Collecting flies for genomic research: workflow at Smithsonian NMNH and Biorepository

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NMNH Biorepository

- cryo-preservation facility at Museum Support Center
 20 liquid nitrogen tanks (-190°C)
 A3 mechanical chest freezers (-80°C)
 - > 43 mechanical chest freezers (-80°C)
- new "type" of collection
 not taxonomically focused
 vial with mammal tissue right next to vial with insect specimen
- ♦ FreezerPro

> Biorepository





Global Genome Initiative

Global Genome Initiative – GGI
 headquarter at NMNH
 Jonathan Coddington – director
 Seán Brady – research

- Collect and barcode a synoptic sample of Earth's genomic diversity ..."
- "Cryo-preserve 50% of the diversity of life in the next five years and make these collections available for research, with appropriate access and benefit sharing"

- Increase computational support and technological capacity to sequence genomes
- "Train the next generation of genomics researchers in biodiversity science"



Global Genome Biodiversity Network

- ♦ Global Genome Biodiversity Network GGBN
 - headquarter at NMNH
 - > bioinformatics at BGBM (Botanischer Garten und Botanisches Museum Berlin-Dahlem)
 > currently 36 member institutions and five collaborating institutions
- "A global network of well-managed collections of genome—quality tissue samples from across the Tree of Life, benefiting society through biodiversity research, development, and conservation."



GGBN

Global Genome Biodiversity Network

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17449 records found (unique samples, not counting multiple samples from the same specimen).

The display is limited to 3000 records.

Your search:

> AA6GE27

Repository

NMNH, Washington (17449)







Preparation

Preparation Date:2005-5-9 Preparation Type: Whole individual organism

Sex: Female; Male Preparations: Ethanol drained

Sample Preservation(s)

Preservation:Dried

- ♦ goal is to preserve specimens in liquid N₂
 - not new methodology done by vertebrate collectors for years and some entomologists
 - > allows both RNA and DNA to be sequenced
 - > we need to think about preserving specimens for genome sequencing!
- vouchers / exemplars
 - \rightarrow extremely important to have vouchers / exemplars that are not in liquid N₂
- applying unique specimen identifiers in the field
 specimen records will be "connected" by unique identifiers
 separate identifier for pinned specimen, liquid N₂ specimen, and leg for COI barcoding
- recording specimen-level data in the field
 - > FIMS (Field Information Management System)
 - > import into EMu

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- ♦ disclaimer
 - > research taxa (Apioceridae, Asilidae, and Mydidae) collected by hand-net
 - > one specimen at a time
 - > generic identification possible in field
 - > identification of conspecific specimens also possible
- I want to sequence genomes of asiloid flies for phylogenetic research!
- field work in southern Arizona and California in April 2015



Scleropogon duncani in the field



field site E of Portal, AZ

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♦ in the field

- > flies kept alive in individual vials at particular site
- > once several specimens of same species collected, next few preserved in ethyl acetate for pinning
- > specimens destined for liquid N₂ placed in a small cooler later transferred to fridge at hotel
- ♦ in the evening
 - > flies pinned unique identifier (USNMENTXXXXXX) attached to pin record databased
 - > conspecific specimen placed in pre-labeled vial with two unique identifiers

USNMENTXXXXXX + Biorepository (AA8IQ05)







USNMENT01115108 on pin

USNMENT01136055 + AA8IQ05 in vial

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- ♦ in the evening
 - flies pinned unique identifier (USNMENTXXXXX) attached to pin record databased
 conspecific specimen placed in pre-labeled vial with two unique identifiers

USNMENTXXXXXX + Biorepository (AA8IQ05)

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- ♦ in the evening
 - > wrap vials in aluminum foil
 - > drop vials into liquid N₂ dry shipper





in the evening

- take legs off for COI barcoding
- > pinned exemplar specimen USNMENT01115108
- > liquid N₂ specimen USNMENT01136055 + AA8IQ05
- > new leg record USNMENT01146015

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back at NMNH

pinned flies

> special label indicating exemplar status

- >added to collection
- liquid N₂-preserved specimens
 added to Biorepository
 vial location recorded in FreezerPro based on unique identifier AA8IQ05
- specimen / leg records uploaded from FIMS into EMu



back at NMNH

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Search the Depa	irtment of F	Entomology Collections	New Search	
Keyword Search Results - Gallery	/ View		Z A X	
No Image	Scleropogon duncani Bro Catalog Number: Barcode: Catalog: Order:	USNMENT 1115108 USNMENT01115108 USNMENT01115108 Specimen Inventory Diptera	Identification Name: Scleropogon duncani Taxonomy (Occurrence): Asilidae (family): Dintera (order): Insecta	+
USNM USNMENT 1115108 Scleropogon duncani Bromley, 1937 Page 1 of 1 Entomology Collections 1 Entomology Collections 1 Entomology Collection The U.S. National Entomc acquisition of the U.S. Depa donated in 1885. These spe largest and most important specimens taken care of by Smithsonian Institution; the Research Service, United St Biosystematics Unit (Wal	Order: Family: Scientific Name: Sex: Stage: Preparation: Country: Province/State: District/County: Precise Locality: Elevation (m): Centroid Latitude: Centroid Latitude: Centroid Longitude: Collector(s): Collecting Date: Record Last Modified: EZID:	Asilidae Scleropogon duncani Bromley, 1937 Male Adult Pinned United States Arizona La Paz off Shea Road, 14 km E Parker 288 34.1044 -114.152 Dikow, Torsten, (ENT), Smithsonian Institution - National M Natural History (UNITED STATES) 28 Apr 2015 (28.April.2015) Date: 2015 Remarks: Submitted by T.Dikow, SI 29 Jun 2015 15:30:00 http://n2t.net/ark:/65665/39e146e40-01c3-4183-9edf-39!	(class); Arthropoda (phylum); Animalia (kingdom); Collection Info Country: United States State/Province: Arizona Locality: off Shea Road, 14 km E Parker Coordinates (latllon): 34.10444I-114.15194 Collector(s): T. Dikow Collection Date: 28.April.2015	
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			Preparation Preparation Date:2015-4-28 Preparation Type: Whole individual organism	
			Sex: Male Preparations: Vial Sample Preservation(s) Preservation:Frozen	

AA8IQ05 in Biorepository > AA8IQ05 record

sequencing a genome

- Proctacanthus coquilletti
 - > large fly (5 cm long) with plenty of thoracic muscle tissue
- sequenced DNA from one specimen on two lanes of HiSeq 2500 (goal 60x coverage)
- ♦ DISCOVAR *de novo* assembly
- ♦ genome
 - > size = 420 Million bp
 - > N50 = 790,000 bp
 - > 98% gene recovery (evaluated through BUSCO and OrthoDB)



- Iet's collect specimens for genome sequencing
- genomic diversity needs to be preserved now as it might vanish soon
- GGI and NMNH Biorepository would be happy to store your genomic specimens
 accessibility to these samples can be negotiated
- Mike Gates and Matt Buffington (USDA SEL) have workflow for parasitoid wasps

acknowledgements

- data import and troubleshooting
 Patricia Gentili-Poole and Michael Lloyd
- ♦ NMNH Biorepository
 - Chris Huddleston
- discussions
 - > Jonathan Coddington





presentation PDF doi:10.6084/m9.figshare.1603023

Asiloid Flies blog: bit.ly/1j0BNXD



Smithsonian National Museum of Natural History