Northeastern University
The Ocean Genome Legacy Center
of New England Biolabs

Sampling and Preservation of Genomic Data and Linking Tissue Samples to Vouchers

Ocean Genome Legacy (OGL)
Northeastern University
http://www.neu.edu/ogl

Charlotte Seid, Ph.D.
Biorepository Manager

Why Archive Genomes?

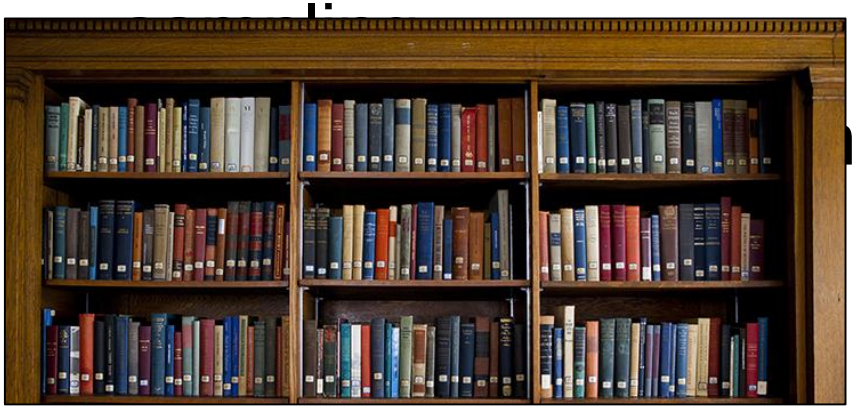
- Genomic information can contribute to:
  - Species identification and description
  - Phylogenetics
  - Systematics
  - Biodiversity monitoring
  - Medicine and drug discovery
  - Biotechnology
  - Sustainable food and energy
  - Conservation

- We can learn more as DNA technology advances
- Urgency due to biodiversity loss

Shared interests and fruitful collaborations between genomic collections and natural history

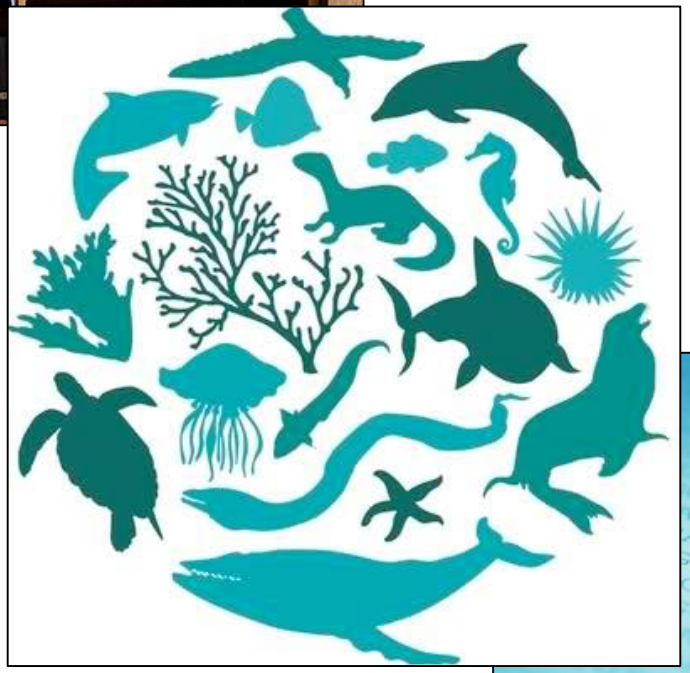
How Genome Banks Help Research and Conservation

- Make rare and valuable materials widely available
- Share the benefits of infrastructure and expertise
- Maximize scientific value of samples by sharing data
- Avoid unnecessary duplication of destructive



The Ocean Genome Legacy Biorepository

A non-profit archive of DNA from marine species



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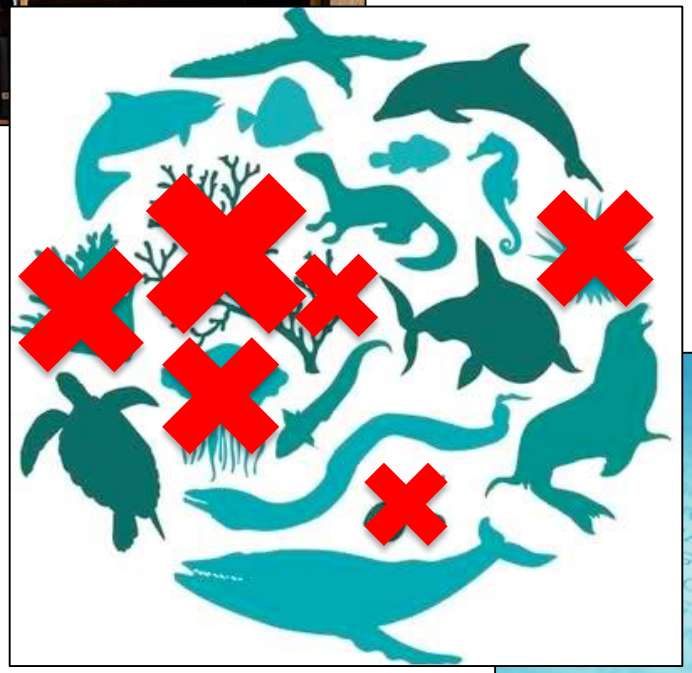

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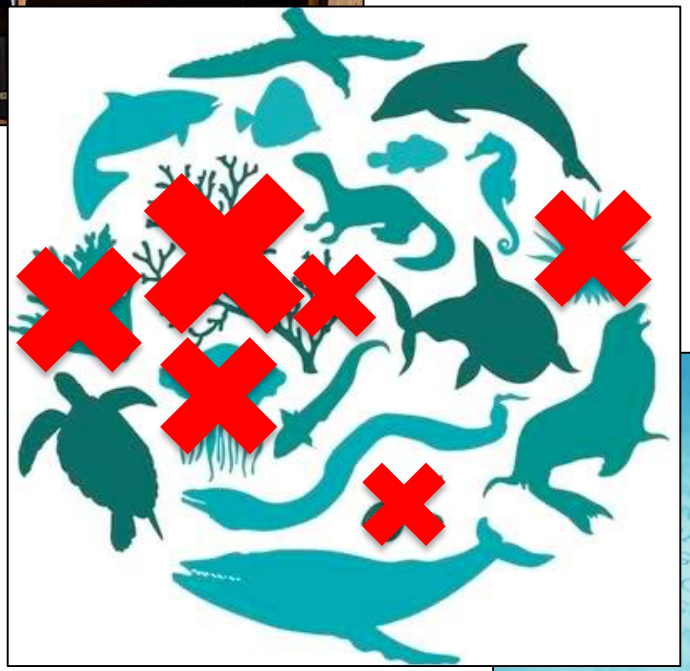
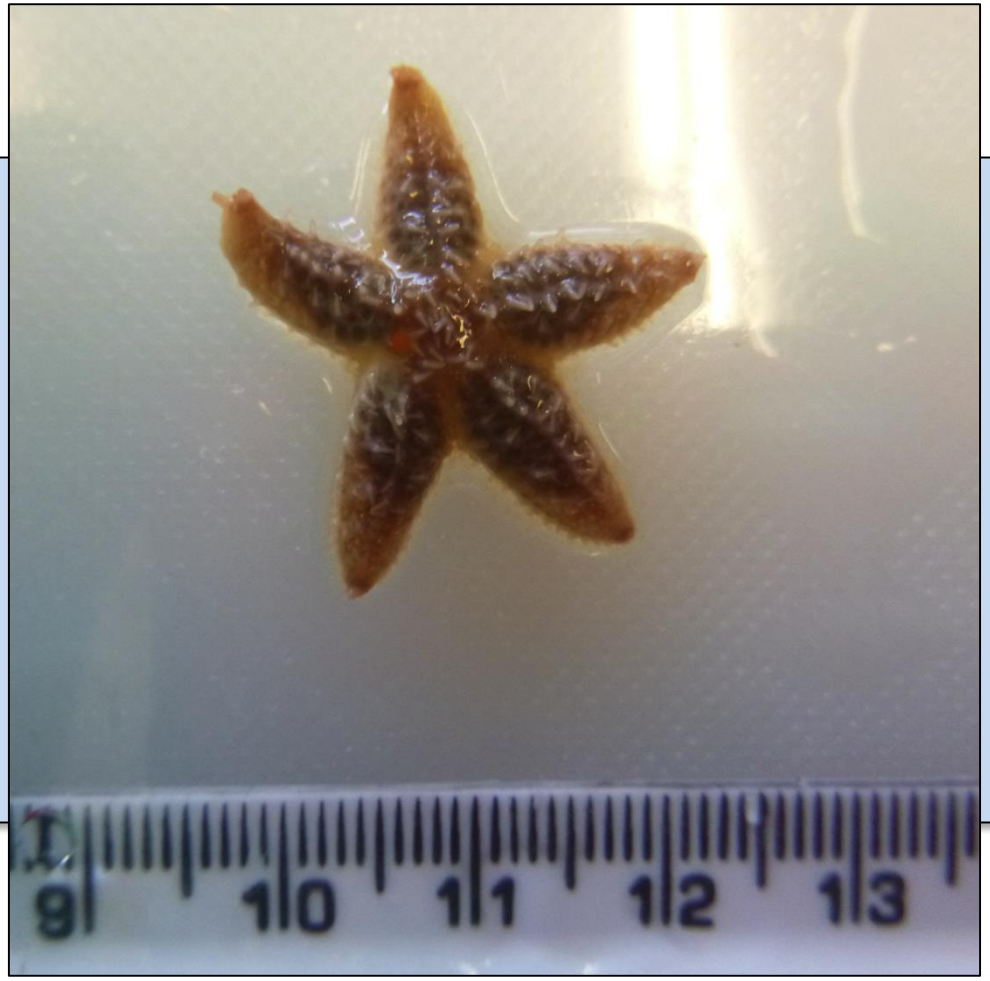
Samples, not sequences



The OGL Biorepository Model

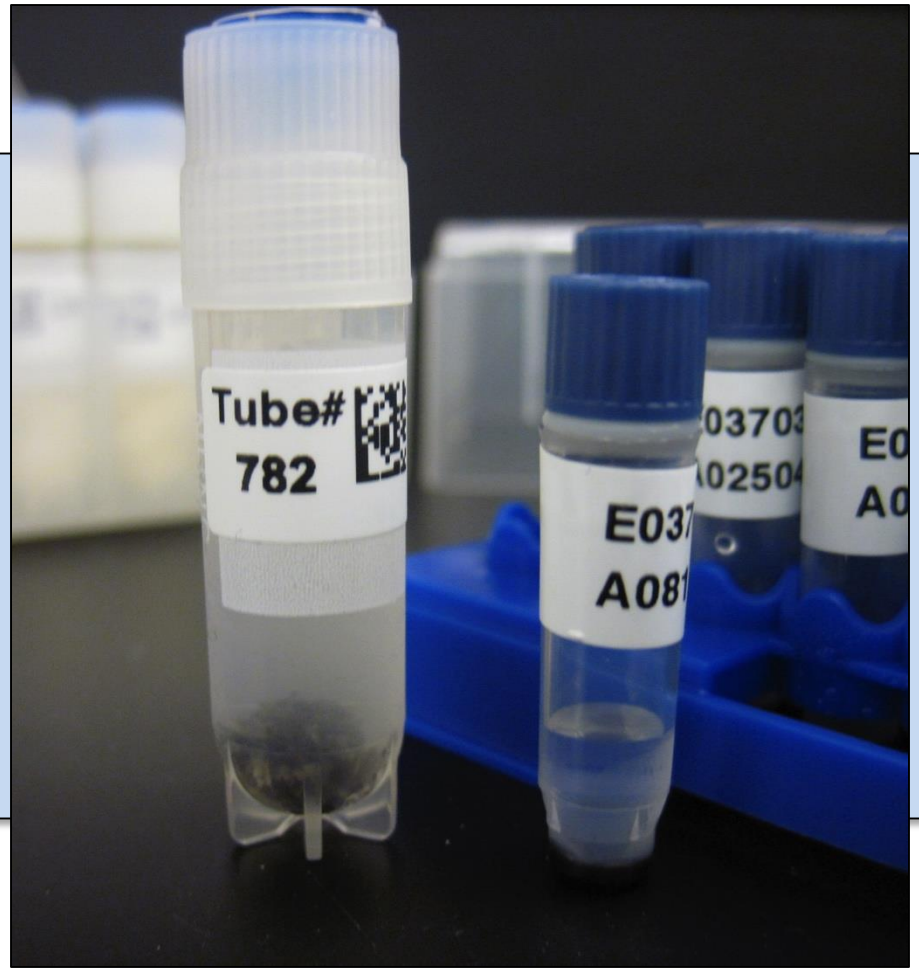


Specimens

Collected by researchers, museums, and “creative” sources

The OGL Biorepository Model

Specimens
Collected by scientists
around the world



Tissue and DNA

Prepared by OGL or by depositors

The OGL Biorepository Model

Specimen

Collected by scie
around the wo

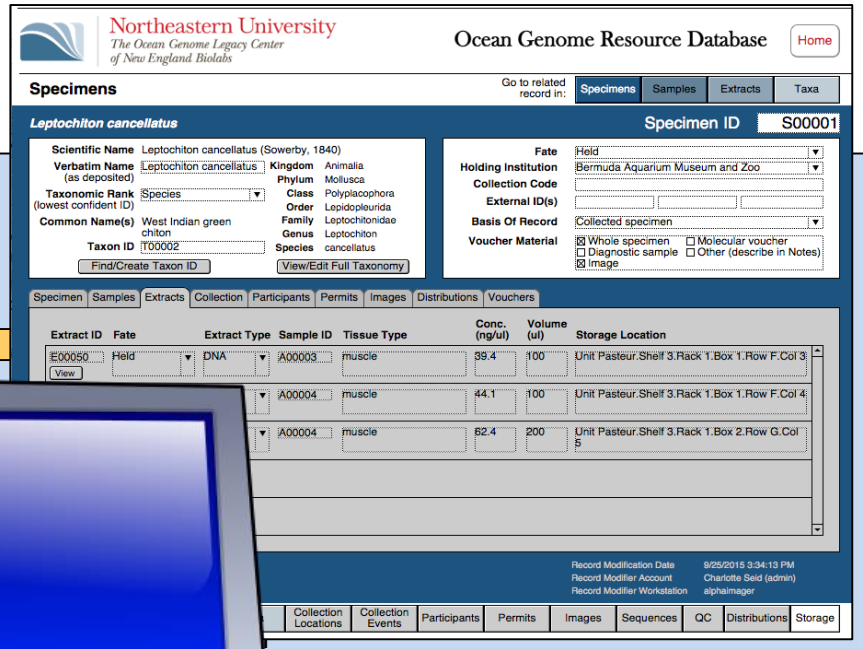
Storage

Secure long-term preservation at the NU Marine Science Center

The OGL Biorepository Model

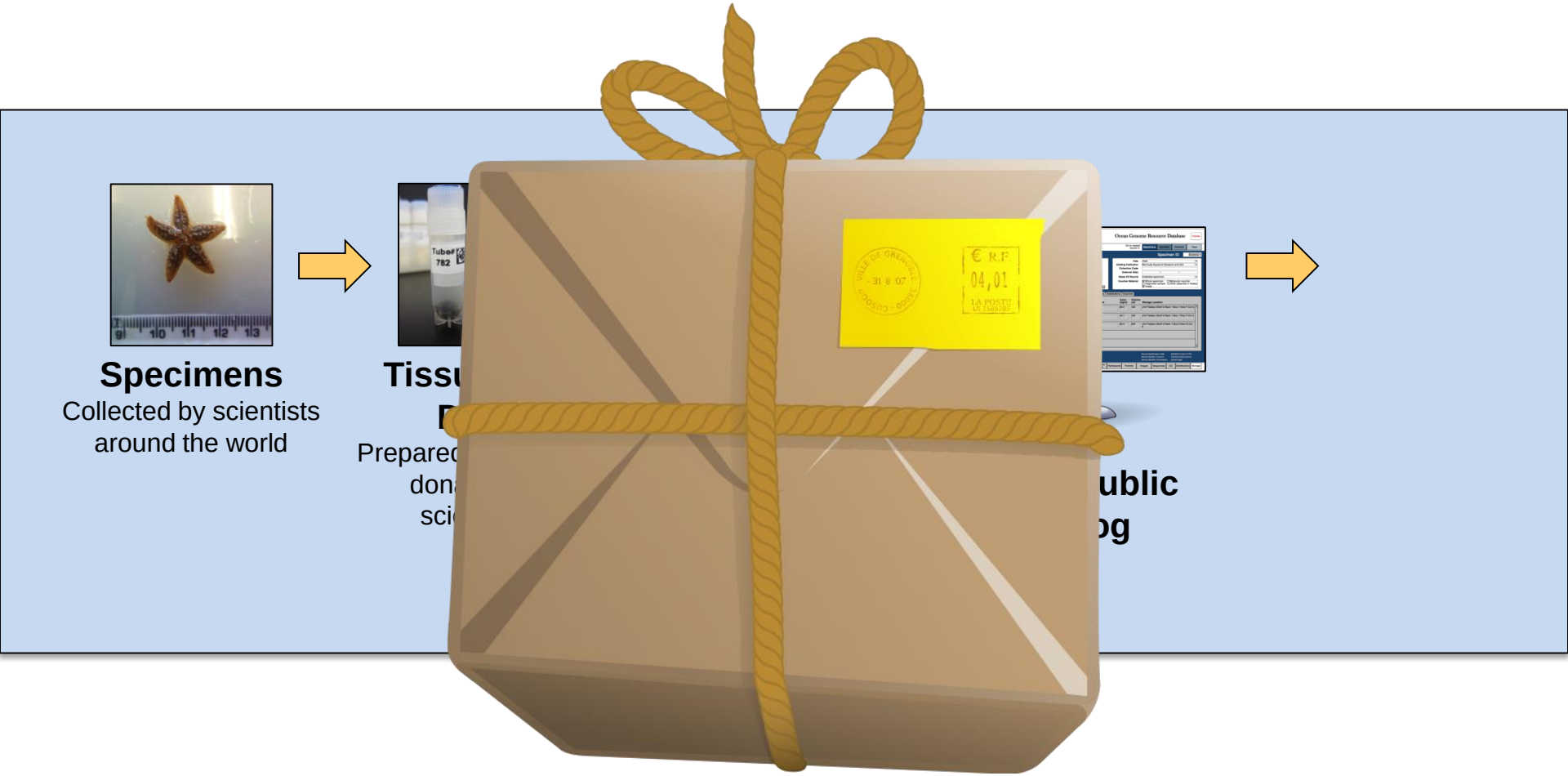
Specimens
Collected by scientists around the world

Pre



Public Online Catalog

The OGL Biorepository Model



Specimens
Collected by scientists around the world

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Distribution

To researchers and educators around the world

The OGL Biorepository Model

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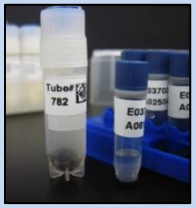
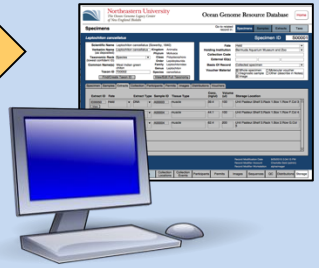


Tissue and DNA
Prepared by OGL or donated by scientists

Cold Storage
Secure long-term preservation here at the Marine Science Center



Online Public Catalog

Distribution
OGL materials go to researchers around the world

Voucher Materials

For OGL's purposes, a voucher can be a:

- Preserved whole specimen or diagnostic parts
  - Ideally, housed and catalogued in a museum collection
- Photograph
  - May supplement other voucher types
  - Often, the only available voucher material if the specimen is
    - Still living
    - Not preserved
    - Entirely consumed for DNA extraction
- Diagnostic DNA sequence(s)
  - May "collect backwards" starting with published sequences

Tissue Sampling and Preservation for Genomic Collections

General considerations

- High quality DNA (high molecular weight)
- DNA yield
- Minimizing contamination from other DNA sources
- Minimizing DNA damage
  - Enzymatic degradation
  - Chemical damage (cross-linking, acid hydrolysis, free radicals)
  - Radiation (UV, X-rays)
- Practical concerns (safety, shipping, storage, cost)

Tissue Sampling

Choosing tissue types

- Avoid:
    - Tissues likely to contain foreign DNA (e.g., gut, mouth)
    - Digestive tissues (rich in enzymes)
    - Tough structural tissues (few living cells, so low DNA yield)
- Frequently sampled tissues at OGL: muscle, fin, gill, blood
- Non-lethal options and accommodating display/educational needs
- Ideally, multiple tissues per individual (backup, yield, scientific needs)

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- Small organisms (<100 mg): entire organism

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Preparation

- Maximize surface area that is exposed to preservative

Tissue Preservation

Initial preservation

- Liquid nitrogen
  - “Gold standard” but rarely convenient
- Ethanol
  - Flammability and shipping; not ideal for long term
- Formalin = **bad!** (even for initial fixation)
- “OGLFix v2”
  - Non-flammable; no special shipping restrictions

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Long-term preservation

- Liquid nitrogen
  - -180 °C slows degradation for years/decades
  - Keeps tissue vitrified, below glass transition temperature of water (-132 °C)
  - Minimizes formation of damaging ice crystals
- Avoid freeze-thaw cycles

Organism, Tissue, and DNA Records

Organism, Tissue, and DNA Records

Taxonomy
Voucher material
Locations
Collection events
Permits

Sequences
Bioinformatics
Assay results

Organism, Tissue, and DNA Records

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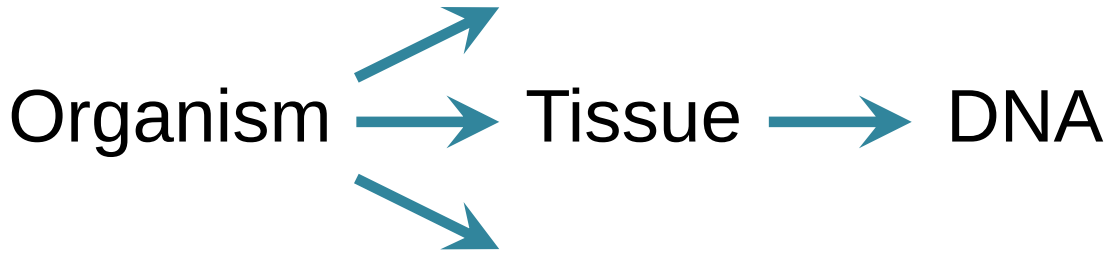

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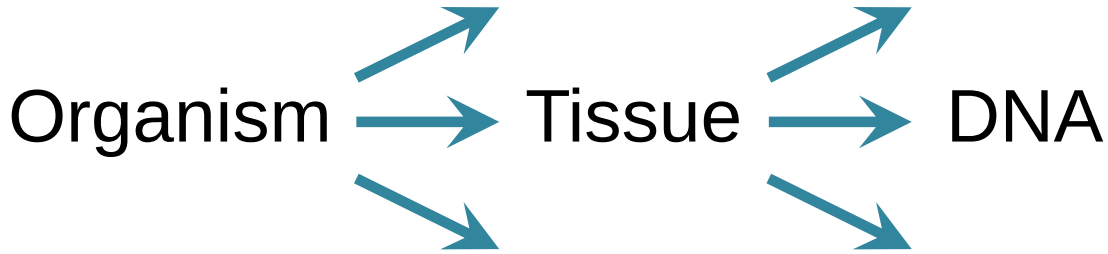

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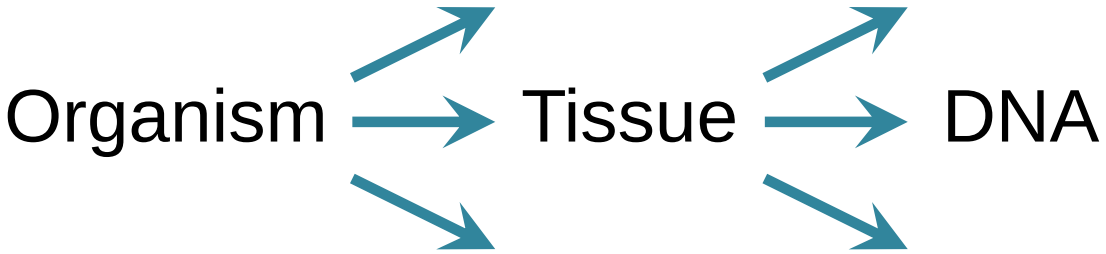

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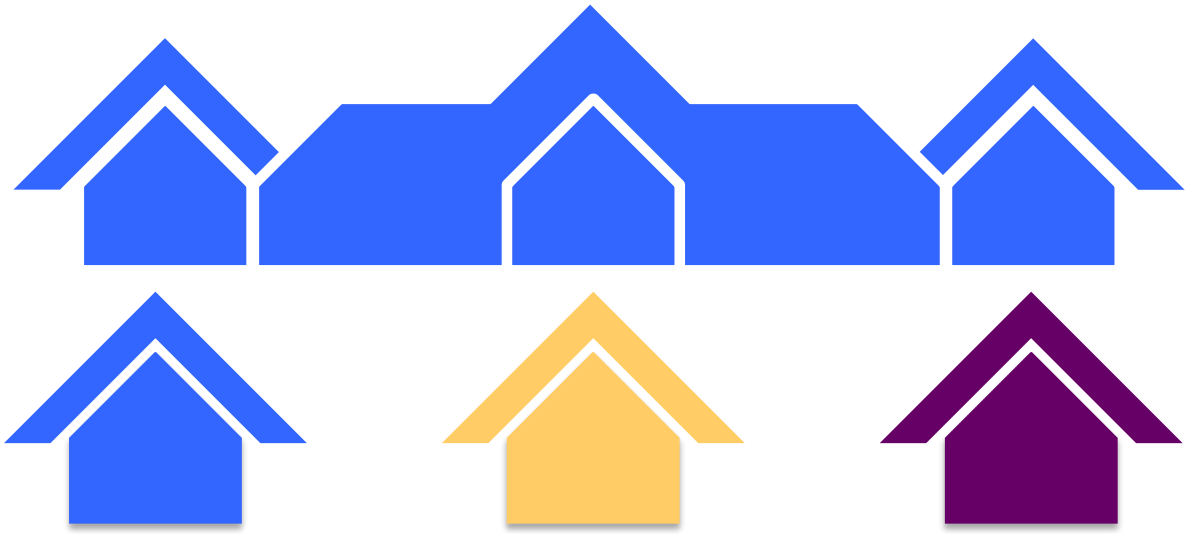

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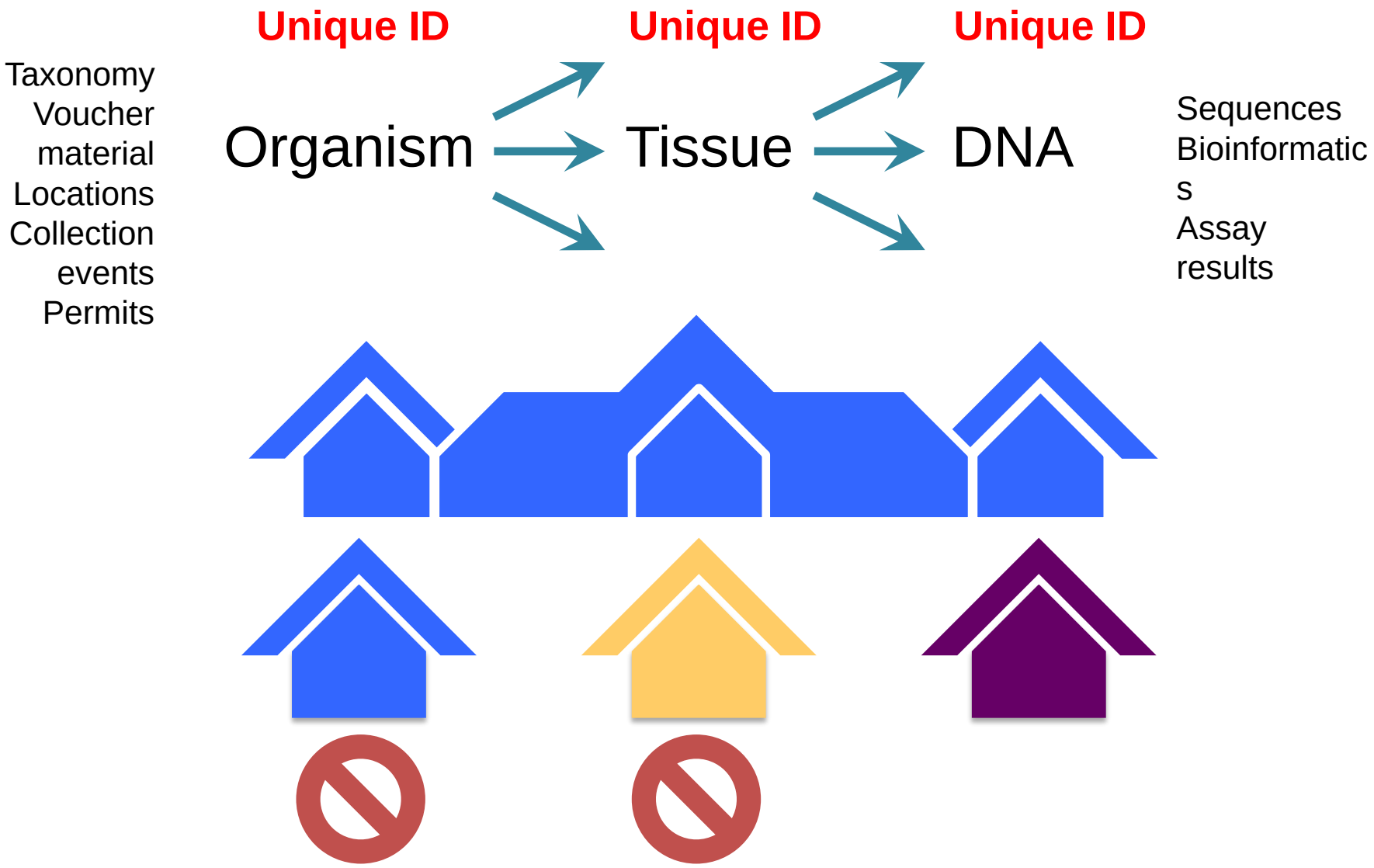

Organism, Tissue, and DNA Records

Taxonomy
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Unique ID
Unique ID
Unique ID

Organism

Unique ID
Unique ID
Unique ID

Tissue

Unique ID
Unique ID
Unique ID

DNA

Sequences
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Tissue Records

	Key Data
Identity	Unique ID Unique ID of source organism *Can be important tissue-specific differences in DNA modifications or sequences*
Source	Sampling method, details Date of sampling Initial preservation Relationship to source organism and voucher (same individual, same lot, same population?)

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Properties	Tissue type Weight, volume
Storage	Preservative Temperature Holding institution(s), aliases

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Sequences?	Link to records in existing bioinformatics repositories

The Great Bioinformatics Beyond…

DNA sequences vs. samples

- Sequence/information repositories
  - Excellent public databases available (e.g., NCBI, BOLD)
  - Distinct from genomic sample repositories
- Important to link bioinformatics data to genomic samples (and consequently to tissues and vouchers)

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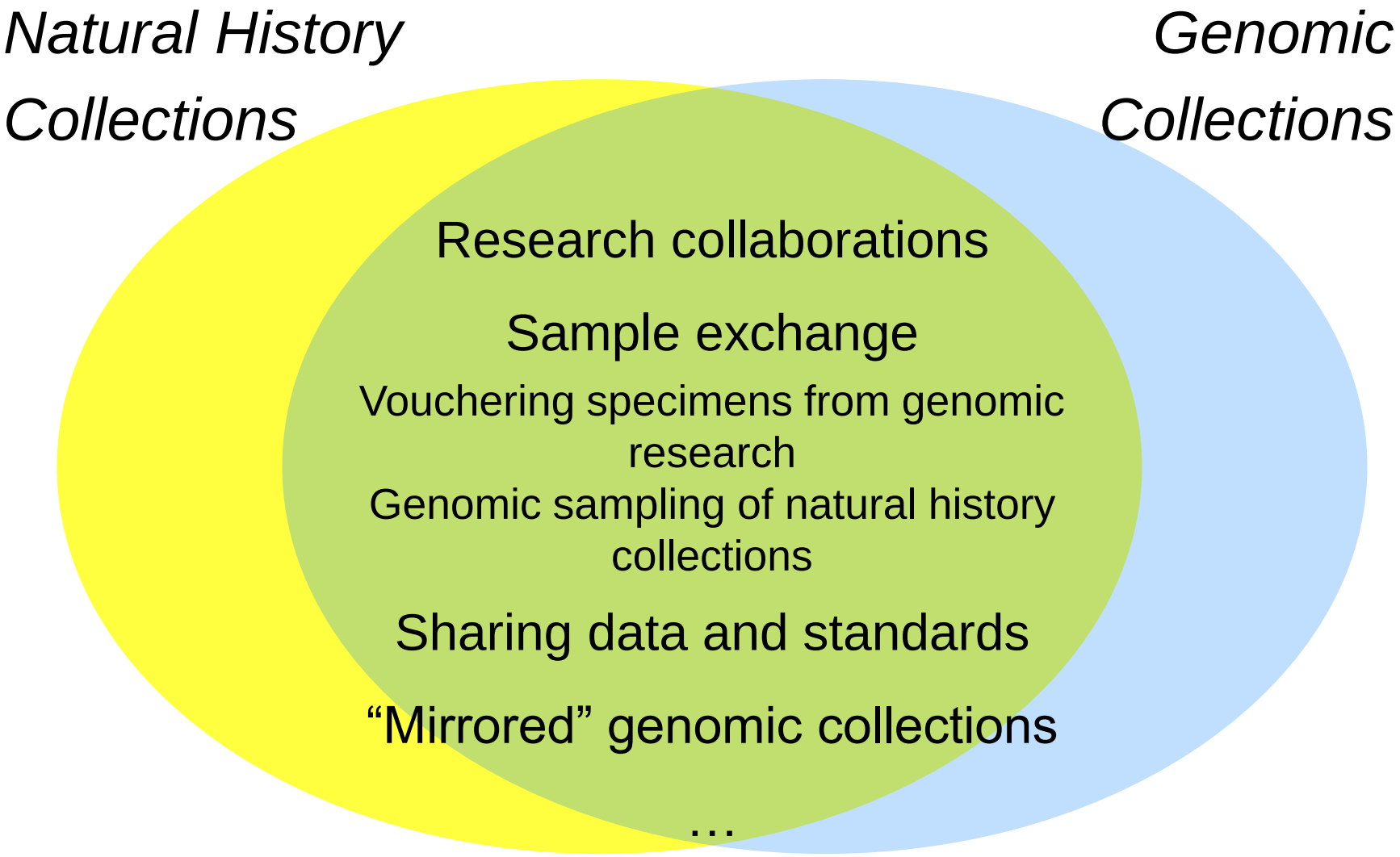
Examples of bioinformatics data

- DNA sequences
- Annotations
- Sequencing metadata
- Metagenomics, epigenomics

New Directions



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Thank you!

Further questions for OGL?

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