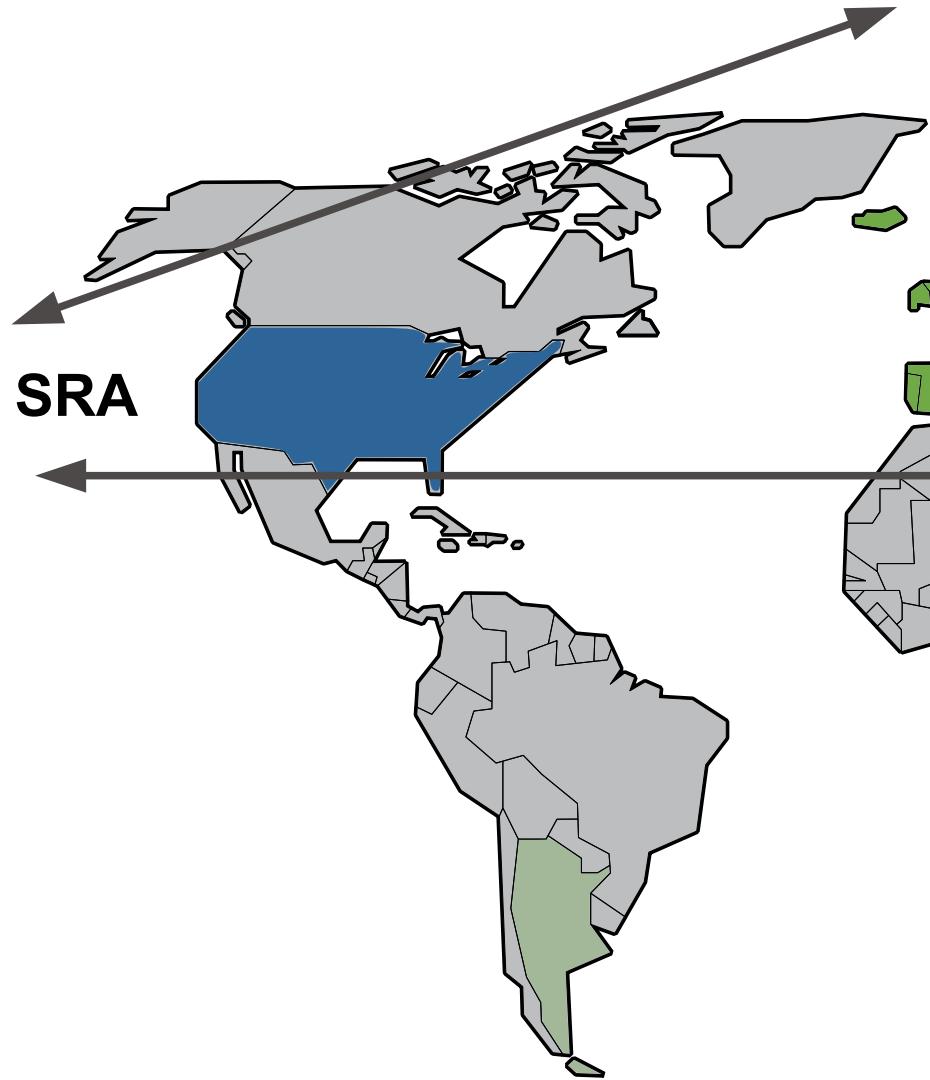








SRA

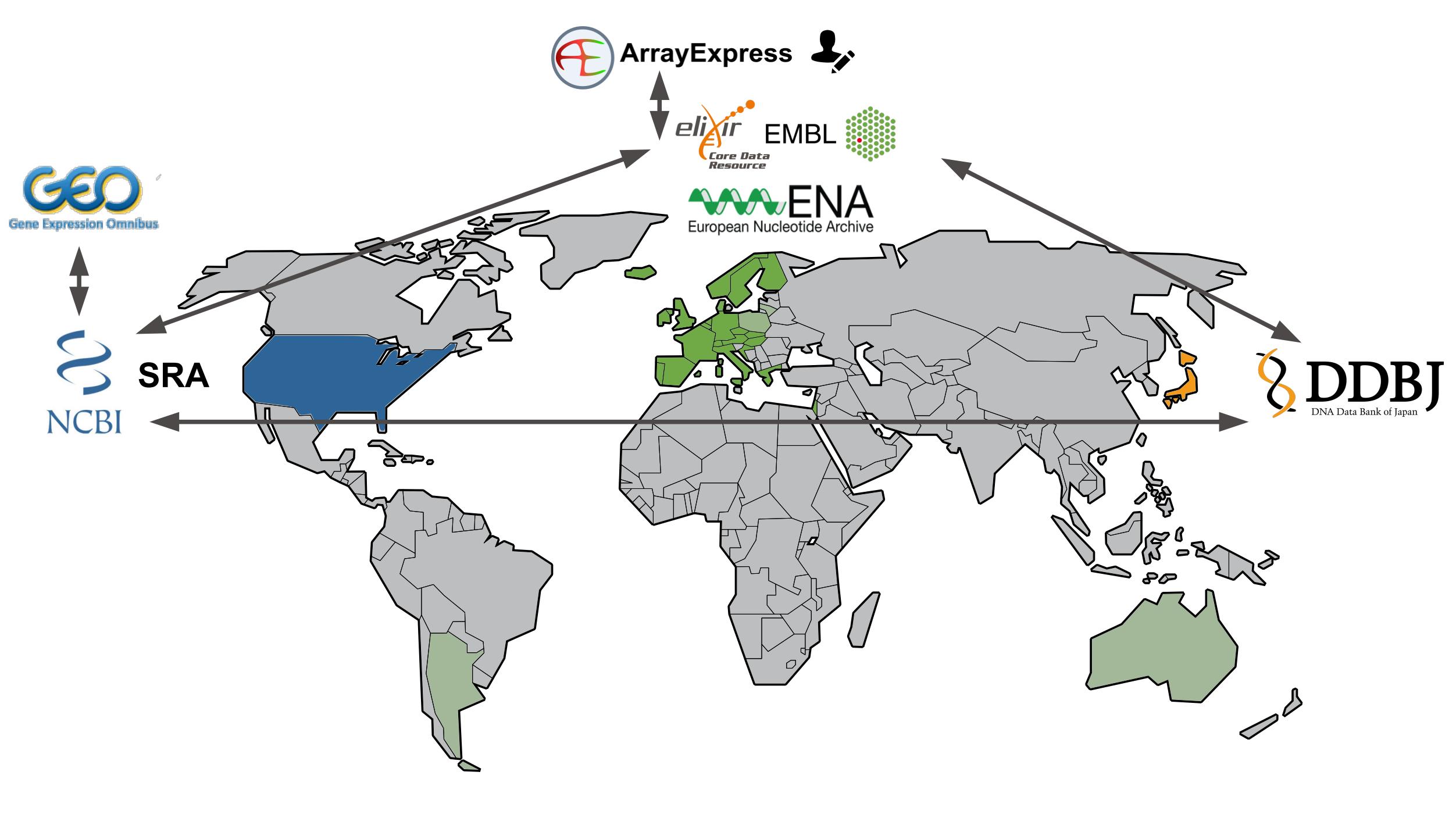


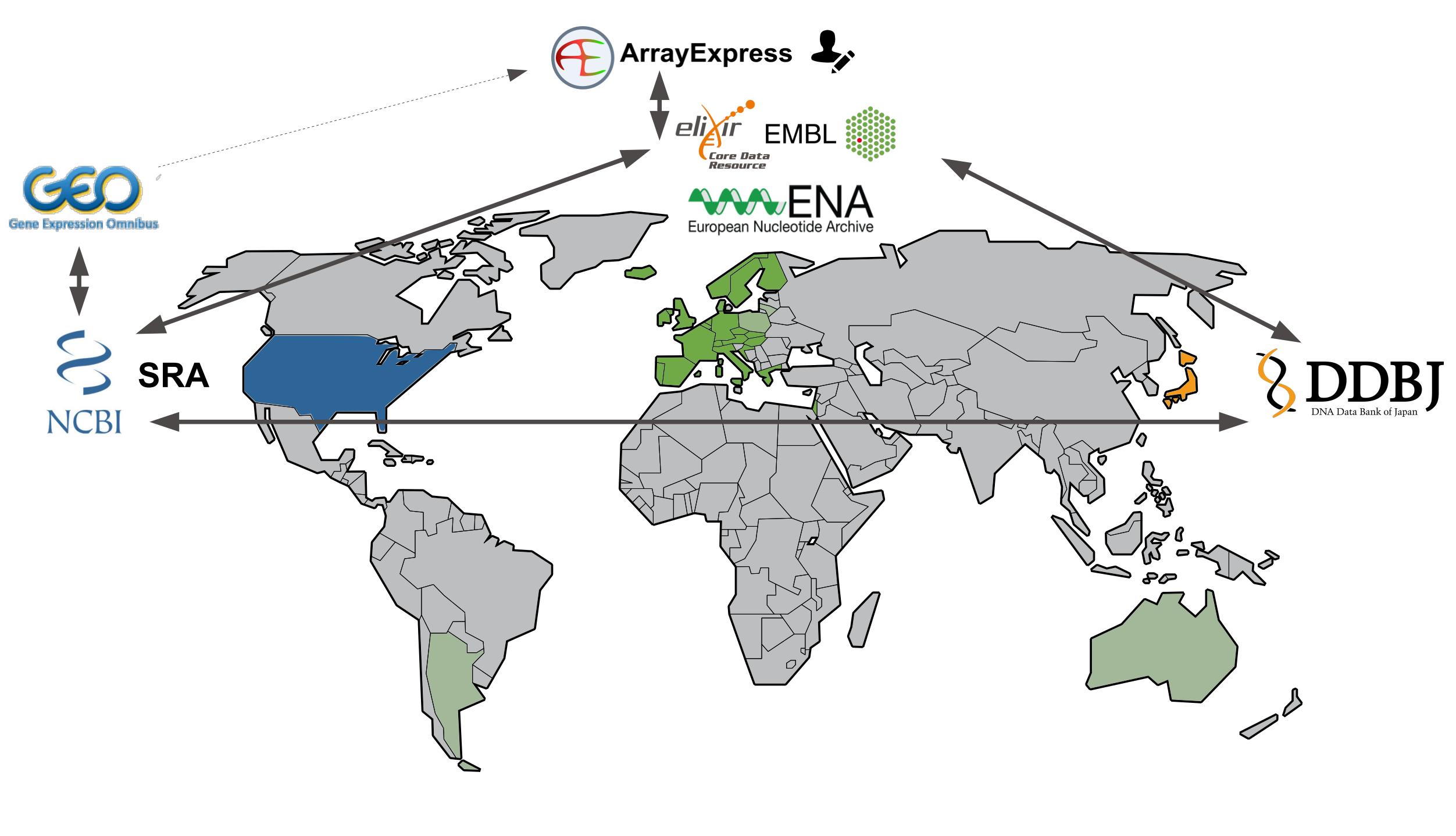
ENA

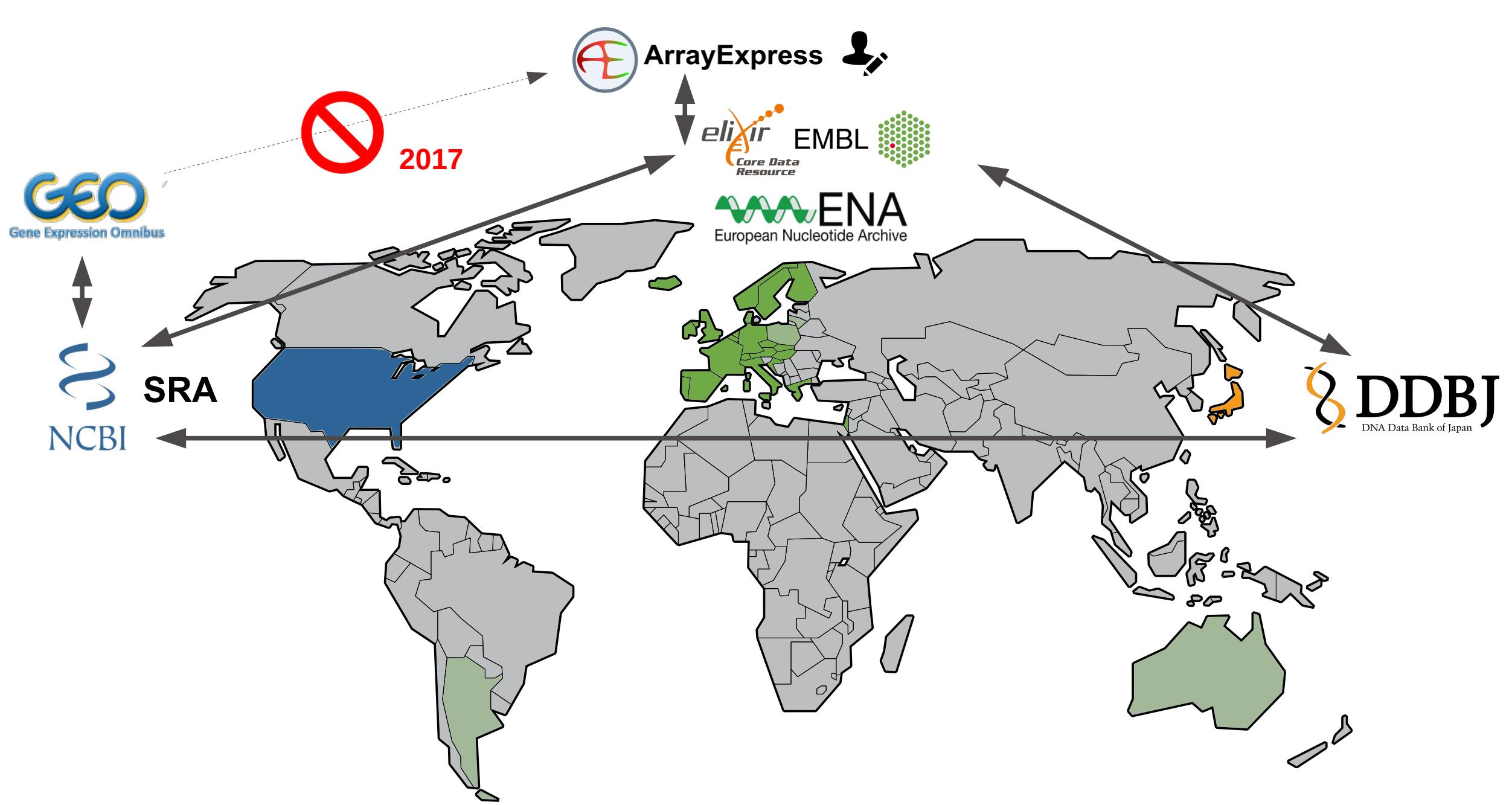
European Nucleotide Archive



DNA Data Bank of Japan









EMBL



A world map where different regions are highlighted in various colors: North America is blue, Europe and parts of Africa and the Middle East are green, China and parts of South Asia are red, Australia is light green, and South America and some countries in Africa and the Middle East are grey.

Proteome
Xchange



Where should I deposit my data?



Where should I deposit my data?

Recognized & Recommended



<https://elixir-europe.org/platforms/data/core-data-resources>

<https://elixir-europe.org/platforms/data/elixir-deposition-databases>

Where should I deposit my data?

Recognized & Recommended

Free of charge



<https://elixir-europe.org/platforms/data/core-data-resources>

<https://elixir-europe.org/platforms/data/elixir-deposition-databases>

Where should I deposit my data?

Recognized & Recommended

Free of charge

Quick upload



Where should I deposit my data?



Recognized & Recommended

Free of charge

Quick upload

Not operated by single university/government

Where should I deposit my data?



Recognized & Recommended

Free of charge

Quick upload

Not operated by single university/government

Guided submission process

Where should I deposit my data?



Recognized & Recommended

Free of charge

Quick upload

Not operated by single university/government

Guided submission process

Generous embargo regulation (2yrs →)

Where should I deposit my data?



Recognized & Recommended

Free of charge

Quick upload

Not operated by single university/government

Guided submission process

Generous embargo regulation (2yrs →)

API access (upload from NeLS planned)

Where should I deposit my data?



Where should I deposit my data?



Where should I deposit my data?



Where should I deposit my data?



ArrayExpress



PRIDE

PRoteomics IDENTifications Database



BioImage Archive



EMPIAR



IDR



BioModels



MetaboLights

Where should I deposit my data?



ArrayExpress

 BioImage Archive



Experimental conditions/design

MINSEQE



SOPs

treatment protocol

sample collection protocol

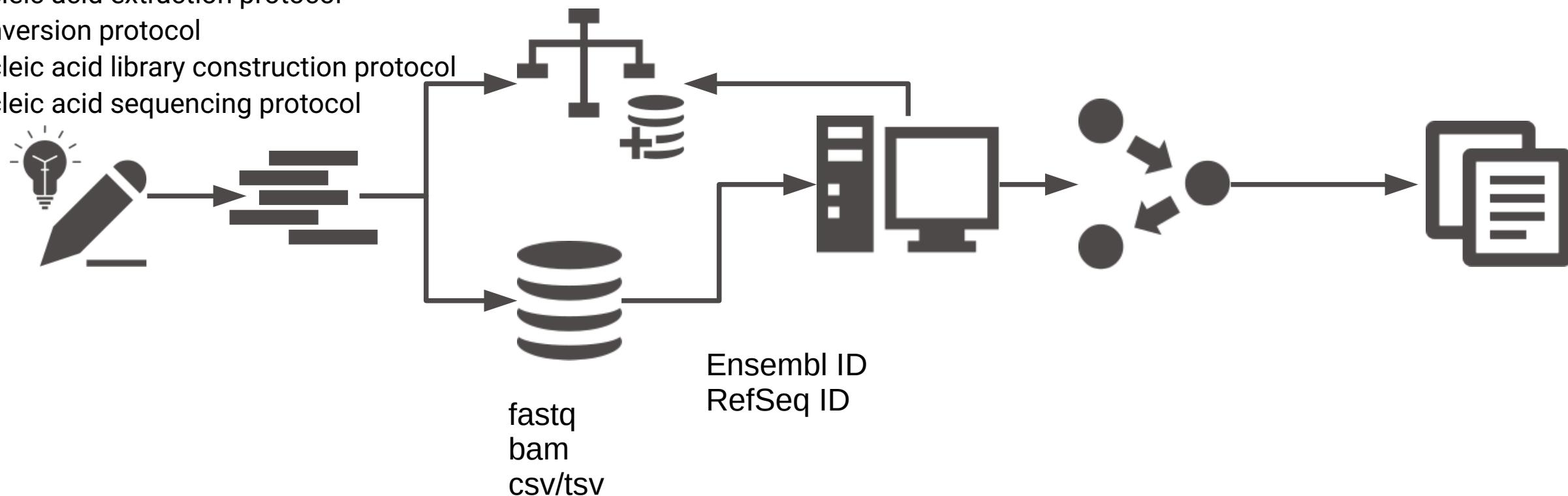
growth protocol

nucleic acid extraction protocol

conversion protocol

nucleic acid library construction protocol

nucleic acid sequencing protocol



Experimental conditions/design

CIMR - ISA-tab

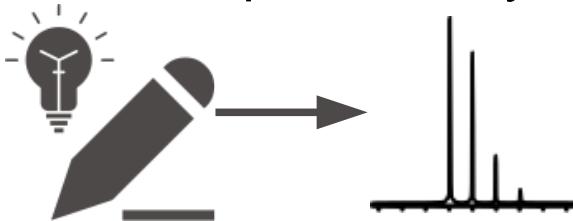
SOPs

Sample collection

Extraction

Chromatography

Mass/NMR spectrometry



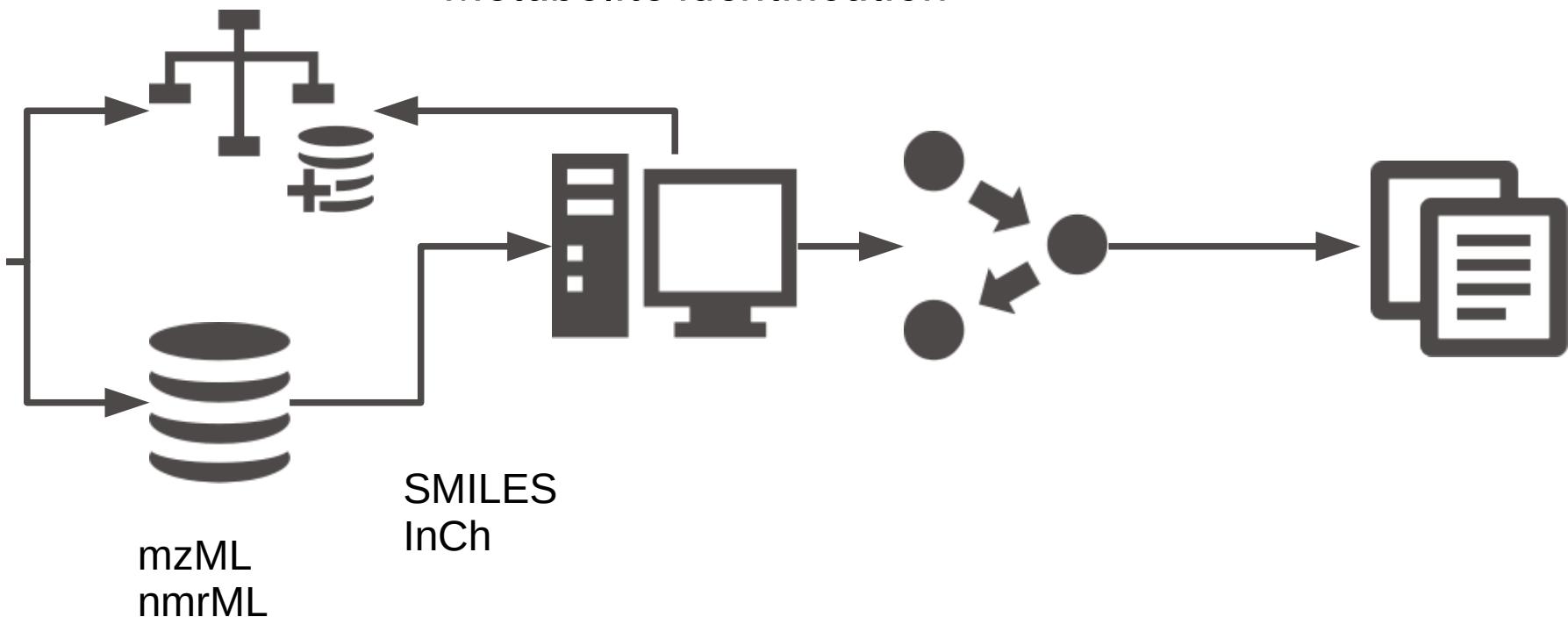
SOPs

Data transformation

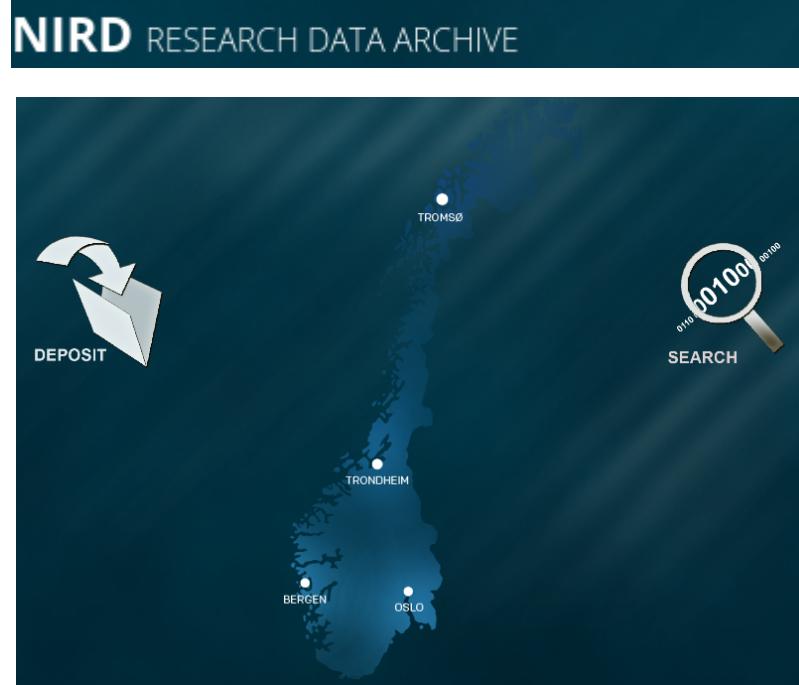
Metabolite identification



MetaboLights



NIRD archive



National, free depositing repository

Domain agnostic

Dublin-core metadata standard

DOI accessible

Supports machine readable metadata harvesting

Generic archives



Less standard metadata → Re-usability ↓



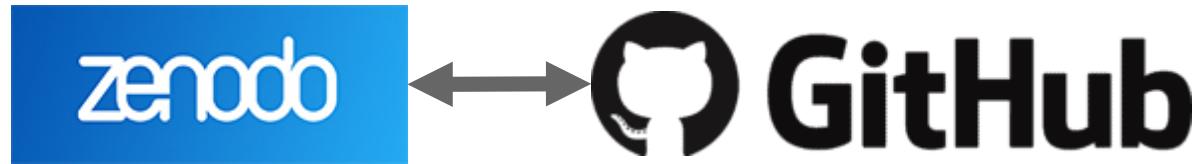
Domain agnostic → Findability ↓

Guided submission process



Commercial actors: Size limitations, ...

Archiving code/scripts



Good integration - easy to implement

Archival of each release

beta solutions for gitlab

What about sensitive data?



EUROPEAN
GENOME-PHENOME
ARCHIVE

ega-archive.org

Central metadata accessibility

Secure storage

Implemented data access committees

Norwegian EGA

(for data that can not leave the country)



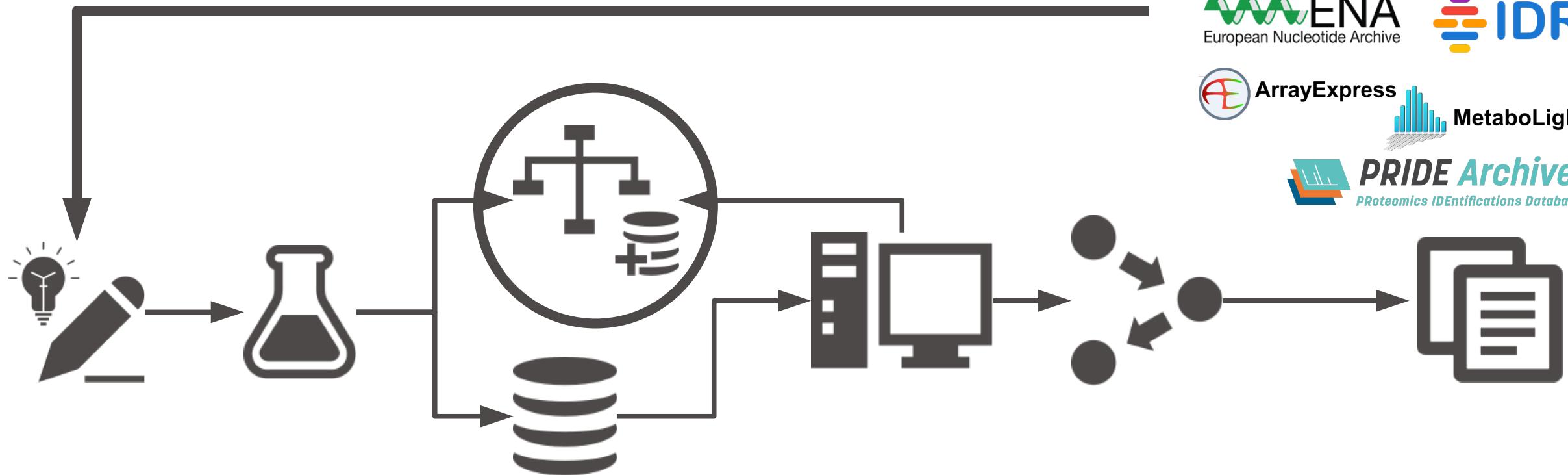
NSD archive

Domain agnostic

DOI accessible

Implemented data access committees

Main data type: Questionnaires, ...



 ENA
European Nucleotide Archive

 IDR

 ArrayExpress

 MetaboLights

 PRIDE Archive
PRoteomics IDEntifications Database

 EUROPEAN
GENOME-PHENOME
ARCHIVE