# DNA extraction from museum specimens

## BIG4 Progress Report La Palma, Canary Islands

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### Elsa CALL

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Natural history museum collections are abundant

**Method** 

• Over 2 billion specimens (1996)

**Projects** 

- Value of museum collections
  - Systematics
  - Biodiversity
    - Habitat loss & Global climate change
    - Biological invasion
  - Public health and safety
    - History of infectious diseases
    - Environmental contaminants

Nudds & Pettitt, 1996; Suarez & Tsutsui, 2004



Conclusion

## • Sequencing of historical samples

**Projects** 

- Beetles 58-159 years old
- Compare library preparation protocols
  - Low amount of input DNA
- List of guidelines
  - Cost-effective sample preparation
- Facilitate new museomics projects



Conclusion

Method

Sproul & Maddison, 2017

#### Projects

Method

## • The main objectives of my PhD

- Investigate the level of DNA degradation
- Determine the proportion of target Lepidoptera DNA
- Target lineages rare and difficult to collect



## • The main objectives of my PhD

• Investigate the level of DNA degradation

**Projects** 

• Determine the proportion of target Lepidoptera DNA

Method

- Target lineages rare and difficult to collect
- New advances in the field of "museomics"
- Phylogenetic relationships of Geometroidea



Conclusion

Projects

- Level of DNA preservation in museum specimens of various ages
  - Are there any general trends in the preservation of DNA over time?



Projects

- Level of DNA preservation in museum specimens of various ages
  - Are there any general trends in the preservation of DNA over time?
- What are we sequencing?
  - Lepidopteran DNA
  - Endogenous bacteria?
  - External bacteria, fungi?
  - What else?



Projects

# Relationships among families in the superfamily Geometroidea

- Geometroidea recently defined
  - 2 phylogenomic studies  $\Rightarrow$  different conclusions
- Epicopeiidae, Sematuridae and Pseudobistonidae
  - Difficult to collect
  - Extensive collections in museums (Paris, Copenhagen, ...)



- *Pieris napi* (Pieridae)
- Reference genome
- Common in Sweden  $\Rightarrow$  important collections

**Projects** 

**Method** 

Conclusion

- Pieris napi (Pieridae)
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Method

Conclusion

- 96 specimens extracted
  - Phenol-Chlorophorm
  - Kit Genomic DNA from tissue
    Nucleospin® Tissue, Marcherey-Nagel

**Projects** 

From abdomen and legFrom 1941, 1947 and 1954

Projects

- Library preparation
- Collection of similar sized DNA fragments
- 4 general steps
  - DNA fragmentation / Target Selection
  - Adapter sequences
  - Size selection
    - Bead based size selection method



Meyer & Richer, 2010 and Carøe, 2017

Projects

## • Issue with historical samples:

- Cytosine deamination
- Causes sequencing errors
  - $C/G \Rightarrow T/A$  misincorporations
- USER: remove the uracil bases









Modified from protocol by Nicolas Dussex & Johanna von Seth

#### Projects

#### Method

Conclusion

Library Preparation Works! 6 libraries being sequenced! Different specimen ages 1 lane of 150 bp PE reads (MiSeq)

> 200 bp 100 bp

> > 10

#### Projects

Method

## • BioAnalyzer results

- Fragments length: 168 173 bp
- Concentrations: 156 270 ng/μl

## • Ready for sequencing!!



#### Projects

- Optimised the best library preparation protocol
- Sequencing data is on its way
- Next Steps:
  - Data analysis What is the non-Lepidoptera DNA?
  - Sequence more specimens
  - Resolve phylogenetic relationships of a superfamily Geometroidea



## THANK YOU FOR YOUR ATTENTION!

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