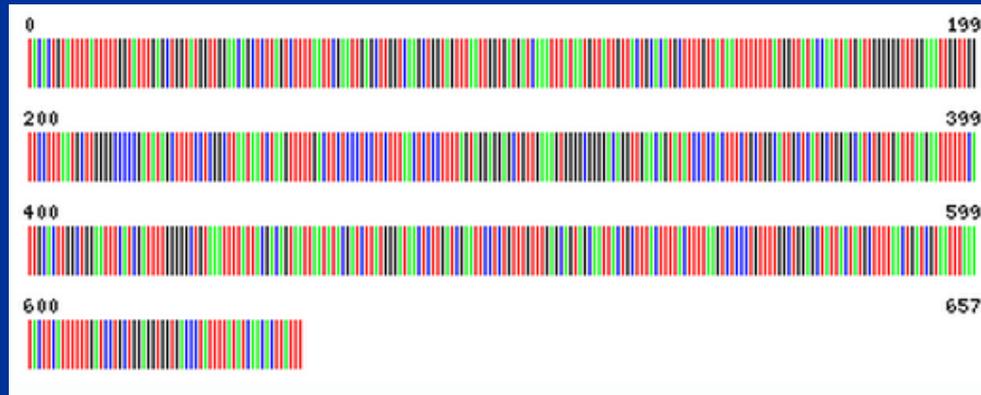


Gestión de colecciones en el ámbito de la biología molecular



Códigos de barras de la vida

Manuel Elías Gutiérrez, Martha Valdez Moreno, Jose Angel Cohuo Colli
El Colegio de la Frontera Sur, Unidad Chetumal

A partir de los 90's del siglo pasado se popularizaron técnicas de secuenciación del ADN de los seres vivos



- En prácticamente todos los casos, estas primeras secuencias fueron realizadas por biólogos moleculares (sin bases de conocimiento taxonómico) y prácticamente la única opción para hacerlas públicas era GenBank, creado desde 1982

Actualmente existen muchas alternativas

- DNA Databank of Japan



- El Laboratorio Europeo de Biología Molecular



- Barcode of Life Database (BOLD)



Daphnia galeata isolate TJC mitochondrion 12S ribosomal RNA gene, partial sequence

GenBank: U13907.1

[FASTA](#) [Graphics](#)

Go to:

LOCUS DGU13907 291 bp DNA linear INV 16-DEC-1996
DEFINITION Daphnia galeata isolate TJC mitochondrion 12S ribosomal RNA gene,
partial sequence.
ACCESSION U13907
VERSION U13907.1
KEYWORDS .
SOURCE mitochondrion Daphnia galeata
ORGANISM [Daphnia galeata](#)
Eukaryota; Metazoa; Ecdysozoa; Arthropoda; Crustacea; Branchiopoda;
Diplostraca; Cladocera; Anomopoda; Daphniidae; Daphnia.
REFERENCE 1 (bases 1 to 291)
AUTHORS Lehman,N., Pfrender,M.E., Morin,P.A., Crease,T.J. and Lynch,M.
TITLE A hierarchical molecular phylogeny within the genus Daphnia
JOURNAL Mol. Phylogenet. Evol. 4 (4), 395-407 (1995)
PUBMED [8747296](#)
REFERENCE 2 (bases 1 to 291)
AUTHORS Lehman,N.
TITLE Direct Submission
JOURNAL Submitted (22-AUG-1994) Department of Biology, University of
Oregon, Klamath Hall, Eugene, OR 97403, USA
FEATURES Location/Qualifiers
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ORIGIN
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121 agttataaag tcttttaact tgaaaacatt ctctaaaagt aatctgacaa cggcgggtata
181 caagctttac aaatgaagga aagataaaac gaggactatc gattaaggga caagctcctc
241 tatttgata aagtgcgcgc aaaatctttg ggtttgaaga acaactnta c

//

Al inicio, las
secuencias
estaban
desligadas de los
especímenes

Al revisar el artículo original...

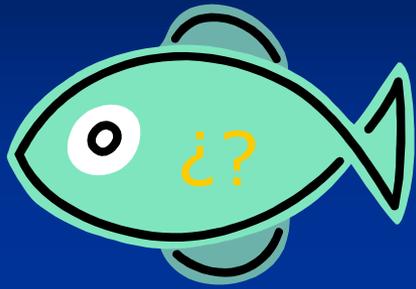
TABLE 2

***Daphnia* Samples Included in This Study**

Species/population name	Sampling location	Habitat type
<i>D. pulex</i> -reference	Amana, Iowa	Temporary pond
<i>D. pulex</i> -unpigmented	Tuktoyaktuk, NWT, Canada	Temporary pond
<i>D. pulex</i> -pigmented	Tuktoyaktuk, NWT, Canada	Temporary pond
<i>D. pulex</i>	Portland Arch, Indiana	Permanent lake
<i>D. pulicaria</i>	Mendota, Wisconsin	Permanent lake
<i>D. middendorffiana</i> -unpigmented	Churchill, Manitoba	Temporary pond
<i>D. middendorffiana</i> -pigmented	Churchill, Manitoba	Temporary pond
<i>D. obtusa</i>	Urbana, Illinois	Temporary pond
<i>D. curvirostris</i>	Tuktoyaktuk, NWT, Canada	Temporary pond
<i>D. galeata</i>	Mendota, Wisconsin	Permanent lake
<i>D. magna</i>	Tuktoyaktuk, NWT, Canada	Temporary pond

Y en este caso podría decir que es uno de los mejor documentados, pero no hay material de referencia

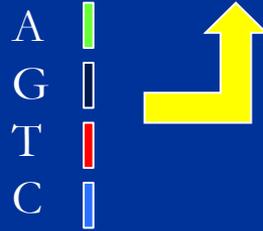
A principios de siglo, se propuso el uso de una pequeña secuencia estandarizada para la determinación taxonómica de toda la biodiversidad del planeta (en plantas y hongos, se han propuesto diferentes genes)



Código de barras



Método de ID



Rocio octofasciata

Código de barras:

Paul Hebert et al. (2003)
Citocromo oxidasa subunidad 1 (COI o Cox 1)
650 pb (primera mitad)
Especie específica

Taxonomy

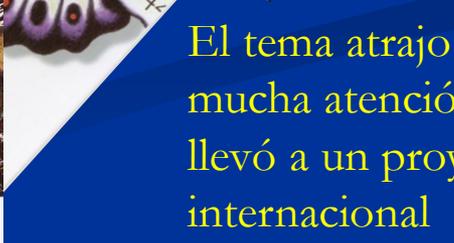
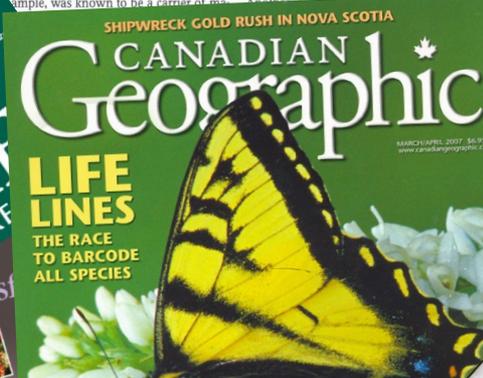
Name, rank and serial number

Biologists want to barcode half a million species in the next five years

THE tale of the unknown goby began in 1982 when Benjamin Victor of the Ocean Science Foundation in California, discovered an unknown reef fish in Panama. With one exception, it was hard prey species, so on his return to his lab...

which there are at least 3,500 species, many of them hard to tell apart. So far Dr Linton's team has used the COI gene to distinguish 390 species of mosquito, of which 7% have turned out to be new species. Anopheles oswaldoi, for example, was known to be a carrier of malaria...

as medicines. In doing so, they have had to identify a new kind of barcode, as the COI gene is not found in plants. Another group that could benefit from barcoding are customs officers, says Mark Blaxter, an evolutionary biologist at the University of Edinburgh. For those struggling to prevent the importation of pests or endangered wildlife, rapid and accurate identification tools are essential—particularly when perishable goods are being held up. America's Department of Agriculture is creating barcodes for the world's fruit flies. These are important agricultural pests and often arrive in the country as hard-to-identify larvae, or eggs, on fruit...



El tema atrajo mucha atención y llevó a un proyecto internacional

Y no ha estado exento de críticas.....

ZOOLOGIA 27 (2): 165–178, April, 2010
doi: 10.1590/S1984-46702010000200003

OPINION¹

Anti-intellectualism in the DNA Barcoding Enterprise

“There are two clear-cut ways in which taxonomy should be strengthened. The first is to give more academic appointments to taxonomists who have mastered the substance, and not just the biometric methodology, of systematics, biologists who are experts on reasonably large groups of organisms on a continental or global basis. They must be allowed to take their place among the theoretical and experimental ecologists now so much in favor in biology departments”

(WILSON 1971:741).

Ebach & Carvalho, 2010

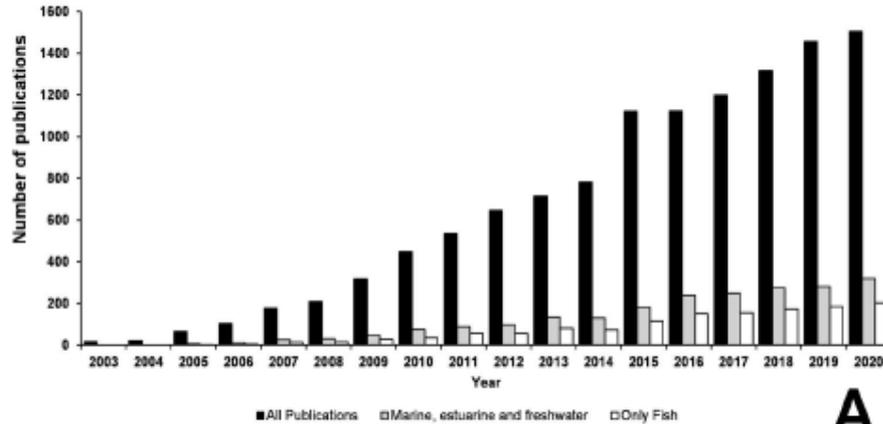
Pero se han vuelto un tema de actualidad:

Diversity 2021, 13, 306

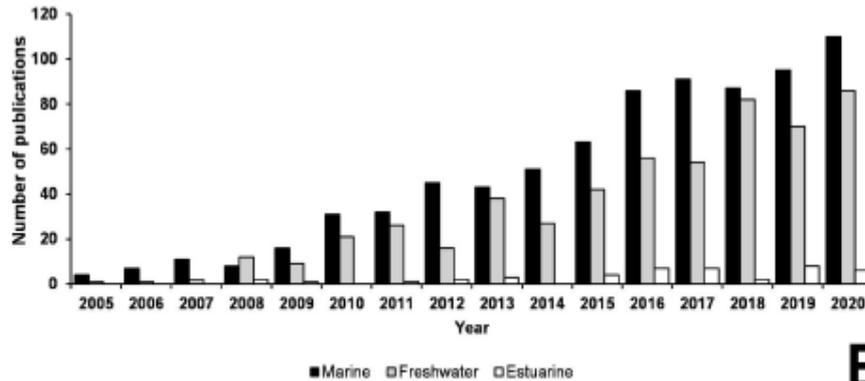
Review

Aquatic Organisms Research with DNA Barcodes

Manuel Elías-Gutiérrez ^{1,*}, Nicolas Hubert ², Rupert A. Collins ³ and Camilo Andrade-Sossa ⁴

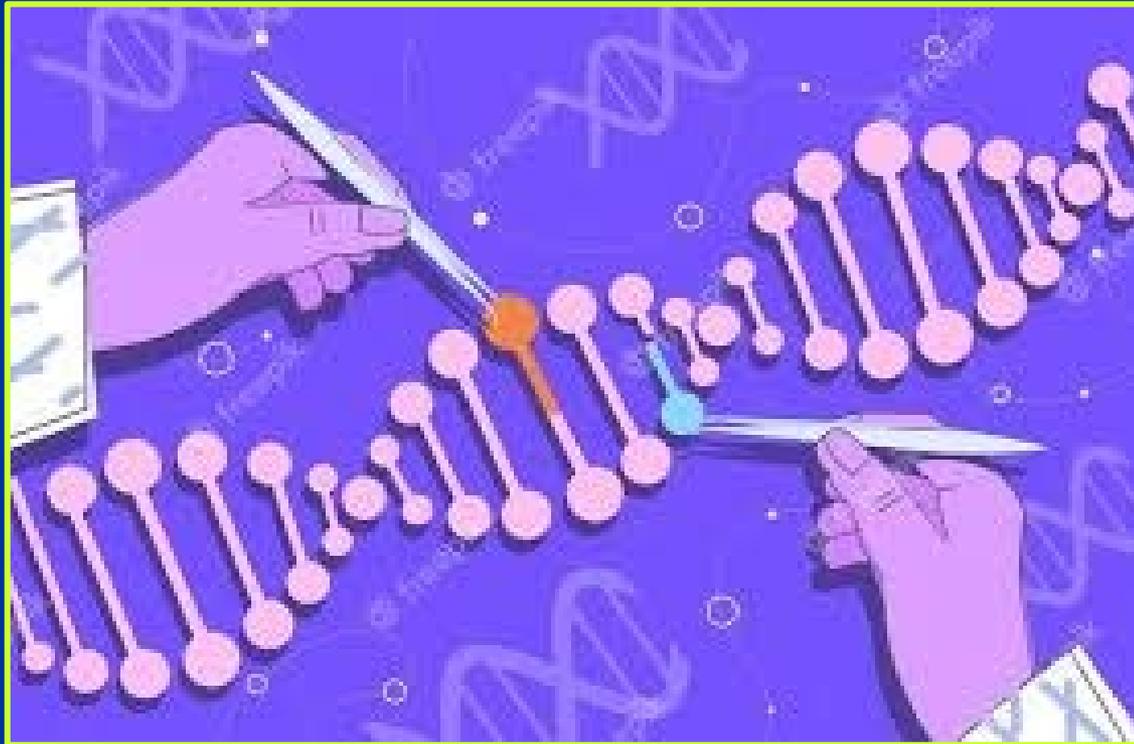


A



B

Como resultado, cada vez más investigadores están secuenciando el ADN de su material recolectado



Ante la popularización de estos métodos ¿Cuales son las mejores prácticas considerando las colecciones científicas?



Especimen

ADN

Tejido



Lo ideal...

Esta base de datos es la que mejor integra estas prácticas: ESTA DISEÑADA PARA LA BIODIVERSIDAD Y COLECCIONES



BOLD SYSTEMS DATABASES IDENTIFICATION TAXONOMY WORKBENCH RESOURCES LOG OUT

BARCODE OF LIFE DATA SYSTEM v4

Advancing biodiversity science through DNA-based species identification.

[EXPLORE THE DATA](#)

DESIGNED TO SUPPORT THE GENERATION & APPLICATION OF DNA BARCODE DATA

BOLD is a cloud-based data storage and analysis platform developed at the Centre for Biodiversity Genomics in Canada. It consists of four main modules, a data portal, an educational portal, a registry of BINs (putative species), and a data collection and analysis workbench.

Please note that this version of BOLD is in beta and will contain bugs. Users can help address these bugs by testing the system and reporting issues to support@boldsystems.org. This version is very different from the prior one but has access to all the same data.

Sujeewan Ratnasingham



- Obtuvo el premio 2010 Ebbe Nielsen de la Global Biodiversity Information Facility (GBIF)

Permite saber donde está el espécimen que se secuenció para corroborar la identificación

ZPLMX173 - Cladocera of Mexico [ZPLMX]



Unspecified default All Rights Reserved Unspecified

Tags

Comments

Lateral 

Process ID: ZPLMX142-06
Identification: *Macrothrix elegans*
Identified by: [Manuel Elias-Gutierrez](#)
Collected in: Guatemala, Alta Verapaz
by: Manuel Elias, Fernando Martinez
Institution Storing: El Colegio de la Frontera Sur
Field ID: Lach1050306
Museum ID: ECO-CH-Z-03303

[Edit Specimen](#) [Show Delta View](#)

Specimen Details

Sample ID: ZPLMX173
Process ID: ZPLMX142-06
Project: ZPLMX
Institution Storing: El Colegio de la Frontera Sur
Field ID: Lach1050306
Museum ID: ECO-CH-Z-03303
Collection Code: ECO-CH-Z
Reference Link:
Note: GPS WGS84

Voucher Status:
Tissue Descriptor:
Sex:
Reproduction:
Life Stage:
Extra Info:
Associated Taxa:
Associated Specimens:

Taxonomy

Phylum: [Arthropoda](#)
Class: [Branchiopoda](#)
Order: [Anomopoda](#)
Family: [Macrothricidae](#)
Subfamily:
Genus: [Macrothrix](#)
Species: [Macrothrix elegans](#)

Identification: *Macrothrix elegans*
Rank: Species
Identifier: [Manuel Elias-Gutierrez](#)
Identification Method:
Identifier Institution: El Colegio de la Frontera Sur, Unidad Chetumal
Identifier Email: melias@ecosur.mx
Taxonomy Note:

Recent Activities

25 records per page Search:

Timestamp	Who	Action
-----------	-----	--------

Barcode Index Numbers

BIN: [BOLD:AAD7091](#)
Type: Member
Max Divergence in BIN: 2.43% (p-dist)
Distance to NN: 2.92% (p-dist)

Phylum: [Arthropoda](#) [59]
Class: [Branchiopoda](#) [59]
Order: [Anomopoda](#) [59]
Family: [Macrothricidae](#) [59]
Subfamily:
Genus: [Macrothrix](#) [59]

[feedback](#)

Showing 1 to 1 of 1 entries

[First](#)
[Previous](#)
[1](#)
[Next](#)
[Last](#)

 Download History:
 [Last Week](#)
[Last Month](#)
[Last 6 Months](#)

Comments

[^](#)
[x](#)

+

Collection Data

[^](#)
[x](#)

Country:	Guatemala	Collector:	Manuel Elias, Fernando Martinez
Province/State:	Alta Verapaz	Date Collected:	05-Mar-2006
Region/County:		Date Accuracy:	
Sector:		Time Collected:	
Exact Site:	Pool near Lanchua Lake	Site Code:	
Lat/Lon:	15.933, -90.677	Habitat:	
Elevation Accuracy:		Sampling Protocol:	
Depth:		Coord. Source:	
Depth Accuracy:		Coord. Accuracy:	
Collection Event ID:			
Collection Notes:			

Map

[^](#)
[x](#)


Leaflet | © OpenStreetMap contributors

Y además está conectado con GBIF

Clasificación

Seleccione una especie

Reino: **Animalia**

Filo: **Arthropoda**

Clase: **Branchiopoda**

Orden: **Diplostraca**

Familia: **Macrothricidae**

Género: **Macrothrix** Baird, 1843

Especie: **Macrothrix elegans** Sars, 1901

Subordinado inmediato

Sin clasificar: **BOLD:AAD7091 (cf. Macrothrix elegans)**

ESPECIE | ACEPTADO

Macrothrix elegans Sars, 1901

Publicado en: Macrothrix elegans G.O. Sars, 1901. Accessed at: <http://www.marinespecies.org/aphia.php?p=taxdetails&id=1302782> on 2020-02-17
fuente: World checklist of freshwater Cladocera species

INFORMACIÓN GENERAL ESTADÍSTICAS TAXÓN DE REFERENCIA

236 REGISTROS 1 INFRAESPECIE

16 REGISTROS CON IMÁGENES



219 REGISTROS GEOREFERENCIADOS



Registros

5

Buscar todos los campos

Simple Avanzada

Estado del registro biológico

Presente

Licencia

Nombre científico

Macrothrix elegans Sars, 1901

Base del registro

BUSCAR REGISTROS DE PRESENCIA | 215 RESULTADOS

TABLA GALERÍA MAP TAXONOMÍA MÉTRICAS DESCARGAR

Nombre científico	País o área	Coordenadas	Mes & año	Base del registro	Conjunto de datos	Reino	Filo/División	Clase
Macrothrix elegans Sars, 1901	México	19.7N, 87.9W	2019 agosto	Muestra de material	International Barcode of Life project (IBOL)	Animalia	Arthropoda	Branchiopoda
BOLD:AAD7091 (cf. Macrothrix elegans)	México	19.5N, 88.1W	2019 agosto	Muestra de material	International Barcode of Life project (IBOL)	Animalia	Arthropoda	Branchiopoda
BOLD:AAD7091 (cf. Macrothrix elegans)	México	19.7N, 87.9W	2019 agosto	Muestra de material	International Barcode of Life project (IBOL)	Animalia	Arthropoda	Branchiopoda
BOLD:AAD7091 (cf. Macrothrix elegans)	México	19.5N, 88.1W	2019 agosto	Muestra de material	International Barcode of Life project (IBOL)	Animalia	Arthropoda	Branchiopoda
BOLD:AAD7091 (cf. Macrothrix elegans)	México	19.1N, 88.0W	2019 agosto	Muestra de material	International Barcode of Life project (IBOL)	Animalia	Arthropoda	Branchiopoda
BOLD:AAD7091 (cf. Macrothrix elegans)	México	19.9N, 87.8W	2019 agosto	Muestra de material	International Barcode of Life project (IBOL)	Animalia	Arthropoda	Branchiopoda

Macrothrix elegans voucher ZPLMX173 cytochrome oxidase subunit 1 (COI) gene, partial cds; mitochondrial

GenBank: EU702196.1

[FASTA](#) [Graphics](#) [PopSet](#)
Go to:

LOCUS EU702196 625 bp DNA linear INV 12-APR-2016

DEFINITION Macrothrix elegans voucher ZPLMX173 cytochrome oxidase subunit 1 (COI) gene, partial cds; mitochondrial.

ACCESSION EU702196

VERSION EU702196.1

KEYWORDS BARCODE.

SOURCE mitochondrion Macrothrix elegans

ORGANISM [Macrothrix elegans](#)
Eukaryota; Metazoa; Ecdysozoa; Arthropoda; Crustacea; Branchiopoda; Diplostraca; Cladocera; Anomopoda; Macrotrichidae; Macrothrix.

REFERENCE 1 (bases 1 to 625)

AUTHORS Elias-Gutierrez,M., Martinez Jeronimo,F., Ivanova,N.V., Valdez-Moreno,M. and Hebert,P.D.N.

TITLE DNA barcodes for Cladocera and Copepoda from Mexico and Guatemala, highlights and new discoveries

JOURNAL Zootaxa 1839, 1-42 (2008)

REFERENCE 2 (bases 1 to 625)

AUTHORS Elias Gutierrez,M., Martinez Jeronimo,F., Ivanova,N.V., Valdez Moreno,M. and Hebert,P.D.N.

TITLE Direct Submission

JOURNAL Submitted (06-MAY-2008) Aquatic Ecology and Systematics, El Colegio de la Frontera Sur, Av. Centenario Km 5.5, Chetumal, Quintana Roo 77014, Mexico

FEATURES

source Location/Qualifiers

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/identified_by="Manuel Elias Gutierrez"

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/gene="COI"

[CDS](#) <1..625

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/transl_table=5

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El mismo
especimen
en GenBank

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ESGAGTGWTVYPPLSAGIAHAGASVDLSIFSLHLAGISSILGAINFITTIINMRSHGM  
TLDRIPLFAWAVGITALLLLSLPVLG AITMLLTDRNLNTSFFDPAG"
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ORIGIN

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121 aattgtcact gctcatgctt ttattataat ttttttc atg gttataccaa tcttgattgg  
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301 ggctgtagaa agaggagcag gaacaggttg gacagtatac cctcccttat cagctggaat  
361 tgctcatgca ggtgcatcag ttgatcttcc aattttttcc cttcacttag ccgggatttc  
421 ttctattcta ggggctatta actttattac tactattatt aatatacgat ctc atgggat  
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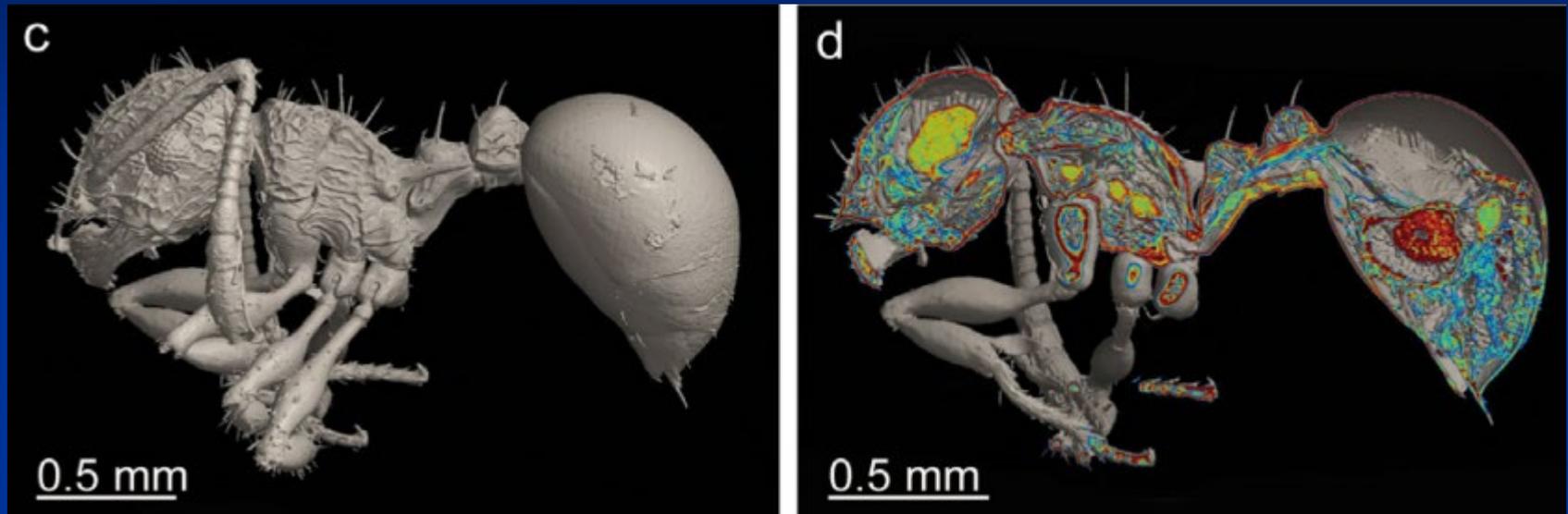
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Annual Review of Entomology
Entomological Collections
in the Age of Big Data

Andrew Edward Z. Short,^{1,*} Torsten Dikow,²
and Corrie S. Moreau³

- Hoy se tienen las más grandes colecciones a nivel global:
- Mas de 500 millones de especímenes solo de insectos
- La mayor parte se están digitalizando hasta en 3D
- Se está buscando la forma de secuenciar especímenes preservados, incluso con nuevas tecnologías

Cada día las imágenes del material en colección son más perfectas



Friedrich et al., 2014

ver : <https://www.livescience.com/45086-3d-insects-system.html>

Cada día cobran más relevancia las colecciones científicas para los interesados en biología molecular

MOLECULAR ECOLOGY RESOURCES

Molecular Ecology Resources (2016) 16, 487–497

doi: 10.1111/1755-0998.12474

DNA barcodes from century-old type specimens using next-generation sequencing

SEAN W. J. PROSSER,* JEREMY R. DEWAARD,* SCOTT E. MILLER† and PAUL D. N. HEBERT*

*Biodiversity Institute of Ontario, University of Guelph, Guelph, ON, Canada, †National Museum of Natural History, Smithsonian Institution, Washington, DC, USA

Fixation, description and DNA barcode of a neotype for *Botryllus schlosseri* (Pallas, 1766) (Tunicata, Ascidiacea)

Por: Brunetti, R (Brunetti, Riccardo)^[1]; Manni, L (Manni, Lucia)^[2]; Mastrototaro, F (Mastrototaro, Francesco)^[3,4]; Gissi, C (Gissi, Carmela)^[5,6]; Gasparini, F (Gasparini, Fabio)^[2]

Ver ResearcherID y ORCID

ZOOTAXA

Volumen: 4353 Número: 1 Páginas: 29-50

Y se están buscando metodologías para recuperar códigos de barras de material en colecciones

RESEARCH ARTICLE

Assessing DNA Barcodes for Species Identification in North American Reptiles and Amphibians in Natural History Collections

E. Anne Chambers^{1,2*}, Paul D. N. Hebert²

1 Department of Integrative Biology, University of Texas, Austin, Texas, United States of America, **2** Centre for Biodiversity Genomics, Biodiversity Institute of Ontario, University of Guelph, Guelph, Ontario, Canada

* eachambers@utexas.edu

Plos One, 2016

Sequence recovery declined with specimen age, and variation in recovery success was noted among collections. Within collections, barcodes effectively flagged seven mislabeled tissues, and barcode fragments were recovered from five formalin-fixed specimens.

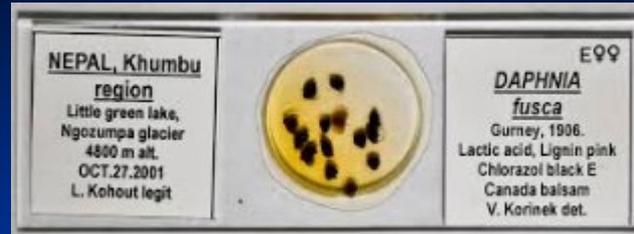


Foto: Lucía Montes

Sin embargo todavía falta mucho para darle la relevancia que merecen las colecciones científicas



Gracias!

El regalo de los taxónomos a los que no saben taxonomía, pero requieren reconocer las especies con que trabajan
Contacto: melias@ecosur.mx

