



@SilkeCleuren

# ICVM 2023

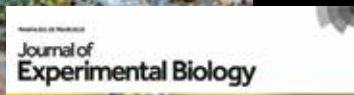
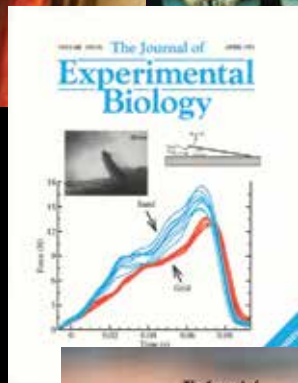
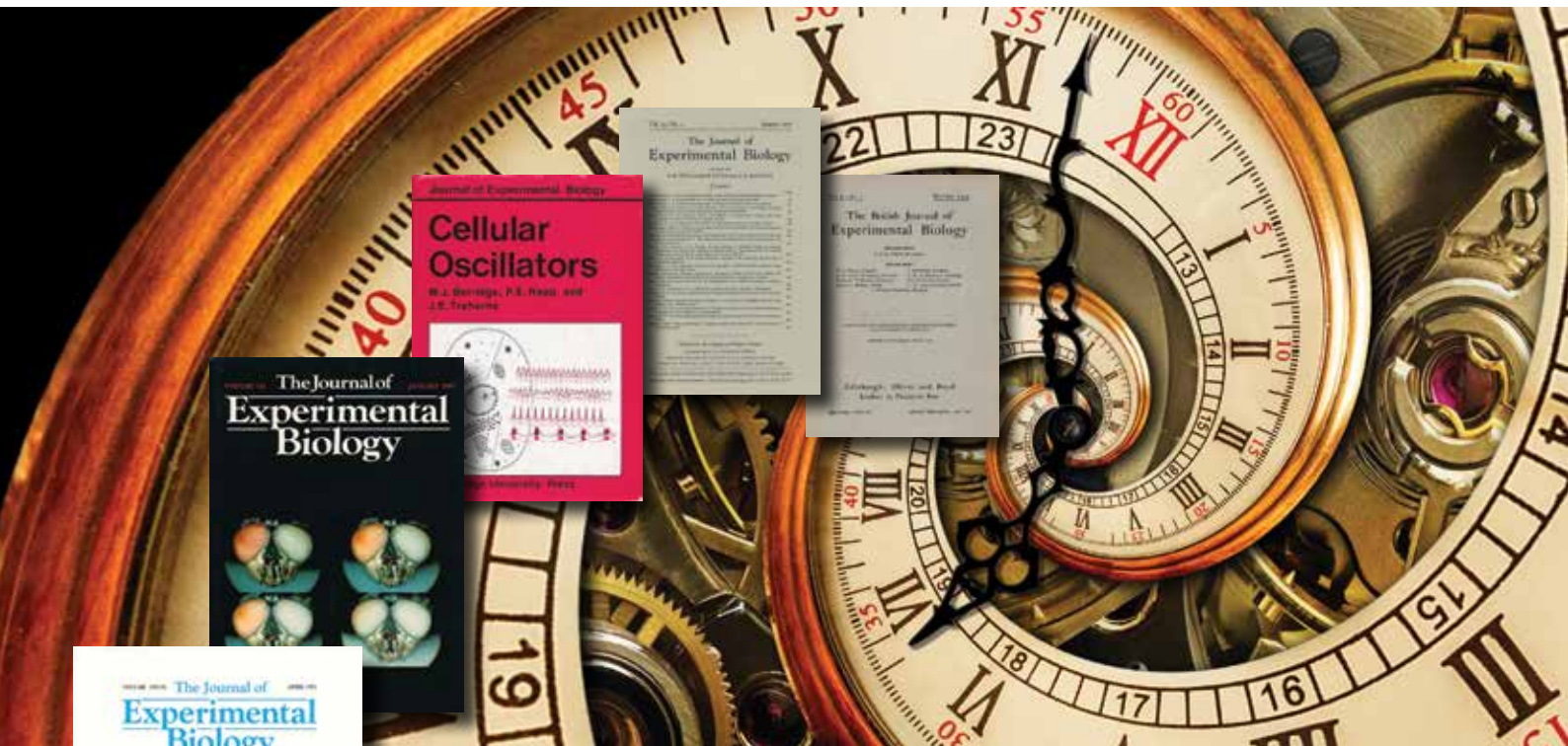
International Congress of  
Vertebrate Morphology  
**Cairns - QLD - Australia**  
28 July - 1 August 2023

## CONFERENCE PROGRAM

The 13<sup>th</sup> International Congress of Vertebrate Morphology



# 2023 marks the 100th anniversary of Journal of Experimental Biology



We are celebrating this historical milestone throughout the year, with activities including:

- publishing a series of Centenary Articles documenting the past, present and future of comparative physiology and biomechanics
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- celebrating with our community at society meetings
- providing greater funding opportunities to support researchers

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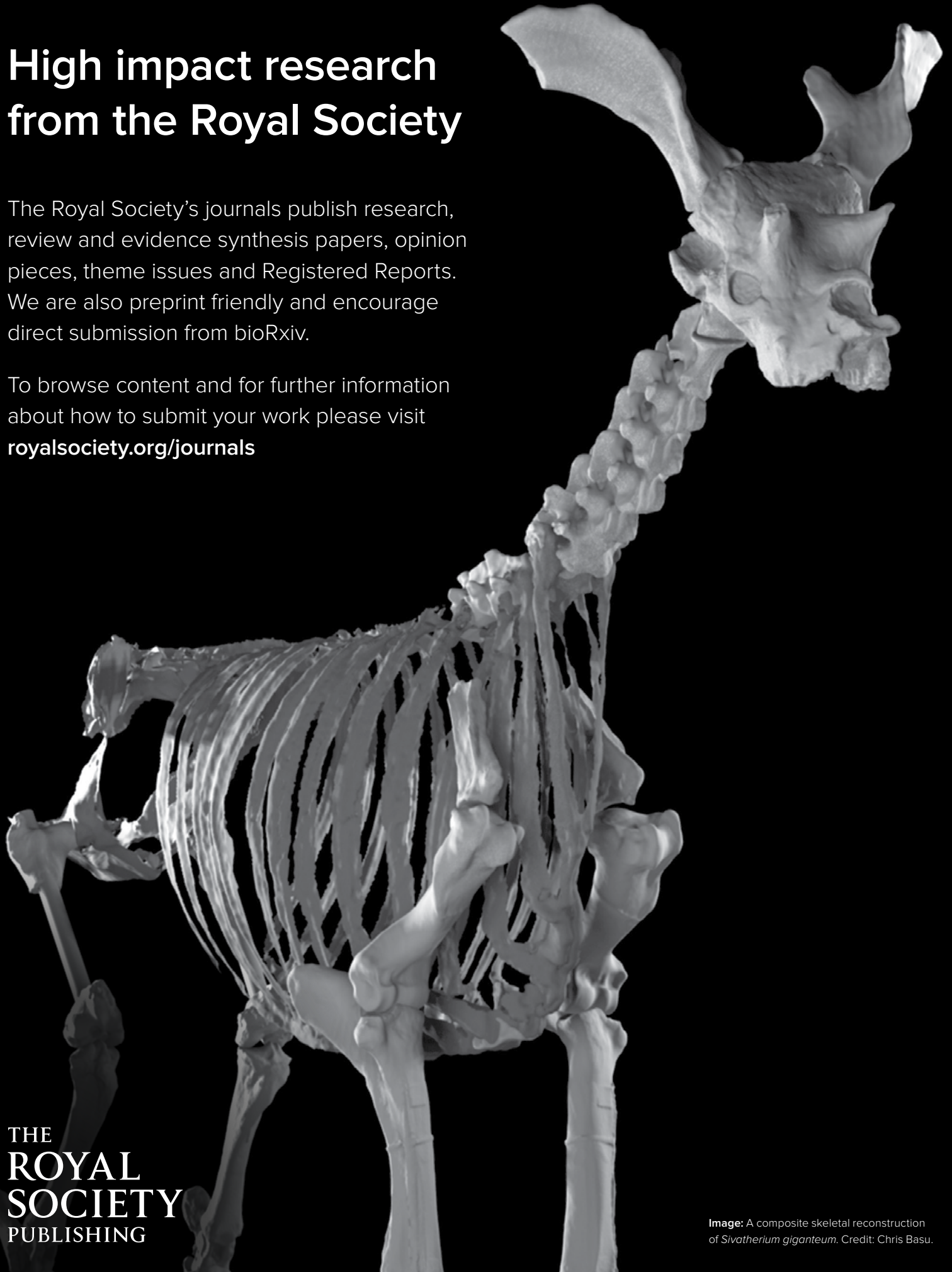
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Image: A composite skeletal reconstruction of *Sivatherium giganteum*. Credit: Chris Basu.



# WELCOME

It is our pleasure to welcome you all on behalf of the International Society of Vertebrate Morphologists to the 13th International Congress of Vertebrate Morphology (ICVM2023) to beautiful Cairns, Australia!

ICVM is a unique and exciting conference that covers the entire academic and methodological breadth of research on vertebrate morphologists, from developmental biology, to morphology and phylogenetics, to functional morphology, to quantitative methods applied to extant and extinct vertebrates. It gives us the chance to enjoy research in our core discipline while thinking outside the box and learning about new aspects of vertebrate morphology at the very same time!

We are particularly excited to finally get together in Cairns, after the global COVID-19 pandemic forced us to postpone this meeting by a year. The world has changed since we last got together in Prague in 2019 and it will be all the more exciting to learn about the new horizons in vertebrate morphology, about breaking new research and new methods, and exchanging with colleagues from all over the world! The program covers a wonderful breadth of topics that reflect the great diversity of our field, including research on particular taxonomic groups or regions of the vertebrate skeleton, the functional morphology of teeth, bone tissue and spines, taking a closer look at the sensory systems and the vertebrate brain and honoring the giants in our field. The conference program reflects how versatile, interdisciplinary and integrative our research has become and what great advances have been made in the past four years! These are exciting times for vertebrate morphologists and ICVM is a great conference to showcase and enhance this interdisciplinary character of our research.

Close to 400 participants from all over the world and from all academic career levels will present their exciting research on ICVM 2023 in over 430 talks and posters. Thanks to Natalie Warburton, Stephen Gatesy, Sharlene Santana, Anjali Goswami, and Virginia Abdala, five outstanding plenaries will close each day's conference program.

ICVM 2023 has a meeting environment that invites and fosters the exchange of research ideas and dialogue among delegates from all career stages. In support of maintaining this environment of respectful interaction, adherence to the ICVM Code of Conduct at the official venue, as well as at other sites is essential.

We would like to express our gratitude to all colleagues, who have served on the ICVM Executive Committee over these past four years and who with great professionalism, creativity and constructiveness have helped to navigate through these difficult times. In particular we would like to thank Beth Brainerd, past president of ISVM, who has generously shared her great expertise and time to successfully prepare this meeting, and Olga Panagiotopoulou for serving as Scientific Program Committee Chair for ICVM 2023. We also acknowledge our sponsors, several of whom have generously supported symposia and travel for early career scientists.

Welcome to Cairns and have a wonderful ICVM 2023!

**Nadia Fröbisch**  
ISVM President

**Brooke Flammang**  
ISVM Secretary

# SPONSORS

## PLATINUM



## SILVER



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# ADMINISTRATION

## **ISVM OFFICERS, 2019-2023**

**President:** Nadia Fröbisch (Germany)

**President-Elect:** John Hutchinson (UK)

**Past President:** Beth Brainerd (USA)

**Secretary:** Brooke Flammang (USA)

**Treasurer:** Dominique Adriaens (Belgium)

## **SCIENTIFIC PROGRAM COMMITTEE**

**Chair:** Olga Panagiotopoulou (Australia)

John Nyakatura (Germany)

Andrea Taylor (USA)

Alistair Evans (Australia)

Alana Sharp (UK)

Russell Main (USA)

Marianne Porter (USA)

Tiana Kohlsdorf (Brazil)

Vera Weisbecker (Australia), Chair of Plenary Program

Dai Koyabu (Hong Kong)

Claire Terhune (USA)

Michael Berthaume (UK)

Emma Sherratt (Australia)

Anne Claire Fabre (Germany)

Adam Hartstone Rose (USA)

## **PROGRAM OFFICERS**

Armita Manafzadeh (USA)

Tahlia Pollock (Australia)

## **ISVM EXECUTIVE COMMITTEE, 2019-2023**

Julia Desojo (Argentina)

Anne-Claire Fabre (France)

Colleen G. Farmer (USA)

Anjali Goswami (UK)

Daisuke Koyabu (Hong Kong)

John Nyakatura (Germany)

Olga Panagiotopoulou (Australia)

Stephanie Pierce (USA)

Karen E. Sears (USA)

Vera Weisbecker (Australia)

## **NOMINATING COMMITTEE**

**Chair:** Karen Sears (USA)

Anthony Herrel (France)

John Nyakatura (Germany)

## **EXHIBITORS AND SPONSORSHIP COMMITTEE\***

**Chair:** Paul Gignac (USA)

Jaimi Gray (Australia)

Anthony Herrel (France)

*\* Note: this is an ad hoc committee appointed by the President*

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# GENERAL INFORMATION

## DATES AND VENUE

**28 July-1 August 2023**

**Cairns Convention Center**

Cnr Wharf & Sheridan Street

Cairns 4870 Queensland Australia

+(07) 4042 4200

## CONFERENCE MANAGEMENT

Burk & Associates, Inc.

950 Herndon Parkway, Suite 450

Herndon, Virginia 20170

1-703-790-1745

add 00 as a prefix when calling from outside the US

**Onsite contact:** Lori Strong, lstrong@burkinc.com

## ON-SITE REGISTRATION

Foyer - Lower Level

### Registration Desk Hours:

Thursday, 27 July 3:00 PM – 6:00 PM

Friday, 28 July 7:00 AM – 4:00 PM

Saturday, 29 July 7:30 AM – 4:00 PM

Sunday, 30 July 7:30 AM – 4:00 PM

Monday, 31 July 7:30 AM – 4:00 PM

Tuesday, 1 August 7:30 AM – 2:00 PM

### Registration Rates for ICVM 2023 (in US Dollars)

#### Regular Registration (By 1 March 2023)

- Full member, \$820
- Early Career Researcher, \$710 (*postdoc or equivalent*)
- Student, \$620

#### Late Registration (After 1 March 2023)

- Full member, \$1120
- Early Career Researcher, \$900 (*postdoc or equivalent*)
- Student, \$800

#### Regular, Early Career, and Student registration fees include:

- Access to the Welcome Reception and Closing Reception
- Access to all scientific sessions and exhibits
- Name badge, program book and sponsor flyers
- Coffee breaks

#### The Companion registration fee includes:

- Access to the Welcome Reception and Closing Reception

## OFFICIAL LANGUAGE

The official language of ICVM 2023 is English.

Simultaneous translation will not be provided.

## BADGES AND SECURITY

It is essential that you wear your personal badge at all times while in the Congress venue and during the social events, as it is the official entrance pass to scientific sessions and other Congress activities.

## NOTES FOR ORAL PRESENTERS (SPEAKERS)

1. Contributed oral presentations are scheduled as 15-minute presentations which includes time for you to walk to the podium, be introduced by moderator, and initiate your computer files. Please plan your actual presentation to be completed in 12 minutes, allowing time to answer questions as these make the sessions much more interactive. Time limits will be strictly enforced. Symposium presentations are scheduled as a mix of 15- and 30- minute presentations. Please check specific symposia for details.
2. Microsoft PowerPoint will be the standard presentation software supported at ICVM 2023.
3. Presentation files should be brought to the Speaker Ready Room (Room G2, ground level) a minimum of two hours prior to the session, preferably much earlier. The file will be brought to the session room before your session.
4. The Speaker Ready Room and breakout session rooms will be using PCs with HDMI. Speakers with presentations on Macs are encouraged to use the PCs, and the fidelity of the conversion can be assessed in the Speaker Ready Room. However, if absolutely necessary, a speaker can use his/her own Mac in the breakout session room, although the hope is to keep computer-swapping to a minimum.
5. **Speaker Ready Room – Room G2 (ground level)**  
**Hours of operation:**

Thursday, 27 July	3:00 PM – 6:00 PM
Friday, 28 July	7:00 AM – 4:30 PM
Saturday, 29 July	7:00 AM – 4:30 PM
Sunday, 30 July	7:00 AM – 4:30 PM
Monday, 31 July	7:00 AM – 4:30 PM
Tuesday, 1 August	7:00 AM – 11:00 AM

## FREE WI-FI INTERNET CONNECTIVITY

- ICVM has contracted for free Wi-Fi in the Cairns Convention Center's meeting spaces for ICVM attendees.

# GENERAL INFORMATION

## NOTES FOR POSTER PRESENTERS

1. Poster authors must be available at their poster during their session's Question & Answer period. Poster sessions will occur over four days (July 29th – August 1st) with presenters allocated to one of four sessions (Part 1, 2, 3, or 4). Please use the following times for set-up, presentation, and tear down on the day you are presenting.
  - Saturday, 29 July: 7:00 AM – 8:00 AM  
Poster session set-up (Part 1 and Part 2 authors)
  - Saturday, 29 July: 4:00 PM – 5:00 PM  
Poster session presentation (Part 1 authors)
  - Sunday, 30 July: 4:00 PM – 5:00 PM  
Poster session presentation (Part 2 authors)
  - Sunday, 30 July: 5:00 PM – 5:30 PM  
Poster session teardown (Part 1 and Part 2 authors)
  - Monday, 31 July: 7:00 AM – 8:00 AM  
Poster session set-up (Part 3 and Part 4 authors)
  - Monday, 31 July: 4:00 PM – 5:00 PM  
Poster session presentation (Part 3 authors)
  - Tuesday, 1 August: 4:00 PM – 5:00 PM  
Poster session presentation (Part 4 authors)
  - Tuesday, 1 August: 5:00 PM – 5:30 PM  
Poster session teardown (Part 3 and Part 4 authors)
2. Poster mounting boards vary with location and stand approximately 30 inches off the floor. Posters must fit within the allotted space of 4'x4' and should be NO LARGER than 42"x42" (106 x 106 cm). There will be several feet of space between rows of poster boards. Be prepared with your own material (push pins and/or velcro) to secure items to the boards.

## SOCIAL EVENTS

1. **Welcome Reception:** 6:00 PM – 7:00 PM, Friday, 28 July 2023, City Terrace
2. **Closing Reception:** 6:00 PM – 7:00 PM, Tuesday, 1 August, City Terrace.
3. The Welcome and Closing Receptions are free for all registered participants and will include a cash bar and light hors d'oeuvres.

## OFFICIAL HASHTAG: ICVM2023

## ICVM MOBILE DEVICE APP FOR IOS AND ANDROID

- Attendees can view the full ICVM program, develop a personalized schedule, receive push notifications, and a range of other interactive functions through the ICVM 2023 app that works on all iOS and Android mobile devices.
- Search In Store: **eConference.io**  
Download, install and open the eConference.io app. Then Enter Code: **ICVM2023**

## NOTIFICATION OF LATE-BREAKING CHANGES AND OTHER ICVM NEWS

1. Other late-breaking changes and news will be posted to Twitter ([#ICVM2023](https://twitter.com/ICVM2023)).
3. Notifications also will be made to the ICVM Mobile Device app

## ICVM 2023 PROGRAM & ABSTRACTS DOWNLOAD

- The ICVM 2023 abstracts are published by the *Anatomical Record*. The abstracts can be found at <https://anatomypubs.onlinelibrary.wiley.com/pb-assets/assets/19328494/Abstracts%20for%20publication%20ICVM%202023-1685668537.pdf>

## ISVM MEETINGS

1. **Executive Committee Meeting #1**  
(with current members)  
Friday, 28 July, 11:30 AM – 1:30 PM, BC3
2. **Executive Committee Meeting #2**  
(with newly elected members, current members are also invited)  
Monday, 31 July, 11:30 AM – 1:30 PM, M5-M6
3. **Congress Welcome and ISVM Business Meeting**  
Friday, 28 July, 4:00 PM – 5:00 PM, Auditorium C  
*All attendees are welcome and encouraged to participate*

## ICVM 2023 COVID MASKING POLICY

Delegates are required to wear masks in public during ICVM 2023. Considering that many delegates will have travelled with long flights including extended durations in international airports, masking is a reasonable and advisable step to prevent potential Covid outbreaks and keep everybody safe and healthy.

## ICVM CODE OF CONDUCT

The International Congress of Vertebrate Morphology expects meeting attendees to behave in a courteous, collegial, and respectful fashion towards each other, ICVM meeting staff, conventions staff, and the public. Attendees should respect common sense rules for professional and personal interactions, public behavior (including behavior in electronic communication related to the meeting), common courtesy, respect for private property, and respect for the intellectual property of the presenters. Demeaning, abusive, harassing or threatening behavior towards other attendees, staff, or the public is not permitted in either personal or electronic interactions. There is an extensive code of conduct document distributed with your printed program and if there are any questions or concerns see any of the meeting staff, ISVM officers, or any delegate with a CODE OF CONDUCT label on their badge.

## NOTE ON PHOTOGRAPHY, OTHER RECORDING, AND SOCIAL MEDIA

1. ICVM Abstracts have been reviewed by the Scientific Program Committee, but authors are responsible for the technical content.
2. Opinions differ widely on the issue of photography and other manner of recording conference presentations. We urge the use of good judgement and courtesy, guided by the ICVM Code of Conduct (above) that emphasizes respect for intellectual property. Asking permission prior to any kind of recording (including photography) or before posting photos online is recommended. Likewise, we encourage discussion of ICVM presentations on social media (#ICVM2023), but again we urge caution and consideration in posting photos or other content that might disclose more than the presenter would desire.
3. Those presenters who do NOT want any of their content recorded, posted, or discussed online have that right, but should inform the audience at the outset of their oral presentation or in a prominent place on their poster.

# PREVIOUS LOCATIONS

## OF THE INTERNATIONAL CONGRESS OF VERTEBRATE MORPHOLOGY

### ICVM-1 1983

Gießen, Germany (~300 participants)

### ICVM-2 1986

Vienna, Austria (~350 participants)

### ICVM-3 1989

Antwerp, Belgium (~430 participants)

### ICVM-4 1994

Chicago, Illinois, USA (~450 participants)

### ICVM-5 1997

Bristol, UK (~450 participants)

### ICVM-6 2001

Jena, Germany (~700 participants)

### ICVM-7 2004

Boca Raton, Florida, USA (~470 participants)

### ICVM-8 2007

Paris, France (~600 participants)

### ICVM-9 2010

Punta del Este, Uruguay (~315 participants)

### ICVM-10 2013

Barcelona, Spain (~450 participants)

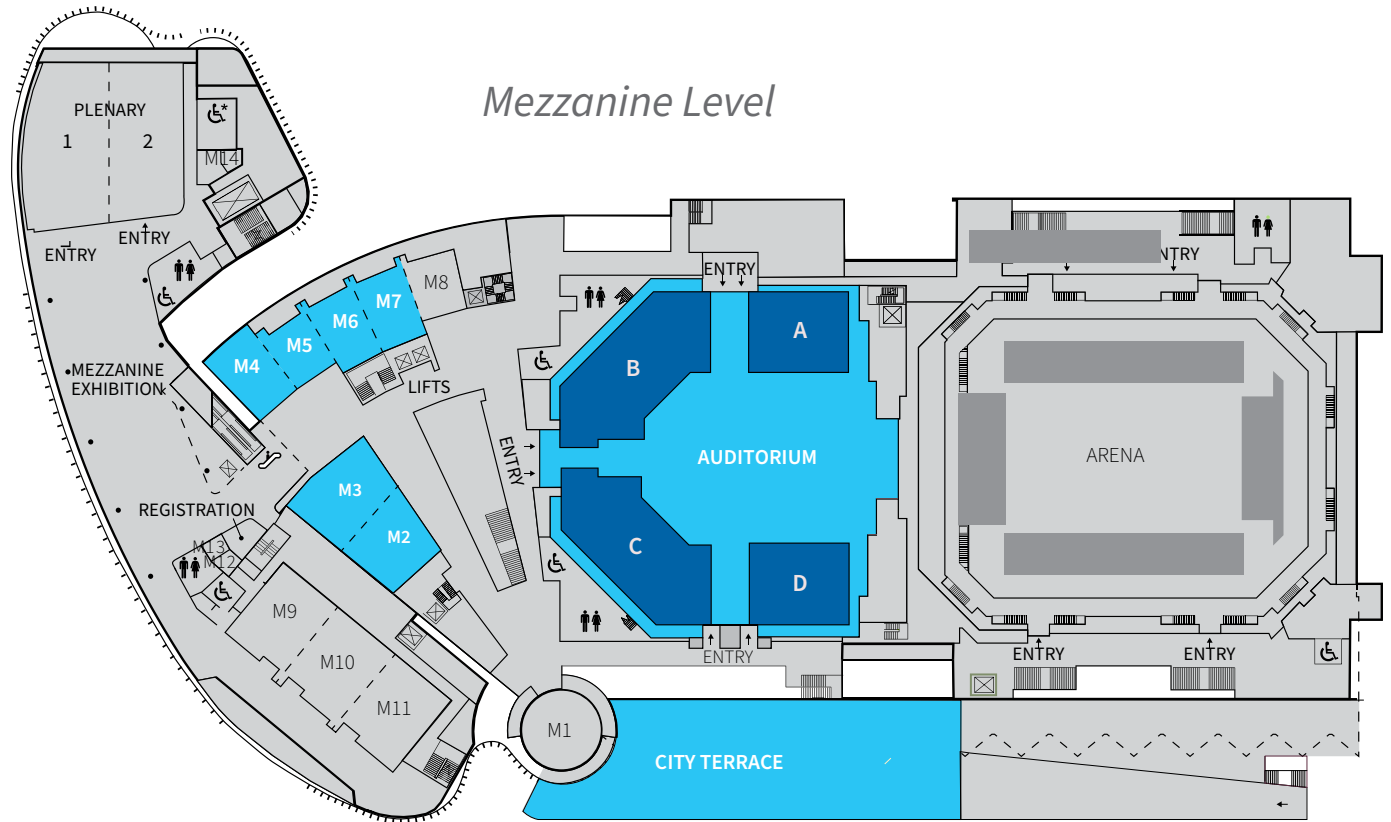
### ICVM-11 2016

Washington, DC, USA (~600 participants)

### ICVM-12 2019

Prague, Czech Republic (~730 participants)

# CAIRNS CONVENTION CENTRE FLOOR PLAN





# EXHIBITOR LISTING

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## The Anatomical Record

wileyonlinelibrary.com/ar  
anatre@anatomy.org

The Anatomical Record: Advances in Integrative Anatomy and Evolutionary Biology, is an official publication of the American Association for Anatomy, publishes new discoveries in the morphological aspects of molecular, cellular, systems, and evolutionary biology. The journal focuses on major new findings in the anatomical consequences of gene disruption, activation, or over expression upon cell, tissue, or organ architecture and also recognizes the importance of descriptive studies in contemporary research, particularly when framed in the context of experimental models or questions.

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## Dryad

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## The Royal Society

6-9 Carlton House Terrace  
London, SW1Y 5AG, United Kingdom  
royalsociety.org/journals

The Royal Society publishes high quality, peer-reviewed journals covering all scientific disciplines. We offer you a range of services including rapid publication, rigorous peer review, international recognition and open access options. We welcome submissions of high-quality science from anywhere in the world, and look forward to working with you.

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## University of Arkansas MICRO

Fayetteville, AR, USA  
micro.uark.edu

The MicroCT Imaging Consortium for Research and Outreach (MICRO) is housed at the University of Arkansas and offers microCT scanning consultation and services. The University of Arkansas also offers a wide variety of MA and PhD graduate programs in anthropology (biological anthropology, archaeology, cultural anthropology), geosciences (geology, geography), and biology (micro/molecular biology, ecology and evolutionary biology).



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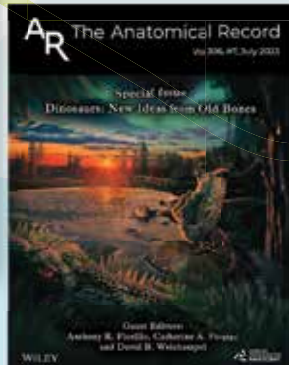
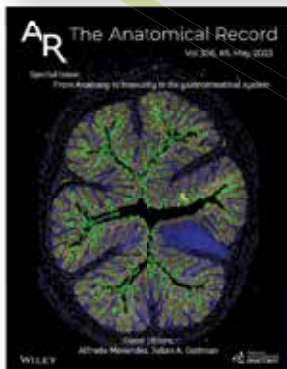
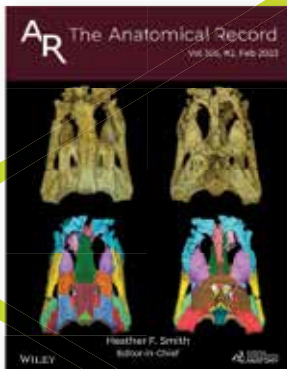


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# AR The Anatomical Record



**EDITOR-IN-CHIEF:** HEATHER F. SMITH, PH.D.  
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*The Anatomical Record: Advances in Integrative Anatomy and Evolutionary Biology*, an official publication of the American Association for Anatomy, publishes new discoveries in morphological aspects of molecular, cellular, systems, and evolutionary biology.

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# PROGRAM AT-A-GLANCE

All events take place at the Cairns Convention Centre.

TIME	Auditorium C	M2-M3	M5-M6	M7-M8
<b>Friday, 28 July</b>				
8:00 AM – 9:30 AM	Session 1	Session 4	Session 2	Session 3
9:30 AM – 10:00 AM	TEA BREAK: Auditorium A/B/D			
10:00 AM – 11:30 AM	Session 5	Session 7	Session 6	Session 8
11:30 AM – 1:30 PM	LUNCH			
1:30 PM – 3:30 PM	Session 9	Session 10	Session 11	Session 12
3:30 PM – 4:00 PM	TEA BREAK: Auditorium A/B/D			
4:00 PM – 5:00 PM	Congress Welcome and ISVM Business Meeting: Auditorium C			
5:00 PM – 6:00 PM	Plenary Lecture 1: Auditorium C			
6:00 PM – 7:00 PM	WELCOME RECEPTION: City Terrace			
<b>Saturday, 29 July</b>				
8:00 AM – 9:30 AM	Session 14	Session 13	Session 16	Session 15
9:30 AM – 10:00 AM	TEA BREAK: Auditorium A/B/D			
10:00 AM – 11:30 AM	Session 18	Session 17	Session 20	Session 19
11:30 AM – 1:30 PM	LUNCH			
1:30 PM – 4:00 PM	Session 22	Session 24	Session 21	Session 23
4:00 PM – 5:00 PM	TEA BREAK and Poster 1: Auditorium A/B/D			
5:00 PM – 6:00 PM	Plenary Lecture 2: Auditorium C			
<b>Sunday, 30 July</b>				
8:00 AM – 9:30 AM	Session 27	Session 26		Session 25
9:30 AM – 10:00 AM	TEA BREAK: Auditorium A/B/D			
10:00 AM – 11:30 AM	Session 30	Session 28	Session 31	Session 29
11:30 AM – 1:30 PM	LUNCH			
1:30 PM – 4:00 PM	Session 34	Session 32	Session 35	Session 33
4:00 PM – 5:00 PM	TEA BREAK and Poster 2: Auditorium A/B/D			
5:00 PM – 6:00 PM	Plenary Lecture 3: Auditorium C			

# Life Sciences *from Chicago*



## **Physiological and Biochemical Zoology**

### **Ecological and Evolutionary Physiology**

*Physiological and Biochemical Zoology: Ecological and Evolutionary Physiology* primarily publishes original research in physiological ecology, ecophysiology, comparative physiology, and evolutionary physiology. Studies at all levels of biological organization from

the molecular to the whole organism are welcome, and work that integrates across levels of organization is particularly encouraged. Studies that focus on behavior or morphology are welcome, so long as they include ties to physiology or biochemistry, in addition to having an ecological or evolutionary context.

## **More science journals**

**The American Naturalist • The Biological Bulletin •  
Freshwater Science • The Quarterly Review of Biology**



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[journals.uchicago.edu](http://journals.uchicago.edu)



# PROGRAM AT-A-GLANCE

All events take place at the Cairns Convention Centre.

TIME	Auditorium C	M2-M3	M5-M6	M7-M8
<b>Monday, 31 July</b>				
8:00 AM – 9:30 AM	Session 37	Session 36		Session 38
9:30 AM – 10:00 AM	TEA BREAK: Auditorium A/B/D			
10:00 AM – 11:30 AM	Session 40	Session 39	Session 42	Session 41
11:30 AM – 1:30 PM	LUNCH			
1:30 PM – 4:00 PM	Session 43	Session 46	Session 45	Session 44
4:00 PM – 5:00 PM	TEA BREAK and Poster 3: Auditorium A/B/D			
5:00 PM – 6:00 PM	Plenary Lecture 4: Auditorium C			
<b>Tuesday, 1 August</b>				
8:00 AM – 9:30 AM	Session 47	Session 48		Session 49
9:30 AM – 10:00 AM	TEA BREAK: Auditorium A/B/D			
10:00 AM – 11:30 AM	Session 50	Session 52		Session 51
11:30 AM – 1:30 PM	LUNCH			
1:30 PM – 4:00 PM	Session 55	Session 54		Session 53
4:00 PM – 5:00 PM	TEA BREAK and Poster 4: Auditorium A/B/D			
5:00 PM – 6:00 PM	Plenary Lecture 5: Auditorium C			
6:00 PM – 7:00 PM	CLOSING RECEPTION: City Terrace			

# PROGRAM

All events take place at the Cairns Convention Centre.

## Friday, 28 July 2023

**8:00 AM – 9:30 AM**      **Session 1**      **Auditorium C**

### Feeding Frenzy

Chair: *David Villalobos Chaves*

- |         |     |  |   |
|---------|-----|--|---|
| 8:00 am | 1-1 | Craniodental traits predict feeding performance and dietary hardness in a community of Neotropical free-tailed bats (Chiroptera: Molossidae) | <i>David Villalobos Chaves, Sharlene Santana; University of Washington</i>  |
| 8:15 am | 1-2 | Mesosaurs went through an environmental and dietary shift throughout their ontogeny  | <i>Antoine Verrière, Jörg Fröbisch; Museum für Naturkunde</i>   |
| 8:30 am | 1-3 | Extant functional and morphological traits used to predict dietary ecology in Cretaceous birds   | <i>Case Miller, Michael Pittman, Jen Bright; University of Hong Kong, University of Hull</i>  |
| 8:45 am | 1-4 | Does metamorphosis foster the morphological evolution of feeding structures in Caudata?  | <i>Anne-Claire Fabre, Vivien Louppe, Julien Clavel, Gabriel Ferreira, Carla Bardua, Renaud Boistel, Nadia Fröbisch, Edward Stanley, Jeff Streicher, Vivien Bothe, David Blackburn, Celeste Pérez-Ben, Donald Davesne, Kathleen Dollman, Vincent Fernandez, Anthony Herrel, Anjali Goswami; NMBE/UniBe, Université Lyon, Eberhard Karls Universität Tübingen, NHM, CNRS, MfN, Florida Museum of Natural History, University of Florida, Leibniz Institute for Evolution and Biodiversity Science, Museum für Naturkunde, ESRF, European Synchrotron Radiation Facility, UMR7179 CNRS/MNHN, The Natural History Museum London</i> |
| 9:00 am | 1-5 | Evolutionary shifts in the morphological diversity of turtle hyoid structures are subjected to feeding behaviour                             | <i>Gabriel Cohen, Melina Jobbins, Dylan Bastiaans, Ingmar Werneburg, Marcelo Sánchez-Villagra; University of Zurich, University of Tübingen</i>   |
| 9:15 am | 1-6 | Head Shape, Foraging Strategies, and Prey Selection in Two Sympatric Sea Turtle Species  | <i>Jeanette Wyneken, Michael Salmon, Tommy Cutt, Don Mcleish, Alexander Gaos; Florida Atlantic University, Maui Ocean Center Marine Institute, Pacific Islands Fisheries Science Center</i>   |

**8:00 AM – 9:30 AM**      **Session 2**      **M5-M6**

### Mass Extinctions and Climate Change

Chair: *Jasmina Wiemann*

- |         |     |   |   |
|---------|-----|---|---|
| 8:00 am | 2-1 | Body size shifts in color polymorphic salamanders in response to climate change   | <i>Maggie Hantak; University of Dayton</i>  |
| 8:15 am | 2-2 | Disentangling drivers on morphological change through time: Late Quaternary evolution of the endemic Eivissa (Ibiza) Wall Lizard        | <i>Stephanie Woodgate, Josep Alcover, Ana Pérez-Cembranos, Valentín Pérez-Mellado, Johannes Müller; Museum für Naturkunde, Leibniz Institute for Evolution and Biodiversity Science, Institut Mediterrani d'Estudis Avançats (CSIC-UIB), Universidad de Salamanca</i>   |
| 8:30 am | 2-3 | Dormant lizards in Belgium – a rare window into the earliest Eocene 'greenhouse world'  | <i>Andrej Čerňanský, Juan Daza, Richard Smith, Aaron Bauer, Thierry Smith, Annelise Folie; Comenius University, Sam Houston State University, Royal Belgian Institute of Natural Sciences, Villanova University</i>   |
| 8:45 am | 2-4 | Mass extinctions make way for mitochondrial metabolic endothermy in amniotes  | <i>Jasmina Wiemann; Field Museum, University of Chicago</i>   |
| 9:00 am | 2-5 | Evolution of axial regionalization in Aves during the Mesozoic and its impact on the survival of modern lineages to KPg mass extinction | <i>Francisco Serrano, Luis Chiappe, Alejandro Pérez-Ramos, Chapman Susan, Dana Rashid, Jordi Marcé-Nogué, Ornella Bertrand, Steve Brusatte, Borja Figueirido; University of Málaga, Natural History Museum of Los Angeles County, Clemson University, Montana State University, Universitat Rovira i Virgili, Institut Català de Paleontologia Miquel Crusafont, Universitat Autònoma de Barcelona, University of Edinburgh</i> |
| 9:15 am | 2-6 | Geographical patterns in turtle shell morphology: functional underpinnings of ecological rules  | <i>Charles Stayton; Bucknell University</i>   |

8:00 AM – 9:30 AM

Session 3

M7-M8

**Symposium in Honor of Sue Herring: A Giant in Her Field (Part 1)***Chairs: Robert Druzinsky, Rebecca Z. German, Anthony Herrel*

8:00 am	3-1	The Legacy of Susan W. Herring: A Giant in Her Field	Rebecca German, Robert Druzinsky, Anthony Herrel; NEOMED, University of Illinois, UMR7179 CNRS/MNHN
8:15 am	3-2	Biomechanical insights into (para)symphyseal fracture fixation	Callum Ross, Clairia Lee, Jose Iriarte-Diaz, Pranav Haravu, Russell Reid, Olga Panagiotopoulou; University of Chicago, Monash Biomedicine Discovery Institute, University of the South, Monash University
8:30 am	3-3	Modelling how suture morphology and complexity drives mammalian cranial evolution	Heather White, Yichen He, Abigail Tucker, Vincent Fernandez, Roberto Portela Miguez, Arkhat Abzhanov, Enrico Grisan, Alana Sharp, Anjali Goswami; Natural History Museum, King's College London, European Synchrotron Radiation Facility, Natural History Museum, Imperial College London, London South Bank University, University of Liverpool
8:45 am	3-4	Myosin heavy chain isoform expression in primate chewing muscles: Regional and functional heterogeneity fine-tunes muscles for specific feeding behaviors	Andrea Taylor, Megan Holmes; Touro University, Duke University
9:00 am	3-5	Morphology, Movement, and Mastication: Dr. Sue Herring's Impact on the Study of Mammalian Chewing	Christopher Vinyard, Christine Wall, Stephane Montuelle, Rachel Olson, Jillian Davis, Susan Williams; Ohio University, Duke University, University of Akron, West Virginia University
9:15 am	3-6	Short Primate Faces and Gums: Facial Sutures in Gouging Primate Gummivores Close Early	Anne Burrows, Tim Smith, Christopher Vinyard; Duquesne University, Slippery Rock University, Ohio University

8:00 AM – 9:15 AM

Session 4

M2-M3

**The Rise and Reign of Mammals***Chair: Eloy Gálvez-López*

8:00 am	4-1	Evolutionary convergence and integration among carnivoran skeletal systems	Chris Law, Leslea Hlusko, Jack Tseng; University of Washington, University of Texas, Spanish National Center for Research on Human Evolution, University of California, Berkeley
8:15 am	4-3	Evolution of scapula size and shape in Carnivora	Eloy Gálvez-López, Adrià Casinos; University of York, Ecology and Environmental Sciences, University of Barcelona
8:30 am	4-4	Using dynamic simulations to explore the sprawling-to-erect postural transition in synapsids	Peter Bishop, Richard Blob, Stephanie Pierce; Harvard University, Clemson University
8:45 am	4-5	Evolutionary dynamics of the synapsid pelvis and femur provides insight into the origin of mammalian limb posture	Mark Wright, Stephanie Pierce; Harvard University
9:00 am	4-6	Musculoskeletal modeling untangles the origins of mammal forelimb function and posture	Robert Brocklehurst, Stephanie Pierce; Museum of Comparative Zoology, Harvard University

10:00 AM – 11:30 AM

Session 5

Auditorium C

**Muscles and Movement***Chair: Jan Wölfer*

10:00 am	5-1	Hindlimb myology in the Macropodiformes	Natasha Tay, Trish Fleming, Natalie Warburton; Harry Butler Institute, Murdoch University
10:15 am	5-2	Ultrastructural analysis of an extensible muscle in Boa constrictor	Jarrod Petersen, John Capano, Thomas Roberts; Brown University
10:30 am	5-3	Feats of supercontractile strength: testing for the presence of supercontracting muscle among chameleon hyoid musculature	Nikole Schneider, Nicholas Henchal, Christopher Anderson; University of South Dakota
10:45 am	5-4	Characterization of the muscle architecture of the zebrafish palatal organ and pharyngeal jaw	Kelsie Pos, L Patricia Hernandez; George Washington University
11:00 am	5-5	What to do when mammalian forelimb muscles don't divide into dorsal and ventral groups: the special case of panniculus carnosus	Margaret Hall, Justin Georgi, Aryeh Grossman, Jose Rodriguez-Sosa, E.L.R. Simons, Heather Smith, Georgina Voegelé; Midwestern University, Midwestern University, University of Chicago
11:15 am	5-6	Adaptation and integration in the muscle moment arms of two hip extensors in caviomorph rodents	Jan Wölfer, Maximilian Vella, Leonie Schielke, John Nyakatura; Humboldt-Universität zu Berlin, Humboldt Universität zu Berlin

**10:00 AM – 11:30 AM****Session 6****M5-M6****New Approaches to Vertebrate Brain Evolution***Chairs: Andrew Iwaniuk, Kara E. Yopak*

- |          |            |   |   |
|----------|------------|---|---|
| 10:00 am | <b>6-1</b> | Sharks, smarts, and headstarts: Brain evolution in cartilaginous fishes   | <i>Kara Yopak; University of North Carolina Wilmington</i>  |
| 10:15 am | <b>6-2</b> | Evolution of the cerebro-cerebellar system revealed by neuron counts  | <i>Pavel Němec, Francesco Dionigi, Alexandra Polonyiová, Lucie Marhounová, Martin Kocourek, Yicheng Zhang, Seweryn Olkowicz, Kristina Kverkova, Patrik Stehlik; Chares University</i> |
| 10:30 am | <b>6-3</b> | The Evolution of the Brain in Euarchontoglires: new perspectives and novel methodologies  | <i>Mary Silcox, Madlen Lang; University of Toronto, Scarborough</i>   |
| 10:45 am | <b>6-4</b> | Brain and endocast evolution over the fish-tetrapod transition: insights from extant taxa inform interpretation of Palaeozoic Sarcopterygians | <i>Alice Clement, Richard Cloutier, Tom Challands, Corinne Mensforth, John Long; Flinders University, Université du Québec à Rimouski, University of Edinburgh</i>                    |
| 11:00 am | <b>6-5</b> | How artificial selection can inform the study of brain evolution  | <i>Andrew Iwaniuk; University of Lethbridge</i>   |
| 11:15 am | <b>6-6</b> | Understanding the endocranial morphological diversity of modern bats (Mammalia: Chiroptera)   | <i>Camilo Lopez-Aguirre, John Ratcliffe, Mary Silcox; University of Toronto Scarborough, University of Toronto Mississauga</i>  |

**10:00 AM – 11:15 AM****Session 7****M2-M3****Pointy Things***Chair: Zichuan Qin*

- |          |            |  |   |
|----------|------------|--|---|
| 10:00 am | <b>7-1</b> | Comparative variation in kinematic transmission of the beak among birds  | <i>Amber Wagstaffe, Philip Anderson, Roger Benson, Gavin Thomas, Peter Watson, Jen Bright; University of Hull, University of Illinois, Urbana-Champaign, University of Oxford, University of Sheffield</i>  |
| 10:15 am | <b>7-2</b> | What's the point?: Morphology and function of claws in attachment in pad-bearing geckos  | <i>Rishab Pillai, Jendrian Riedel, Wytamma Wirth, Will Edwards, Slade Allen-Ankins, Lin Schwarzkopf; James Cook University, Leibniz Institute for the Analysis of Biodiversity Change - Museum Koenig Bonn, Peter Doherty Institute for Infectious Diseases</i> |
| 10:30 am | <b>7-3</b> | Morphological disparity and functional adaption of Mesozoic birds manual claws   | <i>Zichuan Qin, Emily Rayfield, Yuming Liu, Mike Benton, William Deakin, Shiyang Wang, Congyu Yu; University of Bristol, Shenyang Normal University</i>   |
| 10:45 am | <b>7-4</b> | Snakes – Have They Bitten Off More Than They Can Chew?   | <i>Roxanne Armfield, Jacques Gauthier; Yale University</i>  |
| 11:00 am | <b>7-5</b> | Putting the sharp in sharpnose: the morphology and distribution of denticles inside the olfactory rosette of Atlantic sharpnose sharks ( <i>Rhizoprionodon terraenovae</i> ) | <i>Lauren Simonitis, Aubrey Clark, Tricia Meredith, Marianne Porter; Florida Atlantic University, University of Washington's Friday Harbor Labs</i>   |

**10:00 AM – 11:30 AM****Session 8****M7-M8****Symposium in Honor of Sue Herring: A Giant in Her Field (Part 2)***Chairs: Robert Druzinsky, Rebecca Z. German, Anthony Herrel*

- |          |            |  |   |
|----------|------------|--|---|
| 10:00 am | <b>8-1</b> | Revisiting old questions with new methods: interplay between embryonic motility and craniofacial development | <i>Julia Molnar, Akinobu Watanabe; New York Institute of Technology College of Osteopathic Medicine</i>   |
| 10:15 am | <b>8-2</b> | Ontogenetic changes in bite force and gape in tufted capuchins   | <i>Myra Laird, Cláudia Kanno, Caitlin Yoakum, Mariana Fogaça, Andrea Taylor, Callum Ross, Janine Chalk-Wilayto, Megan Holmes, Claire Terhune, José Américo de Oliveira; University of Pennsylvania, Universidade Estadual Paulista (UNESP), Research Center "Núcleo de Procriação de Macacos-Prego", Araçatuba Dental School, Arkansas College of Health Education, Institute of Population Genetics, University of Veterinary Medicine, Vienna &amp; Neotropical Primates Research Group – NeoPREGo, Touro University, University of Chicago, Mercer University, Duke University, University of Arkansas</i>                       |
| 10:30 am | <b>8-3</b> | Ontogeny of masticatory muscle size in tufted and untufted capuchins   | <i>Claire Terhune, Caitlin Yoakum, Myra Laird, Janine Chalk-Wilayto, Cláudia Kanno, José Américo de Oliveira, Taylor Polvadore, Mariana Fogaça, Callum Ross, Andrea Taylor, Megan Holmes; University of Pennsylvania, Arkansas College of Health Education, University of Pennsylvania, Mercer University, Universidade Estadual Paulista (UNESP), Research Center "Núcleo de Procriação de Macacos-Prego", Araçatuba Dental School, Institute of Population Genetics, University of Veterinary Medicine, Vienna &amp; Neotropical Primates Research Group – NeoPREGo, University of Chicago, Touro University, Duke University</i> |



# FRIDAY, 28 JULY 2023

10:45 am	<b>8-4</b>	The Ontogenetic Interface of Jaw-Muscle Leverage and Cranial Morphology in Capuchin Primates	<i>Megan Holmes, Parker Taylor, Rocío Ramirez, Megan Solis, Mariana Fogaça, Janine Chalk-Wilayto, Claire Terhune, Myra Laird; Duke University, University of Arkansas, University of Southern California, Stony Brook University, Institute of Population Genetics, University of Veterinary Medicine, Vienna &amp; Neotropical Primates Research Group – NeoPREGo, Mercer University, University of Pennsylvania</i>
11:00 am	<b>8-6</b>	Bendy Hyoids: In-Vivo and Ex-Vivo Loading and Stiffness of the Hyoid Arch in Elasmobranchs.	<i>Cheryl Wilga, Elizabeth Dumont, Lara Ferry; University of Rhode Island, University of California Merced, Arizona State University</i>

**1:30 PM – 3:30 PM**

**Session 9**

**Auditorium C**

## Fish Feeding

*Chair: L Patricia Hernandez*

1:30 pm	<b>9-1</b>	Is that a fish tongue?: Comparative morphology of the cypriniform palatal organ	<i>L Patricia Hernandez, Kelsie Pos; George Washington University</i>
1:45 pm	<b>9-2</b>	Pharyngeal jaw suction feeding in channel catfish ( <i>Ictalurus punctatus</i> )	<i>Corrine Avidan, Elizabeth Brainerd; Brown University</i>
2:00 pm	<b>9-3</b>	Comparative feeding mechanics of extant lungfishes	<i>Hugo Dutel, Matteo Fabbri, Laura Porro, Kathleen Dollman, Emily Rayfield; University of Bristol, Field Museum of Natural History, University College London, ESRF</i>
2:15 pm	<b>9-4</b>	Feeding kinematics of algal grazing in the gobiid fish <i>Sicydium punctatum</i> : a missing link in the evolution of goby climbing biomechanics?	<i>Richard Blob, Takashi Maie, Heiko Schoenfuss; Clemson University, University of Lynchburg, St. Cloud State University</i>
2:30 pm	<b>9-5</b>	The influence of diet on dental complexity in damselfishes	<i>Keiffer Williams, Samantha Price; Clemson University</i>
2:45 pm	<b>9-6</b>	To Bite or Not to Bite: An investigation into the Tongue-Bite-Apparatus in mormyrid fishes ( <i>Osteoglossiformes</i> )	<i>Kassandra Ford, L Patricia Hernandez; George Washington University</i>
3:00 pm	<b>9-7</b>	A pound of flesh, a pint of blood - ectoparasitic fishes as a model system for understanding evolutionary novelty & diversity	<i>Matthew Kolmann; University of Louisville</i>
3:15 pm	<b>9-8</b>	Evolution and Anatomy of Gizzards in Fishes	<i>Sarah Handy, Lauren Simonitis, Karly Cohen, Matthew Kolmann; Arizona State University, Florida Atlantic University, University of Washington's Friday Harbor Labs, University of Florida, University of Louisville</i>

**1:30 PM – 3:30 PM**

**Session 10**

**M2-M3**

## Jumping, Digging, Climbing, and Hanging

*Chair: Kristi L. Lewton*

1:30 pm	<b>10-1</b>	Comparative analysis of musculoskeletal anatomy in relation to locomotor mode in frogs	<i>Alice Leavey, Laura Porro, Christopher Richards; UCL, University College London, Royal Veterinary College</i>
1:45 pm	<b>10-2</b>	Climbing kinematics and ecomorphology of <i>Aneides</i> salamanders	<i>Jonathan Huie, R. Alexander Pyron, Sandy Kawano; The George Washington University</i>
2:00 pm	<b>10-3</b>	Size and locomotor influences on hindlimb bone cross-sectional properties in saltatory rodents, marsupials, and primates	<i>Kristi Lewton, Kaitlin Hsu, Chloe Knitt, Kyle Schtul, Megan Solis; University of Southern California, University of Colorado, Stony Brook University</i>
2:15 pm	<b>10-4</b>	Long bone loading during suspensory locomotion in brown-throated three-toed sloths ( <i>Bradypus variegatus</i> )	<i>Angela Mossor, Andrew McKamy, Melody Young, Michael Granatosky, Michael Butcher, Jesse Young; Kent State University/ NEOMED, Youngstown State University, New York Institute of Technology, Northeast Ohio Medical University</i>
2:30 pm	<b>10-5</b>	Anatomical Correlates of Cursoriality are Compromised by Body Size and Propensity to Burrow in a Group of Small Mammals ( <i>Lagomorpha</i> )	<i>Ellen Martin, Jesse Young, Connie Fellmann, Brian Kraatz, Emma Sherratt; University of Adelaide, Northeast Ohio Medical University, Colorado State University, Western University of Health Sciences</i>
2:45 pm	<b>10-6</b>	A Permian burrow of stem lepidosaurs and the Paleozoic origin of extant reptile diversity	<i>Tyler Lyson, Eldon Panigot, Holger Petermann, Chase Brownstein, Bruce Rubidge, Gabriel Bever; Denver Museum of Nature &amp; Science, Yale University, University of Witwatersrand, Johns Hopkins University</i>
3:00 pm	<b>10-7</b>	Functional morphology of the head and neck in a new cistecephalid dicynodont (Therapsida: Anomodontia) with implications for the evolution of fossoriality within the clade	<i>Selena Martinez, Jacqueline Lungmus, Kenneth Angielczyk; The University of Chicago, Sam Noble Oklahoma Museum of Natural History, University of Oklahoma, Field Museum of Natural History</i>
3:15 pm	<b>10-8</b>	Variation in curvature and cortical geometry in the primate humerus and their consequences for inferring biomechanical performance	<i>Blake Dickson, Daniel Schmitt, Kevin Hunt; University of New South Wales, Duke University, Indiana University</i>

1:30 PM – 3:30 PM

Session 11

M5-M6

**Paleohistological Inferences of Paleobiological Traits in Pseudosuchia***Chairs: Jorge Cubo, Mariana Valeria de Araujo Sena, Holly Noelle Woodward*

- 1:30 pm **11-1** Synchrotron-based palaeohistology of a small aetosaur from the Upper Triassic Woźniki locality (southern Poland) – growth plasticity or ontogenetic variation? *Elżbieta Teschner, Dawid Drózdź, Julia Desojo, Mateusz Tałanda, Mateusz Antczak, Vincent Fernandez, Tomasz Sulej; University of Opole, Institute of Paleobiology, Polish Academy of Sciences, CONICET División Paleontología Vertebrados Museo de La Plata, University of Warsaw, Institute of Evolutionary Biology, European Synchrotron Radiation Facility*
- 1:45 pm **11-2** Evaluating femur volume as a predictor of body size in Pseudosuchia *Holly Woodward, Haley O'Brien, Paul Aubier, Jorge Cubo, James Farlow; Oklahoma State University Center for Health Sciences, University of Arizona Health Sciences, Sorbonne Université, Indiana University-Purdue University Fort Wayne*
- 2:00 pm **11-3** Was *Pelagosaurus typus* (Crocodylomorpha: Metriorhynchoidea) an ambush predator or an active hunter? Warm-blooded or cold-blooded? *Jorge Cubo, Stéphane Jouve, Mariana Sena, Romain Pellarin, Ronan Allain, Nour-Eddine Jalil; Sorbonne Université, MNHN*
- 2:15 pm **11-4** An examination into the palaeohistology of *Thalattosuchia* (Crocodylomorpha) from the Posidonia Shale Formation, Germany *Michela Johnson, Erin Maxwell; Staatliches Museum für Naturkunde*
- 2:30 pm **11-5** The consequences of calcium: investigating intracortical reproductive signals in the American Alligator for sex determination. *Christian Heck, Holly Woodward; Pacific Northwest University of Health Sciences, Oklahoma State University Center for Health Sciences*
- 2:45 pm **11-6** Integrating histology and vertebral anatomy to reconstruct cardiopulmonary evolution near the divergence of *Avemetatarsalia* and *Pseudosuchia* *Paul Byrne, Lucas Legendre, Nathan Smith, Randall Irmis, Scott Echols, Colleen Farmer, Yun-Hsin Wu, Adam Huttenlocker; University of Southern California, Natural History Museum of Los Angeles County, The University of Texas at Austin, Natural History Museum of Los Angeles County, The Medical Center for Birds, University of Utah*

1:30 PM – 3:30 PM

Session 12

M7-M8

**Symposium in Honor of Sue Herring: A Giant in Her Field (Part 3)***Chairs: Robert Druzinsky, Rebecca Z. German, Anthony Herrel*

- 1:30 pm **12-1** How does the periodontal ligament support the rooting behavior of pigs, *Sus scrofa*? *Tracy Popowics; University of Washington*
- 1:45 pm **12-2** Dentofacial adaptations to masticatory muscle function *Stavros Kiliaridis; University of Geneva*
- 2:00 pm **12-3** Characteristics of Obstructive Sleep Apnea in Obese Minipigs *Zi-Jun Liu; University of Washington*
- 2:15 pm **12-4** The scutulum in *Rhinolophus* - sesamoid and/or meniscus? *Scott Pedersen, Richard Carter, Chelsie Snipes; South Dakota State University, East Tennessee State University*
- 2:30 pm **12-5** A multi-proxy approach to masticatory function in howling monkeys in Costa Rica *Mark Teaford, Christopher Vinyard, Susan Williams, Ken Glander, Cynthia Thompson; Touro University, Ohio University, Duke University, Grand Valley State University*
- 2:45 pm **12-6** Comparing stiffness and density of the skull and mandible across whales, dolphins, and even-toed hoofed mammals *Danielle Adams, Brad Boyce, Dan Hooks, Benjamin Klitsner, Samantha Price, Richard Blob; Clemson University, Sandia National Laboratory, Los Alamos National Laboratories*
- 3:00 pm **12-7** Myological diversity of the masticatory apparatus of herbivorous mammals *Marcos Ercoli, Alicia Álvarez, Natalie Warburton, Christine Janis, Elena Potapova, Sue Herring, Guillermo Cassini, Juliana Tarquini, Alexander Kuznetsov; INECONA, Harry Butler Institute, Murdoch University, University of Bristol, Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences, University of Washington, Museo Argentino de Ciencias Naturales (MACN), Laboratorio de Paleontología de Vertebrados (CICYTTP)*

5:00 PM – 6:00 PM

Plenary 1

Auditorium C

- 5:00 pm Musculoskeletal adaptations in macropodoids – convergence and functional analogues *Natalie Warburton; Harry Butler Institute, Murdoch University*

# Saturday, 29 July 2023

8:00 AM – 9:30 AM		Session 13	M2-M3
<b>Functional Morphology and Biomechanics of Trabecular Bone: Insights Across Organisms and Scales (Part 1)</b>			
<i>Chairs: Stephanie Smith, Michael Doube</i>			
8:00 am	13-1	Trabecular bone distribution and its relationship to joint loading across the ape metatarsus	Zewdi Tsegai, Tracy Kivell, Matthew Skinner; University of Chicago, University of Kent, Max Planck Institute for Evolutionary Anthropology
8:15 am	13-2	The 'indianaBones' R package and a novel protocol to study whole trabecular network: preliminary results from primates	Fabio Alfieri, Marine Cazenave, Uyen Nguyen, Daniele Panetta, Piero Salvadori, Damiano Marchi, Eli Amson, John Nyakatura, Alessio Veneziano; Humboldt Universität zu Berlin, American Museum of Natural History, University of Kent, Canterbury, University of Pretoria, Università di Pisa, University of the Witwatersrand, Museum für Naturkunde Stuttgart, Universitat Rovira i Virgili
8:30 am	13-3	Regional variation of epiphyseal fusion and trabecular architecture in cetacean vertebrae	Jamie Knaub, Marianne Porter; Florida Atlantic University
8:45 am	13-4	How trabecular bone adapts to biomechanical constraints associated with high body weight in limb long bones	Alexandra Houssaye, Cyril Etienne; CNRS/MNHN
9:00 am	13-5	Does carnivoran trabecular bone morphology reflect differences in intensity of locomotor strategy?	Habiba Chirchir, Layne Assif; Marshall University

8:00 AM – 9:30 AM		Session 14	Auditorium C
<b>Joints in Motion</b>			
<i>Chair: Armita Manafzadeh</i>			
8:00 am	14-1	XROMM analysis of flipper movement during locomotion in loggerhead sea turtles	Samantha Trail, Christopher Mayerl, John Capano, Armita Manafzadeh, Noraly van Meer, Richard Blob, Jeanette Wyneken, Elizabeth Brainerd; Florida Atlantic University, Northern Arizona University, Brown University, Yale University, Wageningen University, Clemson University
8:15 am	14-2	Keeping clean: a study of self-grooming kinematics in small sized mammals.	Manuela Schmidt, Celina Richter, Julia van Beesel, Martin Fischer; Friedrich Schiller University, Delft University of Technology
8:30 am	14-3	Extreme long-axis rotation: the functional consequences of fibular reduction in theropod dinosaurs	Armita Manafzadeh, Stephen Gatesy; Yale University, Brown University
8:45 am	14-4	X-ray motion analysis reveals 3D kinematics in the forelimb of balancing tamanduas ( <i>Tamandua tetradactyla</i> )	Adrian Scheidt, Paulo Ditzel, Sandra Geiger, Franziska Wagner, Christoph Mülling, John Nyakatura; Humboldt Universität Berlin, Leipzig University
9:00 am	14-5	A novel mode of jaw protrusion in the hingemouth, <i>Phractolaemus ansorgii</i>	Allyson Evans, Emily Naylor, Nathan Lujan, Sandy Kawano, L Patricia Hernandez; George Washington University, James Madison University, Royal Ontario Museum

8:00 AM – 9:30 AM		Session 15	M7-M8
<b>More Than Sucking, Chewing, and Swallowing: Feeding Biomechanics in Vertebrates and Beyond (Part 1)</b>			
<i>Chairs: Christine Böhmer, Mugino Kubo, Daniela E. Winkler, Shinji Nagata</i>			
8:00 am	15-1	Is there a veggie option? Dietary adaptation and feeding mechanics in dinosaurs	Stephan Lautenschlager; University of Birmingham
8:30 am	15-2	Diet-induced morphological change in red squirrels	Kim Chandler, Andrew Kitchener, Philip Cox; University of York, National Museums Scotland, University College London
9:00 am	15-3	Extant anamniotes as models of how feeding influences terrestrialization events	Nicolai Konow; U. Mass. Lowell

8:00 AM – 9:30 AM		Session 16	M5-M6
<b>Traumatic Brain Injury: Not Just for Humans (Part 1)</b>			
<i>Chair: Nicole Ackermans</i>			
8:00 am	16-1	Lessons from outside of the laboratory: naturally occurring TBI	Nicole Ackermans; University of Alabama
8:30 am	16-2	TBI magnitude affects anxiety and dopaminergic signaling in fish	Cassidy McColl, Ryan Earley, Grace Bollinger, Kathryn Rathke, Bailey Maze, Andrew Atkinson, Jenna Hartzler; University of Alabama, University of South Carolina School of Medicine Columbia

# SATURDAY, 29 JULY 2023

8:45 am	16-3	Is the braincase a headbutting stabilizer?	Nicole Ackermans, Terrie Williams, Patrick Hof, Joy Reidenberg; University of Alabama, University of California, Santa Cruz, Icahn School of Medicine at Mount Sinai
9:00 am	16-4	'They're just like football players': Human ethics in animal research	Gregory Hollin; University of Sheffield

## 10:00 AM – 11:30 AM

### Session 17

M2-M3

#### Functional Morphology and Biomechanics of Trabecular Bone: Insights Across Organisms and Scales (Part 2)

*Chairs: Stephanie Smith, Michael Doube*

10:00 am	17-1	Characterizing the complex relationship between limb morphology, microanatomy and posture to draw reliable paleoecological inferences in early amniotes and relatives	Aurore Canoville, Andréas Jannel; Stiftung Schloss Friedenstein Gotha, Museum für Naturkunde
10:15 am	17-2	BoneJ status and the evolving ecosystem of bone analysis software	Michael Doube; City University of Hong Kong
10:30 am	17-3	Early evolution of trabecular-bone resistance to terrestrial constraints in a fossil lobe-finned fish	François Clarac, Alexis Cornille, Sifra Bijl, Paul Tafforeau, Sophie Sanchez; CR2P, Centre de Recherche en Paléontologie-Paris, Muséum National d'Histoire Naturelle, Sorbonne Université, Centre National de la Recherche Scientifique, Museum für Naturkunde Berlin, Uppsala University, European Synchrotron Radiation Facility
10:45 am	17-4	The helmeted hornbill's hammer: complex anatomy and impact-resistant structural design of the casque	Chloe Hatten, Mason Dean, Venkata Surapaneni, Benjamin Flaum, Ting Fai Kong, Ruien Hu; City University of Hong Kong, The Hong Kong Polytechnic University
11:00 am	17-5	Body size effects on trabecular bone morphology in Philippine cloud forest rodents	Stephanie Smith, Kenneth Angielczyk, Lawrence Heaney; Field Museum of Natural History
11:15 am	17-6	Intraspecific variation in trabecular bone in metapodials – a case-study in kangaroos	Tyson Puggaard, Natalie Warburton, Guanjin Wang, Aaron Camens; Murdoch University, Harry Butler Institute, Murdoch University, Flinders University

## 10:00 AM – 11:30 AM

### Session 18

Auditorium C

#### Long in the Tooth: New Insights Into the Functional Morphology of Hypertrophied Canines from Gorgonopsids to Sabertooth Cats (Part 1)

*Chairs: Tahlia Pollock, Adam Hartstone-Rose, Lars Werdelin*

10:00 am	18-1	Sabertooths and beyond: a review of hypertrophied canines and their uses	Lars Werdelin, Tahlia Pollock, Adam Hartstone-Rose; Swedish Museum of Natural History, Monash University, North Carolina State University
10:30 am	18-2	A myological approach to gape and bite force reconstruction in Smilodon	Adam Hartstone-Rose, Ashley Deutsch, Arin Berger, Lara Martens; North Carolina State University
11:00 am	18-3	Assessing the biomechanics of sabre teeth through the trade-off between puncture performance and breakage resistance	Tahlia Pollock, William Deakin, William Parker, Narimane Chatar, Olga Panagiotopoulou, Douglass Rovinsky, Justin Adams, David Hocking, Philip Donoghue, Emily Rayfield, Alistair Evans; Monash University, University of Bristol, University of Liège, Flinders University, Tasmanian Museum and Art Gallery
11:15 am	18-4	Comparative serration histology in hyper carnivorous fossils	Megan Whitney, Aaron LeBlanc, Ashley Reynolds, Kirstin Brink; Loyola University of Chicago, King's College London, University of Toronto, University of Manitoba

## 10:00 AM – 11:30 AM

### Session 19

M7-M8

#### More Than Sucking, Chewing, and Swallowing: Feeding Biomechanics in Vertebrates and Beyond (Part 2)

*Chairs: Christine Böhmer, Mugino Kubo, Daniela E. Winkler, Shinji Nagata*

10:00 am	19-1	Evolutionary changes of the mammalian skull and their influence on feeding efficiency	Julia Schultz; Universität Bonn
10:15 am	19-2	The universal wear process: mandible microwear texture analysis of crickets raised on different diets	Daniela E. Winkler, Hitomi Seike, Shinji Nagata, Mugino Kubo; Kiel University, Zoological Institute, The University of Tokyo
10:30 am	19-3	Aquatic feeding in pinnipeds: Does the masticatory musculature reflect dietary specializations in grey seals and harbor seals?	Christine Böhmer, Anne Erichsen, Paul Krapoth, Charlotte Thøstesen; Christian-Albrechts-Universität zu Kiel, The Fisheries and Maritime Museum
10:45 am	19-4	Unique agenesis of third molars in a wild sika deer population impacts longevity	Mugino Kubo, Daniela E. Winkler; The University of Tokyo, Graduate School of Frontier Sciences, Kiel University, Zoological Institute

11:00 am	<b>19-5</b>	Dynamic simulation of macaque jaw mechanics during a complete power stroke of mastication.	<i>Olga Panagiotopoulou, Dale Robinson, Jose Iriarte-Diaz, David Ackland, Alec Wilken, Andrea Taylor, Callum Ross; Monash University, University of Melbourne, University of the South, University of Chicago, Touro University</i>
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**10:00 AM – 11:30 AM      Session 20      M5-M6**

**Traumatic Brain Injury: Not Just for Humans (Part 2)**

*Chair: Nicole Ackermans*

10:00 am	<b>20-1</b>	An amphibious fish that might self-inflict TBI?	<i>Ryan Earley, Cassidy McColl, Grace Bollinger, Jenna Hartzler, Brandon McCormick, Andrea Glenn; University of Alabama</i>
10:30 am	<b>20-2</b>	Short and Long-Term Effects of Mild Traumatic Brain Injury on Aggressive and Risky Behavior	<i>Grace Bollinger, Cassidy McColl, Kathryn Rathke, Claire Tumlin, Ryan Earley; University of Alabama, University of South Carolina School of Medicine Columbia</i>
10:45 am	<b>20-3</b>	Transcriptomic Characterization of neuronal damage markers in the dolphin cortex	<i>Brigid Maloney, Ksenia Orekhova, Maisha Uddin, Erich Jarvis, Marcelo Magnasco, Rockefeller University, University of Padova, CUNY Hunter College</i>

**1:30 PM – 4:00 PM      Session 21      M5-M6**

**Birds: Past and Present**

*Chair: Daniel Field*

1:30 pm	<b>21-1</b>	Elucidating the ecological and life history drivers of Galloanserae skull evolution using high density 3D geometric morphometrics	<i>Eloise Hunt, Ryan Felice, Daniel Field, Joseph Tobias, Anjali Goswami; Natural History Museum, London, University College London, University of Cambridge, Imperial College London</i>
1:45 pm	<b>21-2</b>	A tool for testing aeroelastic links in bird wings: Blocking feather muscle activity in vivo in fowl ( <i>Gallus gallus</i> ) with 6-hydroxydopamine.	<i>Tobin Hieronymus, Patricia Sanchez Montejo, Caleb Oleson, Bret Tobalske; Northeast Ohio Medical University, University of Montana</i>
2:00 pm	<b>21-3</b>	Quantification of avian postcranial pneumaticity sheds light on the evolution and function of skeletal pneumatization	<i>Maria Grace Burton, Roger Benson, Daniel Field; University of Cambridge, University of Oxford</i>
2:15 pm	<b>21-4</b>	Patterns of morphological convergence in the crania and hindlimbs of Anseriformes	<i>Ray Chatterji, Janet Buckner; The University of Texas at Arlington</i>
2:30 pm	<b>21-5</b>	Phenotypic evolution influences speciation and extinction in birds	<i>Ryan Felice, Christopher Torres, Patrick OConnor, Michael May; University College London, Ohio University, University of California, Davis</i>
2:45 pm	<b>21-6</b>	Comparative morphology of the passerine appendicular skeleton; implications for unravelling the early evolution of Passeriformes	<i>Elizabeth Steell, Matthieu Chotard, Jacqueline Nguyen, Roger Benson, Daniel Field; University of Cambridge, The Chinese University of Hong Kong, Australian Museum, University of Oxford</i>
3:00 pm	<b>21-7</b>	Remarkable insights into modern bird origins from the Type Maastrichtian	<i>Daniel Field, Juan Benito, Pei-Chen Kuo, Albert Chen, Klara Widrig, Daniel Ksepka, John Jagt; University of Cambridge, Bruce Museum, Natuurhistorisch Museum Maastricht</i>

**1:30 PM – 4:00 PM      Session 22      Auditorium C**

**Long in the Tooth: New Insights Into the Functional Morphology of Hypertrophied Canines from Gorgonopsids to Sabertooth Cats (Part 2)**

*Chairs: Adam Hartstone-Rose, Lars Werdelin, Tahlia Pollock*

1:30 pm	<b>22-1</b>	Investigating the Morphological Diversity of the Canine Teeth of Sabertooth Feliforms and their Extant Relatives and its Potential Use as a Diagnostic Tool	<i>Caitlin Shelbourne, Stephan Lautenschlager; University of Birmingham</i>
1:45 pm	<b>22-2</b>	Mandibular shape and mechanical performance of <i>Smilodon fatalis</i> through ontogeny	<i>Narimane Chatar, Valentin Fischer, Clara Julémont, Jack Tseng; University of Liège, University of California, Berkeley</i>
2:00 pm	<b>22-3</b>	Bite me: comparing cranial biomechanics in <i>Smilodon fatalis</i> vs <i>Barbourofelis fricki</i>	<i>Borja Figueirido, Stephan Lautenschlager; University of Málaga, University of Birmingham</i>
2:15 pm	<b>22-4</b>	Taking a bite out of the controversy: A practical method for investigating the killing bite of sabertooths	<i>Joseph Costa, Frank Mendel; State University of New York at Buffalo</i>
2:45 pm	<b>22-5</b>	Fangs, Beaks and Spines-Oh My!: The Diversity and Energetics of Biological Puncture Systems	<i>Philip Anderson, Kehan Pan, Brad Scott, Abby Weber, Bingyang Zhang; University of Illinois, Urbana-Champaign, ETH Zurich</i>



# SATURDAY, 29 JULY 2023

3:00 pm	<b>22-6</b>	Leveraging the Bite: Comparative humeral strength in <i>Smilodon fatalis</i> and extant pantherine cats	<i>Emily Bogner, Jack Tseng, Julie Meachen; University of California, Berkeley, Des Moines University</i>
3:15 pm	<b>22-7</b>	The Utility of Saber-like Canines in Gentle Giants; a study of Uintathere teeth	<i>Benjamin Burger; Utah State University - Uintah Basin Campus</i>
3:45 pm	<b>22-8</b>	Who was the real sabertooth: <i>Thylacosmilus</i> or <i>Thylacoleo</i> ?	<i>Christine Janis; Bristol Palaeobiology Group, University of Bristol</i>

**1:30 PM – 4:00 PM**

## Session 23

**M7-M8**

### More Than Sucking, Chewing, and Swallowing: Feeding Biomechanics in Vertebrates and Beyond (Part 3)

*Chairs: Christine Böhmer, Mugino Kubo, Daniela E. Winkler, Shinji Nagata*

1:30 pm	<b>23-1</b>	Moving skulls: kinesis and sutures in feeding biomechanics of reptiles	<i>Jordi Marcé-Nogué, Josep Fortuny; Universitat Rovira i Virgili, Institut Català de Paleontologia Miquel Crusafont</i>
2:00 pm	<b>23-2</b>	Evolutionary conserved mandibular exoskeleton structures in chewing insects	<i>Shinji Nagata, Hitomi Seike, Wataru Kashiwabara, Michio Suzuki; The University of Tokyo</i>
2:15 pm	<b>23-3</b>	Investigating the strength of mechanical function in controlling the shape of vertebrate jaws	<i>William Deakin, Emily Rayfield, Philip Donoghue; University of Bristol</i>
2:30 pm	<b>23-4</b>	Functional morphology of the pharyngeal teeth of the ocean sunfish, <i>Mola mola</i>	<i>Benjamin Flaum, Mason Dean, Laura Ekstrom, Michael Blumer; City University of Hong Kong, Wheaton College, Medical University of Innsbruck</i>
2:45 pm	<b>23-5</b>	Lessons from really big fish : integrating incomplete data in parametric modelling of coherent skeletal model	<i>Tairan Li, Martha Paskin, Mike Schindler, Venkata Surapaneni, Frederik Mollen, Daniel Baum, Sean Hanna, Mason Dean; University College London, Zuse Institute of Berlin, City University of Hong Kong, Elasmobranch Research Belgium (ERB), Zuse Institute Berlin</i>

**1:45 PM – 4:00 PM**

## Session 24

**M2-M3**

### Paleo-Evo-Devo

*Chair: Zachary Morris*

1:45 pm	<b>24-2</b>	Positive allometric shift of prenasal cartilage during craniofacial development underpins the origin of the avian beak	<i>Matteo Fabbri, Daniel Paredes, Miccaela Cereghino, Hugo Dutel, Alex Ruebenstahl, James Napoli, Roxanne Armfield, Laurel Yohe, Lawrence Witmer, Jingmai O'Connor, Roger Benson, Bhart-Anjan Bhullar; Field Museum of Natural History, Museum für Naturkunde, Leibniz-Institut für Evolutions- und Biodiversitätsforschung, University of Bristol, Yale University, American Museum of Natural History, UNC Charlotte, Ohio University Heritage College of Osteopathic Medicine, University of Oxford</i>
2:00 pm	<b>24-3</b>	Developmental mechanism for pelvic fin evolution in chondrichthyans.	<i>Catherine Boisvert, Jacob Pears, Carley Tillett, Rui Tahara, Hans Larsson, Kate Trinajstic; Curtin University, Hub for Immersive Visualisation and eResearch, Curtin University, Redpath Museum, McGill University</i>
2:15 pm	<b>24-4</b>	Developmental mechanisms of maxillary variation among bats and implications for craniofacial diversification in mammals	<i>Fumiya Meguro, Masaki Takechi, Toshiko Furutera, Taro Nojiri, Yannick Pommery, Laura Wilson, Vuong Tan Tu, Kai Ito, Daisuke Koyabu; University of Tsukuba, Juntendo University, Australian National University, Vietnam Academy of Science and Technology, The University of Tokyo, City University of Hong Kong</i>
2:30 pm	<b>24-5</b>	Revisiting the homology of the therian premaxilla	<i>Hiroki Higashiyama, Daisuke Koyabu, Hiroki Kurihara; The University of Tokyo, University of Tsukuba, City University of Hong Kong</i>
2:45 pm	<b>24-6</b>	The developmental mechanisms underlying the evolution of the avian pelvis	<i>Christopher Griffin, Zachary Morris, Bhart-Anjan Bhullar; Yale University</i>
3:00 pm	<b>24-7</b>	The origin of tympanic hearing in crown reptiles from a paleo-evo-devo perspective	<i>Mario Bronzati, Felipe Vieceli, Pedro Godoy, Felipe Montefeltro, Jann Nassif, Douglas Ribeiro, Vitoria Botezelli, C.Y. Irene Yan, Ingmar Werneburg, Tiana Kohlsdorf; University of São Paulo, University of Tübingen, Stony Brook University, Midwestern University</i>
3:15 pm	<b>24-8</b>	Embryonic origins of amniote palate diversity	<i>Zachary Morris, Bhart-Anjan Bhullar; Yale University</i>
3:30 pm	<b>24-9</b>	Evolution of the naso-palatal complex in Lepidosauria – insights from comparative embryology	<i>Paweł Kaczmarek, Ingmar Werneburg, Brian Metscher, Magdalena Kowalska, Weronika Rupik; University of Silesia in Katowice, University of Tübingen, University of Vienna</i>

SATURDAY, 29 JULY 2023

4:00 PM – 5:00 PM		P1	Auditorium A/B/D
P1-1	Locomotor biomechanics of the early dinosaur relative <i>Lagosuchus lilloensis</i>	Alejandro Otero, Peter Bishop, John Hutchinson; Museo de La Plata, Harvard University, Royal Veterinary College	
P1-2	Pug-nosed Pigs—What Goes Wrong?	Michael Baldwin, Katherine Rafferty, Sue Herring; University of Washington	
P1-4	Trunk morphology in the Asian and African savanna elephant	Lennart Eigen, Luke Longren, Daniel Baum, Ani Shubitidze, Oliver Lieschneegg, Thomas Hildebrandt, Michael Brecht; Bernstein Center for Computational Neuroscience Berlin, Zuse Institute Berlin, Leibniz Institute for Zoo and Wildlife Research	
P1-5	The bracing strut for flapping muscles: coracoid strength can be used to reveal the origin and evolution of wing-beat propulsion in birds.	Akeda Takumi, Shin-ichi Fujiwara; Nagoya University Graduate School of Environmental Studies, Nagoya University Museum	
P1-6	On the Development of the Avian Patella	Juan Pablo Venegas Martínez, Joao Botelho; Universidad de Chile, Pontificia Universidad Católica de Chile	
P1-7	Limb development GRNs are alternatively spliced during limb development	Sean Driscoll, Fjodor Merkuri, Jennifer Fish, Frederic Chain; Umass Lowell	
P1-8	Histomorphological indices to evaluate unique forelimb posture and digging strategy in moles (Eulipotyphla: Talpidae)	Daichi Nakai, Yasushi Yokohata; Nagoya University, University of Toyama	
P1-9	Postcanine tooth morphology of Arctic seals and its relation to their zooplankton reliance	Uno Ishihara, Yuuki Watanabe; Department of Polar Science, Graduate Institute for Advanced Studies, Japan	
P1-10	Integration of the oral and pharyngeal jaws of suckers (Cypriniformes: Catostomidae)	Kelsie Pos, L Patricia Hernandez; George Washington University	
P1-11	Lost in Endocranial Space: CT-based investigation of brain and endocast shape in frogs	David Blackburn, Jaimi Gray; University of Florida, Florida Museum of Natural History	
P1-12	The chondrocranium of the common musk turtle ( <i>Sternotherus odoratus</i> , Kinosternidae, Cryptodira, Testudines), with a comparison to other turtles	Luca Leicht, Zitong Zhang, Ingmar Werneburg; University of Tübingen, Fachbereich Geowissenschaften, Universität Tübingen	
P1-13	Morphological diversity and functional adaptations of the non-avian maniraptoran manual claws and indication of their ecological niche shifts	Yuming Liu, Zichuan Qin, William Deakin, Emily Rayfield, Mike Benton; University of Bristol	
P1-14	Analysis of a three-dimensional musculoskeletal model of the forelimb of <i>Guanlong wucaii</i> (Theropoda: Tyrannosauroida)	Sara Burch, John Hutchinson, Xi Yao, Xing Xu; SUNY Geneseo, Royal Veterinary College, Yunnan University, Institute of Vertebrate Paleontology and Paleoanthropology	
P1-15	Comparative 3D myology of the koala ( <i>Phascolarctos cinereus</i> ) and common wombat ( <i>Vombatus ursinus</i> ) forelimb	Hazel Richards, Justin Adams, Alistair Evans; Monash University	
P1-16	Comparative functional morphology of the pharyngeal musculature in invasive Asian Carp	L Patricia Hernandez, Caitlin Garrett, Allyson Evans, Kelsie Pos; George Washington University, The George Washington University	
P1-17	Biting off more than you can chew: Using finite-element analysis to predict feeding biomechanics of Devonian lungfish jaws	Joshua Bland, Alice Clement, Olga Panagiotopoulou, John Long; Flinders University, Monash University	
P1-18	Ozboneviz: A virtual 3D database of Australian vertebrate fauna skeletons	Vera Weisbecker, Pietro Viacava, Sofia Samper-Carro, Erin Mein, Jacob Van Zoelen, Tiina Manne; Flinders University, Australian National Wildlife Collection (CSIRO), The Australian National University, The University of Queensland	
P1-19	Cutting corners: a tool for measuring Functional Homodonty in 3D Slicer	Jonathan Huie, Karly Cohen; The George Washington University, University of Florida	
P1-20	Influence of muscular mechanical forces during the embryonic development of the opposable hallux of birds and its evolution from basal theropods.	Daniela Flores, Viviana Toro-Ibacache, Dominique Adriaens, Alexander Vargas; University of Chile, Centro de Análisis Cuantitativo en Antropología Dental, Universidad de Chile, Ghent University	
P1-21	The temporal region of the first aquatic crocodylomorphs and a comparison with extant crocodylians	María Victoria Fernandez Blanco, Pascal Abel, Fachbereich Geowissenschaften, Michela Maria Johnson, Franziska Zepf, Paula Bona, Ingmar Werneburg; Museo de La Plata, Eberhard-Karls-Universität Tübingen, Staatliches Museum für Naturkunde, University of Tübingen	

5:00 PM – 6:00 PM		Plenary 2	Auditorium C
5:00 pm	Taking a step back: 3-D kinematic studies spark new perspectives on skeletal and footprint form	Stephen Gatesy; Brown University	

# Sunday, 30 July 2023

8:15 AM – 9:30 AM

Session 25

M7-M8

## Domestication and Feralization: Modern Techniques on Evolutionary Exemplars (Part 1)

Chairs: Emma Sherratt, Ana Balcarcel, Akinobu Watanabe

8:15 am	25-2	The emergence of domestic dog morphology	Allowen Evin, Carly Ameen, Keith Dobney, Greger Larson; Institut des Sciences de l'Evolution, Université de Montpellier, CNRS, IRD, EPHE, University of Exeter, University of Sydney, University of Oxford
8:30 am	25-3	Universal or unique? Insights into morphological changes along the 'domestication continuum'	Madeleine Geiger; Natural History Museum St.Gallen
8:45 am	25-4	Phenomics Of Goldfish Domestication	Kévin Le Verger, Laurelle Küng, Anne-Claire Fabre, Thomas Schmelzle, Gabriel Aguirre-Fernández, Marcelo Sánchez-Villagra; Paleontological Institute and Museum at the University of Zurich, NMBE/UniBe
9:00 am	25-5	On the developmental origin of Araucana's ear-tufts	Daniel Nunez-Leon, Cheng-Ming Chuong; University of Southern California
9:15 am	25-6	Setting the tempo of morphological change: Osteological shape diversity in domestic pigs over 100 generations of intensive human directed selection	Ashleigh Haruda; University of Oxford

8:00 AM – 9:30 AM

Session 26

M2-M3

## Hearing, Seeing, and Smelling

Chair: Catherine Early

8:00 am	26-1	Paleoneurobiology of the Tetrapod Olfactory Bulb Inferred from Extant Chemoreceptor Repertoires	Laurel Yohe, Nicholas Krell, Matteo Fabbri, Bhart-Anjan Bhullar; UNC Charlotte, Field Museum of Natural History, Yale University
8:15 am	26-2	Diversification in the hearing and vestibular organs of elasmobranch fishes in 3D	Lucille Chapuis, Kara Yopak, Shaun Collin, Craig Radford; University of Bristol, University of North Carolina Wilmington, La Trobe University, Australia, University of Auckland
8:30 am	26-3	Developmental transcriptomics and morpho-informatics of bats provide new insights into the evolution of laryngeal echolocation and hearing	Rui Cao, Masaki Takechi, Fumiya Meguro, Peng Shi, Xiuwan Wang, Toshiko Furutera, Taro Nojiri, Vuong Tan Tu, Jun Li, Daisuke Koyabu; City University of Hong Kong, Juntendo University, University of Tsukuba, Vietnam Academy of Science and Technology
8:45 am	26-4	Avian olfactory bulb evolution informed by the Late Cretaceous neornithine <i>Asteriornis maastrichtensis</i>	Catherine Early, Sam Giles, Daniel Ksepka, Daniel Field; Science Museum of Minnesota, University of Birmingham, Bruce Museum, University of Cambridge
9:00 am	26-5	First turbinals from an alloverian mammal from <i>Meniscoessus robustus</i> (Cimolodonta, Multituberculata) of the Late Cretaceous of North America	Anne Weil, Alexander Claxton; Oklahoma State University Center for Health Sciences
9:15 am	26-6	Functional morphology of human and non-human primate middle ears	Alexander Stoessel, Romain David, Laura-Isabell Jantz, Steffen Ossmann, Matthias Bornitz, Marcus Neudert; Max Planck Institute for Evolutionary Anthropology Leipzig, Centre for Human Evolution Research, The Natural History Museum, Instituto de Medicina Molecular, University of Lisbon, TU Dresden

8:00 AM – 9:30 AM

Session 27

Auditorium C

## Teeth: Morphology, Function, and Evolution (Part 1)

Chairs: Marion Segall, Maitena Dumont

8:00 am	27-1	Probing for the developmental mechanisms underlying repeated tooth loss in frogs	Daniel Paluh; University of Dayton
8:15 am	27-2	Evolution of asymmetric dentition in Asian snail-eating snakes	Masaki Hoso; Waseda University
8:30 am	27-3	General principles of form and function in vertebrate teeth	Alistair Evans; Monash University
9:00 am	27-4	Squamates as a model to understand the key dental features of vertebrates	Lotta Salomies, Daria Razmadze, Julia Eymann, Nicolas Di-Poi; University of Helsinki
9:15 am	27-5	What causes differential colouration and banding in the dentine and enamel of fossilized teeth?	Kirstin Brink, Virginia Gold, Emily Cross, Rhy McMillan, Mostafa Fayek, Michael Schindler, Stefanie Brueckner, Caleb Brown; University of Manitoba, University of Victoria, Vancouver Island University, Royal Tyrrell Museum of Palaeontology

10:00 AM – 11:30 AM

Session 28

M2-M3

**Anatomical Variations of Hearing and Sound Production in Amniotes (Part 1)***Chairs: Jason Bourke, Daisuke Koyabu, Laura Wilson*

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|----------|-------------|---|--|
| 10:00 am | <b>28-1</b> | Subsonic symphonics of duck-bill dinosaurs: Computationally reconstructing acoustics in the nasal-crest of <i>Parasaurolophus</i> (Dinosauria: Hadrosauridae: Lambeosaurinae) | Jason Bourke, Terry Gates, Lawrence Witmer, Lindsay Zanno; NYITCOM at Arkansas State, North Carolina State University, Ohio University Heritage College of Osteopathic Medicine, North Carolina Museum of Natural Sciences   |
| 10:30 am | <b>28-2</b> | Modelling nasal airflow and acoustics in The Greater Horseshoe Bat ( <i>Rhinolophus ferrumequinum</i> )   | Carley Goodwin, Jason Bourke, Daisuke Koyabu, Laura Wilson; Australian National University, NYITCOM at Arkansas State, University of Tsukuba, City University of Hong Kong   |
| 11:00 am | <b>28-3</b> | Pre- and postnatal morphogenesis of the hyolaryngeal apparatus in bats with evolutionary insights into the laryngeal echolocation.  | Taro Nojiri, Nicolas Brualla, Masaki Takechi, Vuong Tan Tu, Dai Fukui, Richard Carter, Daisuke Koyabu; Juntendo University, City University of Hong Kong, Vietnam Academy of Science and Technology, The University of Tokyo Hokkaido Forest, East Tennessee State University, University of Tsukuba |

10:00 AM – 11:30 AM

Session 29

M7-M8

**Domestication and Feralization: Modern Techniques on Evolutionary Exemplars (Part 2)***Chairs: Ana Balcarcel, Akinobu Watanabe, Emma Sherratt*

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|----------|-------------|---|--|
| 10:00 am | <b>29-1</b> | Polish Crested Chickens: A Promising New Model System with Aberrant Head Anatomy  | Akinobu Watanabe, Scott Landman, Sylvia Marshall, Mohit Shah, Meredith Taylor, Todd Green, Paul Gignac; New York Institute of Technology, University of Arizona, Tucson  |
| 10:15 am | <b>29-2</b> | Does behavioral selection correlate with brain size? Testing the evolutionary plasticity of the brain with the cattle and dog breed models. | Ana Balcarcel, Marcelo Sánchez-Villagra, Anne-Claire Fabre, Allowen Evin; Paleontological Institute and Museum at the University of Zurich, NMBE/UniBe, Institut des Sciences de l'Evolution, Université de Montpellier, CNRS, IRD, EPHE   |
| 10:30 am | <b>29-3</b> | Feral cats in Australia – skull shape as a reflection of diet   | Trish Fleming, Heather Crawford, Clare Auckland, Sarah Barber, Natasha Tay, Natalie Warburton, Mike Calver; Harry Butler Institute, Murdoch University   |
| 10:45 am | <b>29-4</b> | Morphological Consequences of Domestication and Feralization in Rabbits   | Emma Sherratt, Brian Kraatz, Julia Schaar, Christine Böhmer, Irina Ruf, Thomas Sanger, Madeleine Geiger; The University of Adelaide, Western University of Health Sciences, Christian-Albrechts-Universität zu Kiel, Senckenberg Forschungsinstitut und Naturmuseum Frankfurt, Loyola University Chicago, Natural History Museum St.Gallen |
| 11:00 am | <b>29-5</b> | Modularity patterns in mammalian domestication: assessing developmental hypotheses for diversification                                      | Laura Wilson, Ana Balcarcel, Madeleine Geiger, Laura Heck, Marcelo Sánchez-Villagra; Australian National University, Paleontological Institute and Museum at the University of Zurich, Natural History Museum St.Gallen  |
| 11:15 am | <b>29-6</b> | Sheep and Goat: Comparison of 8000 years of evolution of two morphologically close domesticated species                                     | Marine Jeanjean, Cyprien Mureau, Allowen Evin; Institut des Sciences de l'Evolution, Université de Montpellier, CNRS, IRD, EPHE  |

10:00 AM – 11:30 AM

Session 30

Auditorium C

**Teeth: Morphology, Function, and Evolution (Part 2)***Chairs: Marion Segall, Maitena Dumont*

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|----------|-------------|--|---|
| 10:00 am | <b>30-1</b> | Microstructure, biomechanics and chemical composition of teeth in seals                      | Carolina Loch; University of Otago Faculty of Dentistry   |
| 10:15 am | <b>30-2</b> | Beyond the fangs: the untold story of snake tooth microstructure                             | Maitena Dumont, Anthony Herrel, Marion Segall; HUJI, UMR7179 CNRS/MNHN, Natural History Museum  |
| 10:30 am | <b>30-3</b> | The hidden complexity of reptilian enamel  | Aaron LeBlanc, Alexander Morrell, Slobodan Sirovica, David Labonte, Owen Addison; King's College London, Queen Mary University of London, Imperial College London                     |
| 10:45 am | <b>30-4</b> | Multiple evolutionary pathways to piscivory in Neotropical freshwater fishes (Characiformes) | Karly Cohen, Matthew Kolmann; University of Florida, University of Louisville   |
| 11:00 am | <b>30-5</b> | Ecomorphology of snakes' teeth   | Marion Segall, Anthony Herrel, Maitena Dumont; Natural History Museum, UMR7179 CNRS/MNHN, HUJI  |
| 11:15 am | <b>30-6</b> | Developmental mechanisms facilitating molar shape diversification in bats                    | Alexa Sadier, David Grossnickle, Marina Zernik, Paul François, Sharlene Santana, Karen Sears; University of California, Los Angeles, University of Washington, Université de Montréal |

10:00 AM – 11:00 AM

Session 31

M5-M6

**The Morphology of Coral Reef Fishes: Functional, Ecological, and Evolutionary Implications (Part 1)***Chairs: Laura Wilson, Jason Bourke, Daisuke Koyabu*

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|----------|-------------|--|---|
| 10:00 am | <b>31-1</b> | The feeding kinematics of a surgeonfish ( <i>Zebrasoma desjardini</i> ) and the associated functional implications | <i>Michalis Mihalitsis, Peter Wainwright; University of California, Davis</i>   |
| 10:15 am | <b>31-2</b> | The functional morphospace of fish skulls is constrained by evolutionarily rigid, ubiquitous bounds                | <i>Roi Holzman, Christopher Martin, Peter Wainwright, Edward Burress; Tel Aviv University, University of California, Berkeley, University of California, Davis, University of Alabama</i> |
| 10:30 am | <b>31-3</b> | A Functional Morphospace for the Feeding System of Coral Reef Fishes   | <i>Peter Wainwright; University of California, Davis</i>  |
| 10:45 am | <b>31-4</b> | Leveraging kinematic performance landscapes to model the macroevolution of feeding in reef fishes                  | <i>Katherine Corn, Roi Holzman, Christopher Martin, Josef Uyeda; Virginia Tech, Tel Aviv University, University of California, Berkeley</i>   |

1:30 PM – 3:30 PM

Session 32

M2-M3

**Anatomical Variations of Hearing and Sound Production in Amniotes (Part 2)***Chairs: Laura Wilson, Jason Bourke, Daisuke Koyabu*

- |         |             |   |  |
|---------|-------------|---|--|
| 1:30 pm | <b>32-1</b> | Comparative anatomy of the vocal apparatus in bats: insights into the evolutionary history of echolocation. | <i>Nicolas Brualla, Laura Wilson, Vuong Tan Tu, Taro Nojiri, Richard Carter, Thongchai Ngamprasertwong, Thanakul Wannaprasert, Michael Doube, Dai Fukui, Daisuke Koyabu; City University of Hong Kong, Australian National University, Vietnam Academy of Science and Technology, Juntendo University, East Tennessee State University, Chulalongkorn University, The University of Tokyo Hokkaido Forest, University of Tsukuba</i> |
| 2:00 pm | <b>32-2</b> | Vocal learning, chorusing seal pups and the evolution of rhythm   | <i>Andrea Ravnani; Comparative Bioacoustics Group, Max Planck Institute for Psycholinguistics</i>  |
| 2:30 pm | <b>32-3</b> | Comparison of cranial development in echolocating and non-echolocating bats                                 | <i>Yannick Pommery, Daisuke Koyabu, Fumiya Meguro, Taro Nojiri, Vuong Tan Tu, Alistair Evans, Tim Denham, Laura Wilson; Australian National University, University of Tsukuba, City University of Hong Kong, Juntendo University, Vietnam Academy of Science and Technology, Monash University</i>   |
| 3:00 pm | <b>32-4</b> | Embryonic evidence uncovers convergent origins of laryngeal echolocation in bats                            | <i>Daisuke Koyabu, Taro Nojiri, Rui Cao, Laura Wilson, Camilo Lopez-Aguirre, Fumiya Meguro, Hiroki Higashiyama, Alexa Sadier, Karen Sears, Vuong Tan Tu, Jun Li; University of Tsukuba, City University of Hong Kong, Juntendo University, Australian National University, University of Toronto Scarborough, The University of Tokyo, University of California, Los Angeles, Vietnam Academy of Science and Technology</i>          |

1:30 PM – 4:15 PM

Session 33

M7-M8

**Backbones: Bending, Bouncing, and Beyond***Chair: Verónica Díez Díaz*

- |         |              |   |   |
|---------|--------------|---|---|
| 1:30 pm | <b>33-1</b>  | Sequential Scales: New perspectives on snake axial evolution  | <i>Tamika Nash-Hahn, Kate Sanders, Emma Sherratt; University of Adelaide</i>  |
| 1:45 pm | <b>33-2</b>  | Vertebrate Spines and Continuum Robots  | <i>Ian Walker, Nithesh Kumar; Clemson University</i>  |
| 2:00 pm | <b>33-3</b>  | Born to do pilates: morphological analysis of flexibility and stability in the backbone of hares and rabbits    | <i>Nuttakorn Taewcharoen, Philip Stott, Rachel Norris, Emma Sherratt; University of Adelaide</i>  |
| 2:15 pm | <b>33-4</b>  | Morphological disparity and integration in the vertebral column of pinnipeds (Mammalia, Carnivora)              | <i>Alberto Martín-Serra, Juan Miguel Esteban Núñez, Alejandro Pérez-Ramos, Borja Figueirido; Universidad de Málaga</i>  |
| 2:30 pm | <b>33-6</b>  | Raise your head: Evaluating mechanical advantage of predorsal region of terrestrial quadrupedal amniotes        | <i>Kuan-Yu Chou, Ren-Chung Cheng, Kai-Jung Chi, Tzu-Ruei Yang; Department of Geology, National Museum of Natural Science, National Chung Hsing University</i>         |
| 3:00 pm | <b>33-8</b>  | Connective Tissue and Lateral Stabilization of the Giraffe Cervical Vertebral Column                            | <i>Justin Georgi, Kevin Manfredi, K. E. Townsend; Midwestern University</i>   |
| 3:15 pm | <b>33-9</b>  | Shape diversification of spine in bony fish by adaptation to mechanical forces                                  | <i>Misaki Sakashita, Shigeru Kondo, Shintaro Yamasaki, Naoyuki Wada; Applied Biological Science, Tokyo University of Science, Osaka University, Waseda University</i> |
| 4:00 pm | <b>33-10</b> | The role of spine motion in vertical jumping performance of the common degu ( <i>Octodon degus</i> , Rodentia). | <i>Celina Richter, Martin Fischer, Manuela Schmidt; Friedrich Schiller University</i>   |



1:30 PM – 4:00 PM

Session 34

Auditorium C

**Teeth: Morphology, Function, and Evolution (Part 3)**

*Chairs: Marion Segall, Maitena Dumont*

- |         |             |   |  |
|---------|-------------|---|--|
| 1:30 pm | <b>34-1</b> | Odonto-seq: using shark developmental transcriptomics to define a tooth                 | <i>Gareth Fraser, Ella Nicklin, Karly Cohen; University of Florida</i> |
| 1:45 pm | <b>34-2</b> | Thinking beyond the cusp: patterns of tooth diversity in Lake Tanganyika cichlid fishes | <i>Nick Peoples, Peter Wainwright; University of California, Davis</i> |
| 2:00 pm | <b>34-3</b> | Growing long in the tooth – continuously growing dentition and the power cascade model  | <i>William Parker, Justin Adams, Alistair Evans; Monash University</i> |

1:30 PM – 4:00 PM

Session 35

M5-M6

**The Morphology of Coral Reef Fishes: Functional, Ecological, and Evolutionary Implications (Part 2)**

*Chairs: Roi Holzman, Michalis Mihalitsis*

- |         |             |   |  |
|---------|-------------|---|--|
| 1:30 pm | <b>35-1</b> | Many roads lead to herbivory: Phylogenetic Constraints on the Convergent Evolution of Marine Herbivorous Fishes   | <i>Kory Evans, Christopher Martinez; Rice University, University of California Irvine</i>  |
| 2:00 pm | <b>35-2</b> | Effects of history on ecomorphological convergence across planktivorous fishes  | <i>Jennifer Hodge, Danielle Adams, Laura Alencar, Benjamin Camper, Olivier Larouche, Mason Thurman, Keiffer Williams, Katerina Zapfe, Samantha Price; Clemson University, Yale University, University of Houston, University of North Carolina Charlotte</i> |
| 2:30 pm | <b>35-3</b> | Body Shape and Bold Colour Pattern Evolution across Reef-Associated Fishes  | <i>Katerina Zapfe, Jennifer Hodge, Samantha Price; Clemson University, University of North Carolina Charlotte</i>  |
| 2:45 pm | <b>35-4</b> | A snap to the left, a swing to the right - head and body shape affect biting kinematics in reef fishes  | <i>Tal Perevolotsky, Jacob Brotman-Krass, Cassandra Donatelli, Matthew Kolmann, Adam Summers, Roi Holzman; Tel-Aviv University, University of Rochester, Chapman University, University of Louisville, University of Washington</i>                          |
| 3:00 pm | <b>35-5</b> | How to measure color pattern variation in coral reef fishes   | <i>Hannah Weller, Steven Van Belleghem; Brown University, KU Leuven</i>  |
| 3:15 pm | <b>35-6</b> | Morphological differences in surgeonfishes shape ecological roles and response to a key stressor  | <i>Sterling Tebbett, David Bellwood; James Cook University</i>   |
| 3:30 pm | <b>35-7</b> | Three-dimensional morphometric data reveals patterns of cranial evolution associated with habitat transitions in fossil and extant tetraodontiform fishes | <i>Emily Troyer, Kory Evans, Christopher Goatley, Dahiana Arcila; University of Oklahoma, Rice University, University of Southampton</i>   |

4:00 PM – 5:00 PM

P2

Auditorium A/B/D

- |             |   |   |
|-------------|---|---|
| <b>P2-1</b> | Jaws wide open: 50 years of modeling mammalian jaw gapes since Herring and Herring 1974                               | <i>Andrea Taylor, Claire Terhune, Christopher Vinyard; Touro University, University of Arkansas, Ohio University</i>  |
| <b>P2-2</b> | Structure and function in the Cetacean pulmonary airway tree  | <i>Robert Cieri, Robert Shadwick, Merryn Tawhai, Marina Piscitelli; University of British Columbia, University of Auckland</i>  |
| <b>P2-3</b> | Sthenurine kangaroos break the CREA rule of facial allometry  | <i>Christine Janis, William Richardson, Nuria Morales-García; University of Bristol</i>   |
| <b>P2-4</b> | Comparative Anatomy of Otomorphan Epibranchial Organs   | <i>Allyson Evans, L Patricia Hernandez, Joshua Egan; George Washington University, University of Minnesota</i>  |
| <b>P2-5</b> | Looking into the future of migratory parrots: assessing the vision of iconic species to assist conservation planning  | <i>Aubrey Keirnan, Vera Weisbecker, Andrew Iwaniuk, Gavin Prideaux; Flinders University, University of Lethbridge</i>   |
| <b>P2-6</b> | Growing up sucks: modelling sucking and biting in human mandibles through development                                 | <i>Tahlia Pollock, Pranav Haravu, Alec Wilken, Andrea Taylor, Russell Reid, Callum Ross, Olga Panagiotopoulou; Monash University, University of Chicago, Touro University</i> |
| <b>P2-7</b> | The anomalous form of the tapir scapula (Perissodactyla: Tapiridae), with new insights from dissection and 3D imaging | <i>Jamie MacLaren; University of Antwerp</i>  |
| <b>P2-8</b> | Musculoskeletal constraints on hopping in the distal hindlimbs of giant extinct kangaroos                             | <i>Megan Jones, Katrina Jones, Robert Nudds; University of Manchester</i>   |
| <b>P2-9</b> | Correlation of precipitation and hatchling morphology in sea turtles <i>Caretta caretta</i> and <i>Chelonia mydas</i> | <i>Omar Ragalado Fernandez, Parima Parsi-Pour, John Nyakatura, Ingmar Werneburg; University of Tübingen, Museum für Naturkunde Berlin, Humboldt Universität zu Berlin</i>     |

# SUNDAY, 30 JULY 2023

<b>P2-10</b>	Functional morphology of the skull of <i>Henodus</i> chelyops (Placodontia)	<i>Ingmar Werneburg, Yannick Pommery, Maciej Ruciński, Benedikt Kästle, Gabriel Cohen, Nikolay Natchev, Octávio Mateus, Gabriel Ferreira; University of Tübingen, Australian National University, Natural History Museum at the University of Oslo, University of Zurich, Konstantin Preslavsky University of Shumen, GeoBioTec, NOVA School of Science and Technology, Senckenberg Centre for Human Evolution &amp; Palaeoenvironment (SHEP) at the Eberhard Karls Universität Tübingen</i>
<b>P2-11</b>	Evolution of phalangeal morphology in an ecomorphological gecko radiation with incipiently expressed adhesive toepads	<i>Jendrian Riedel, Jonas Dreesmann, Mariam Gabelaia, Timothy Higham, Lee Grismer, Dennis Rödder, Benjamin Wipfler, Anthony Russell; Leibniz Institute for the Analysis of Biodiversity Change - Museum Koenig Bonn, University of California, Riverside, La Sierra University, University of Calgary</i>
<b>P2-12</b>	What factors create mammalian complex molar morphology: classical theories revisited	<i>Masakazu Asahara, Tomohiro Harano; Aichi Gakuin University</i>
<b>P2-13</b>	What's diet got to do with it? Analysis of craniofacial evolution in Lake Victoria cichlids	<i>Kassandra Ford, L Patricia Hernandez, Pooja Singh, Mikki Law, David Habertur, Ruslan Hlushchuk, Kory Evans, Ole Seehausen; George Washington University, University of Bern, Institute of Anatomy, Universität Bern, Rice University</i>
<b>P2-14</b>	Soft tissues, hard limits: integrating ligament strain into joint range-of-motion estimates	<i>Stephanie Pierce, Robert Brocklehurst, Peter Bishop; Harvard University, Museum of Comparative Zoology</i>
<b>P2-15</b>	Telling Tails: Comparative muscular morphology and function of mammalian tails	<i>Juri Miyamae, Talia Moore; University of Michigan</i>
<b>P2-16</b>	The current state of the field in using continuous shape data for phylogenetic reconstruction: A systematic review	<i>Emma Holvast, Melina Celik, Matthew Phillips, Laura Wilson; Australian National University, Queensland University of Technology</i>
<b>P2-17</b>	Osteological Correlates of Carnivoran Masticatory Fascicle Lengths	<i>Sarah Piersanti, Ashley Deutsch, Adam Hartstone-Rose; Arizona State University, North Carolina State University</i>
<b>P2-18</b>	Effects of cursoriality on mammalian semicircular canal morphology	<i>Addison Kemp, Justin Benjamin; University of Southern California</i>
<b>P2-19</b>	The Rules of Variation in Vertebral Formulae of Birds and Mammals: Individuals Vary Within Developmental Rules but with Species-Specific Magnitudes	<i>Kathryn D Kavanagh, K. Avery Hamlin; University of Massachusetts Dartmouth</i>
<b>P2-20</b>	Fin Shape Evolution in Coral Reef Fishes	<i>Darien Satterfield; University of California, Davis</i>
<b>P2-21</b>	Effects of mTBI on depressive-like behavior and blood brain barrier permeability in a jumping fish	<i>Jenna E. Hartzler, Grace Bollinger, Cassidy McColl, Ryan L. Earley; University of Alabama</i>

**5:00 PM – 6:00 PM**

**Plenary 3**

**Auditorium C**

5:00 pm

Uncovering the mechanisms of bat diversification through integrative morphology research

*Sharlene Santana; University of Washington*

# Monday, 31 July 2023

8:00 AM – 9:15 AM		Session 36	M2-M3
<b>Feeding: Soft Parts</b>			
<i>Chair: Jillian Davis</i>			
8:00 am	<b>36-1</b>	The Impacts of Various Modalities of Esophageal Stimulation on Infant Mammalian Feeding Physiology	<i>Chloe Edmonds, Kaitlyn Robbins, Christopher Mayerl, Rebecca German; Northeast Ohio Medical University, Kent State University, The Ohio State University, Northern Arizona University, NEOMED</i>
8:15 am	<b>36-2</b>	The impact of diet on vertebrate intestinal length	<i>María José Duque Correa, Carlo Meloro, Walter Salzburger, Kendall Clements, Marcus Clauss; University of Zurich, Liverpool John Moores University, University of Basel, Zoological Institute, University of Auckland</i>
8:30 am	<b>36-4</b>	Masticatory Motor Patterns in Frugivorous Phyllostomid Bats	<i>Jillian Davis, Erika Tavares, Brooke Quinn, Megan McCullough, Sharon Swartz; West Virginia University, Brown University</i>
8:45 am	<b>36-5</b>	Gotta catch them all: a novel view of the anatomy and functional morphology of the masticatory apparatus in hystricomorphous rodents	<i>Léa Da Cunha, Pierre-Henri Fabre, Anthony Herrel, Lionel Hautier; Institut des Sciences de l'Evolution de Montpellier, Université de Montpellier</i>
9:00 am	<b>36-6</b>	Diversifying the Power Stroke of Premaxillary Protrusion: The Evolution of Diverse Cranial Musculature in Cypriniform Fishes	<i>Joshua Storch; George Washington University</i>

8:00 AM – 9:30 AM		Session 37	Auditorium C
<b>Limbs and "Limbs"</b>			
<i>Chair: Jamie MacLaren</i>			
8:00 am	<b>37-1</b>	The evolution of the knee sesamoids in Primates	<i>Michael Berthaume, Nelly Fragoso; London South Bank University</i>
8:15 am	<b>37-2</b>	Maximum force and fingers implication of tip trunk in African savannah elephants.	<i>Pauline Costes, Céline Houssin, Arnaud Delapré, Baptiste Mulot, Raphaël Cornette, Emmanuelle Pouydebat; Museum National d'Histoire Naturelle, Sorbonne Universités Equipe Diversité Périspécifique, Spéciations, Interactions, Invasions, L'Institut de Systématique, Évolution, Biodiversité Systématique, Phylogénie, Évolution, Conservation (SPEC), ZooParc de Beauval &amp; Beauval Nature, Université des Antilles Équipe</i>
8:30 am	<b>37-3</b>	Rates of evolution and morphological disparity in the primate tarsal skeleton	<i>Nicole Barber, Christophe Soligo, Anjali Goswami; University College London, The Natural History Museum</i>
8:45 am	<b>37-4</b>	Investigation of the convergent evolution of the prehensile tail among small-bodied rodents from the Hydromyini tribe	<i>Arthur Naas, František Vejmelka, Anthony Herrel, Pierre-Henri Fabre; Institute of Evolutionary Sciences of Montpellier, Biology Centre of the Czech Academy of Sciences, Université de Montpellier</i>
9:00 am	<b>37-5</b>	Avoiding the edge of failure: a strength-based perspective to explain equid digit reduction	<i>Jamie MacLaren, Peter Aerts; University of Antwerp</i>
9:15 am	<b>37-6</b>	The hindlimb of Allodaposuchus (Crocodyliformes, Eusuchia) from a biomechanical viewpoint	<i>Alejandro Blanco, Verónica Díez Díaz, Blanca Moncunill-Solé; Universidade da Coruña, Museum für Naturkunde Berlin - Leibniz Institute for Evolution and Biodiversity Science</i>

8:00 AM – 9:30 AM		Session 38	M7-M8
<b>The Integumentary Skeleton: Evolution, Development, Biomechanics, and Bioinspiration (Part 1)</b>			
<i>Chairs: Matthew Vickaryous, Mehran Moazen, Catherine Williams</i>			
8:00 am	<b>38-1</b>	Dermal ossifications in extinct tetrapods and their bearing on phylogenetics, function, and palaeoecology	<i>Torsten Scheyer; University of Zurich, Switzerland</i>
8:30 am	<b>38-2</b>	Skeletal Diversity in the Skin: Histological Variation and the Evolution of Lizard Osteoderms	<i>Matthew Vickaryous, Gabriella Willan, Catherine Williams, Alex Kirby, Anthony Herrel, Loïc Kéver, Arsalan Marghoub, Shreya Rai, Arkhat Abzhanov, Edward Stanley, Susan Evans, Mehran Moazen; University of Guelph, University College London, Imperial College London, Florida Museum of Natural History</i>
9:00 am	<b>38-3</b>	Lizards in Chain Mail: Reconstructing the Enigmatic Past of Dermal Armour in Squamate Reptiles	<i>Roy Ebel, Chris Broeckhoven, Edward Stanley, Till Ramm, Rocio Aguilar, Johannes Müller, David Chapple, Scott Keogh; Australian National University, University of Antwerp, Florida Museum of Natural History, Museum für Naturkunde - Leibniz Institute for Evolution and Biodiversity Science, Museums Victoria, Monash University</i>

- 9:15 am **38-4** The bizarre bulbous bucklers of skates: Denticles, dermal bone or something else? *Mason Dean, Aaron LeBlanc, Moya Smith, Charlie Underwood, Mélanie Debais-Thibaud, Zerina Johanson; City University of Hong Kong, King's College London, Birkbeck University of London, Université de Montpellier, Natural History Museum*

**10:00 AM – 11:30 AM**

**Session 39**

**M2-M3**

**Feeding: Hard Parts**

*Chair: Larisa DeSantis*

- 10:00 am **39-1** On the cusp of adaptive change: the tempos and modes of molar evolution during the phyllostomid bat radiation *David Grossnickle, Alexa Sadier, Edward Patterson, Stephanie Jimenez Rivera, Nashaly Cortes-Viruet, Karen Sears, Sharlene Santana; University of Washington, University of California, Los Angeles, Inter American University of Puerto Rico*
- 10:15 am **39-2** A new Jurassic shuotheriid casts light on pseudotribosphenic tooth evolution and higher-level phylogeny of mammals *Jin Meng, Fangyuan Mao; American Museum of Natural History, Chinese Academy of Sciences*
- 10:30 am **39-3** Temporal dietary shift toward more abrasive food among Cretaceous ornithomimid dinosaurs *Tai Kubo, Mugino Kubo, Manabu Sakamoto, Daniela E. Winkler, Masateru Shibata, Wenjie Zheng, Xingsheng Jin, Hai-Lu You; Okinawa Institute of Science and Technology, The University of Tokyo, University of Lincoln, Kiel University, Zoological Institute, Fukui Prefectural University, Zhejiang Museum of Natural History, Institute of Vertebrate Paleontology and Paleoanthropology*
- 10:45 am **39-4** Dental microwear texture attributes in similar tooth forms can reasonably be compared in phylogenetically disparate mammals *Larisa DeSantis; Vanderbilt University*
- 11:00 am **39-5** Dietary correlates of primate tooth root surface areas *Ashley Deutsch, Adam Hartstone-Rose; North Carolina State University*
- 11:15 am **39-6** Fantastic filters: comparative morphology of rorqual baleen *Shirel Kahane-Rapport, Megan Vandenberg, Karly Cohen, Robert Rubin, Jeremy Goldbogen, Adam Summers, Misty Paig-Tran; California State University, Fullerton, University of Florida, Hopkins Marine Station, Stanford University, University of Washington*

**10:00 AM – 11:30 AM**

**Session 40**

**Auditorium C**

**Fins (Not Limbs)**

*Chair: Markus Lambertz*

- 10:00 am **40-1** Comparative and evolutionary perspectives on the ontogeny of post-cranial skeletal pneumaticity *Markus Lambertz, Pia Schucht; Rheinische Friedrich-Wilhelms-Universität Bonn*
- 10:15 am **40-2** MYTHBUSTERS: refining observations about anal fin variation in surfperches *Breana Goldman, Karen Crow; San Francisco State University*
- 10:30 am **40-3** Turning a Skate into a Ray: The Genetic Basis of Modified Pectoral Fins in Manta Rays and their Relatives *Emily McFarland, Karen Crow; San Francisco State University*
- 10:45 am **40-4** Red lionfish (*Pterois volitans*) use big fins and persistence to exploit the evasion strategy of prey *Ashley Peterson, Anthony Thompson, Derek Paley, Matthew McHenry; University of California, Irvine, University of Maryland*
- 11:00 am **40-5** Investigating the only extant vertebrate with three sets of paired appendages *Karen Crow, Kayla Hall, Riley Jones; San Francisco State University, University of Washington, California State University Northridge*
- 11:15 am **40-6** What are they good for: Morphological variations of Pre-Pelvic Claspers across Holocephalans *Kayla Hall; University of Washington*

**10:00 AM – 11:30 AM**

**Session 41**

**M7-M8**

**The Integumentary Skeleton: Evolution, Development, Biomechanics, and Bioinspiration (Part 2)**

*Chairs: Mehran Moazen, Catherine Williams, Matthew Vickaryous*

- 10:00 am **41-1** Scaled up defenses: Patterns and drivers of dermal armor in lizards *Edward Stanley, Jaimi Gray, David Blackburn; Florida Museum of Natural History, University of Florida*
- 10:30 am **41-2** Multi-scale interactions in the armor of fishes *Adam Summers, Matthew Kolmann, Cassandra Donatelli; University of Washington, University of Louisville, Chapman University*
- 11:00 am **41-3** Form and function of lizard cranial osteoderms *Anthony Herrel, Loïc Kéver, Arsalan Marghoub, Edward Stanley, Catherine Williams, Matthew Vickaryous, Arkhat Abzhanov, Shreya Rai, Susan Evans, Mehran Moazen; UMR7179 CNRS/MNHN, UCL, Florida Museum of Natural History, University of Guelph, Imperial College London*

**The Sensory World of Vertebrates (Part 1)**

*Chairs: Irina Ruf, Tim Smith*

10:00 am	<b>42-1</b>	Development and morphofunction of the malleus in muroid rodents	<i>Irina Ruf, Franziska Fritzsche, Wolfgang Maier; Senckenberg Forschungsinstitut und Naturmuseum Frankfurt, Senckenberg Museum für Naturkunde Görlitz, Eberhard-Karls-Universität Tübingen</i>
10:15 am	<b>42-2</b>	Development of dolphin sensory systems	<i>Rachel Racicot; Vanderbilt University</i>
10:30 am	<b>42-3</b>	Bioimaging of sensory organs and the central nervous system in fishes and reptiles	<i>Shaun Collin, Lucille Chapuis, Victoria Camilieri-Asch, Kara Yopak, Caroline Kerr, Hope Robins, Myoung Ha, Travis Dutka, Jenna Crowe-Riddell; La Trobe University, University of Bristol, Queensland University of Technology, University of North Carolina Wilmington</i>
10:45 am	<b>42-4</b>	Open Questions in Fish Photoreception	<i>Lorian Schweikert; University of North Carolina Wilmington</i>
11:00 am	<b>42-5</b>	The Parietal Eye in Fossil Amniotes	<i>Kelsey Jenkins, Caleb Gordon, Bhart-Anjan Bhullar; Yale University</i>
11:15 am	<b>42-6</b>	Mammalian olfaction, an integrative perspective	<i>Quentin Martinez, Matthias Laska, Gabriel Ferreira, Vincent Fernandez, Matthieu Keller, Thomas Cucchi, Cecile Molinier, Justin Adams, Roberto Portela Miguez, Federico Vilaplana Grosso, Erin Hecht, Sophie Barton, Molly Selba, Eli Amson; State Museum of Natural History, Linköping University, Senckenberg Centre for Human Evolution &amp; Palaeoenvironment (SHEP) at the Eberhard Karls Universität Tübingen, European Synchrotron Radiation Facility, INRAE/CNRS/Université de Tours/IFCE, CNRS/Muséum National d'Histoire Naturelle, Planck Institute for Biology Tübingen, Monash University, Natural History Museum, University of Florida, Harvard University, Museum für Naturkunde Stuttgart</i>

**Cranial Evolution**

*Chair: Maria Laura Habegger*

1:30 pm	<b>43-1</b>	The Perks of Being a Eupercarian: Rapid Skull Shape Evolution in a Massive Radiation of Bony Fishes	<i>JoJo West, Rose Faucher, Elizabeth Miller, Emily Troyer, Ricardo Betancur-R, Dahiana Arcila, Kory Evans; Rice University, University of Oklahoma</i>
1:45 pm	<b>43-2</b>	Sample size and two-dimensional geometric morphometrics impact the evaluation of morphological variation in three species of Louisiana bat	<i>Brandon Hedrick, Erin Sheehy, Emma Schachner, Andrea Rummel; Cornell University, Tulane University, University of Florida, Princeton University</i>
2:00 pm	<b>43-3</b>	An osteological description of the rostrum in billfishes through development (Xiphiidae and Istiophoridae)	<i>Maria Laura Habegger, Jihae Kim, Dominique Adriaens, Dave Johnson; University of North Florida, Ghent University, Smithsonian National Museum of Natural History</i>
2:15 pm	<b>43-4</b>	Modularity, biomechanics and bmp4 expression integrate developmental plasticity in fish novel head morphotypes.	<i>Leandro Lofeu, Felipe Montefeltro, Monique Simon, Tiana Kohlsdorf; Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto - Universidade de São Paulo, São Paulo State University, Oklahoma State University</i>
2:30 pm	<b>43-5</b>	Biomechanical basics for the evolution of cranial openings in amniotes	<i>Ingmar Werneburg, Holger Preuschoft; University of Tübingen, Ruhr-Universität Bochum</i>
2:45 pm	<b>43-6</b>	Evolutionary patterns in the composition of the tetrapod lower jaw	<i>Emily Watt, Ryan Felice, Anjali Goswami; The Natural History Museum, University College London</i>
3:00 pm	<b>43-7</b>	3D anatomy of the craniomandibular joint of derived South American cynodonts and homoplasy in the evolution of the mammalian jaw	<i>James Rawson, Pamela Gill, Agustín Martinelli, Marina Soares, Cesar Schultz, Emily Rayfield; University of Bristol, Natural History Museum, Museo Argentino Ciencias Naturales "Bernardino Rivadavia", Museu Nacional, Universidade Federal do Rio de Janeiro, Universidade Federal do Rio Grande do Sul</i>
3:15 pm	<b>43-8</b>	On the development of the nasal turbinals and homology in laurasiatherians, with special reference to pangolins	<i>Kai Ito, Ryo Kodera, Kuroda Noriyuki, Mugino Kubo; The University of Tokyo, Tsurumi University</i>
3:30 pm	<b>43-9</b>	The influence of jaw muscle architecture on mandibular disparity in Lepidosauria	<i>Antonio Ballell, Hugo Dutel, Matteo Fabbri, Christina Hammond, Anthony Herrel, Emily Rayfield; University of Bristol, Field Museum of Natural History, UMR7179 CNRS/MNHN</i>



1:30 PM – 4:00 PM

Session 44

M7-M8

**The Integumentary Skeleton: Evolution, Development, Biomechanics, and Bioinspiration (Part 3)**

*Chairs: Matthew Vickaryous, Mehran Moazen, Catherine Williams*

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|---------|-------------|---|---|
| 1:30 pm | <b>44-1</b> | Armed to the teeth: Adaptive functionality of shark denticles from material and mechanical perspectives | Mike Schindler, Chuang Liu, Tairan Li, Martha Paskin, Yen Png, Frederik Mollen, Nicholas Payne, Shahrouz Amini, Venkata Surapaneni, Mason Dean; City University of Hong Kong, Hohai University, University College London, Zuse Institute of Berlin, Elasmobranch Research Belgium (ERB), Trinity College Dublin, Max Planck Institute of Colloids and Interfaces |
| 2:00 pm | <b>44-2</b> | Nanoscale Investigation of an Enigmatic Skeletal Tissue type: Lizard Osteoderm Capping Tissue           | Catherine Williams, Arsalan Marghoub, Shreya Rai, Dmitry Karpov, Gabriella Willan, Loïc Kéver, Arkhat Abzhanov, Anthony Herrel, Edward Stanley, Susan Evans, Mehran Moazen, Matthew Vickaryous; UCL, Imperial College London, European Synchrotron Radiation Facility, University of Guelph, UMR7179 CNRS/MNHN, Florida Museum of Natural History                 |
| 2:30 pm | <b>44-3</b> | Mechanical properties of lizard osteoderms  | Mehran Moazen, Arsalan Marghoub, Anastasiia Maliuk, Jeremy Tan, Loïc Kéver, Catherine Williams, Shreya Rai, Susan Evans, Arkhat Abzhanov, Matthew Vickaryous, Anthony Herrel; University College London, UMR7179 CNRS/MNHN, Imperial College London, University of Guelph   |
| 3:00 pm | <b>44-4</b> | More than just a platey face: the versatile role of armor in fishes                                     | Cassandra Donatelli, Megan Vandenberg, Adam Summers, Matthew Kolmann; Chapman Univeristy, University of Washington, University of Louisville  |
| 3:30 pm | <b>44-5</b> | Mechanical Anisotropy of Shark Skin   | Madeleine Hagood, Joseph Alexander, Marianne Porter; Florida Atlantic University  |

1:30 PM – 4:00 PM

Session 45

M5-M6

**The Sensory World of Vertebrates (Part 2)**

*Chairs: Irina Ruf, Tim Smith*

- |         |              |   |   |
|---------|--------------|---|---|
| 1:30 pm | <b>45-1</b>  | Understanding a missing link in the evolution of mammalian hearing and balance systems through morphometric analysis of the Ductus Reunians                     | Christopher Smith, Ian Curthoys, Jeffrey Laitman; City University of New York, University of Sydney, Icahn School of Medicine at Mount Sinai            |
| 1:45 pm | <b>45-2</b>  | Whisked Away: synapsid sensory innovations and the evolution of facial musculature  | Juri Miyamae; University of Michigan  |
| 2:00 pm | <b>45-3</b>  | Grasping at primate touch: integrating genetics, histology, and ecology   | Carrie Veilleux, Magdalena Muchlinski, Amanda Melin; Midwestern University, Oregon Health & Science University, University of Calgary                   |
| 2:15 pm | <b>45-4</b>  | Endosseous labyrinths, ear bones, and digital endocasts of fossil baenid turtles reveal functional aspects of hearing and balance in Paracryptodira             | Heather Smith, Brent Adrian, Madison Berg; Midwestern University, Arizona State University  |
| 2:30 pm | <b>45-5</b>  | On the relationship between retinal and visual field topography in vertebrates  | Christopher Heesy; Midwestern University  |
| 2:45 pm | <b>45-6</b>  | Aging and the senses  | Jeffrey Laitman, Christopher Smith; Icahn School of Medicine at Mount Sinai, The Graduate Center, City University of New York                           |
| 3:00 pm | <b>45-7</b>  | Hair, there and everywhere: a comparison of bat wing sensory hair distribution  | Brooke Quinn, Andrea Rummel, Melissa Sierra, Sharon Swartz; Brown University, Princeton University, University of Maryland School of Medicine           |
| 3:15 pm | <b>45-8</b>  | The Extraordinary Sensory Biology of the Silverjaw Minnow, <i>Notropis buccatus</i>   | Aubree Jones, Kevin Conway, Jacqueline Webb; University of Rhode Island, Texas A&M University   |
| 3:30 pm | <b>45-9</b>  | Predicting Ecology and Hearing Sensitives in Parapontoporia   | Joyce Sanks, Rachel Racicot; Vanderbilt University  |
| 3:45 pm | <b>45-10</b> | Anatomy of the premaxilla of <i>Tylosaurus nepaeolicus</i> (Squamata: Mosasaurioidea) and its implications in the sensoriality of aquatically adapted squamates | Paulina Jiménez-Huidobro, Ariana Paulina-Carabajal, Michael Caldwell; Universität Bonn, CONICET-Universidad Nacional del Comahue, University of Alberta |

**Transitions: Water to Land to Water**

Chair: *Laura Porro*

1:30 pm	<b>46-1</b>	Two limbs or four: evaluating the role of forelimbs in protocetid swimming	<i>Sam Coatham, William I. Sellers, Lia Gavazzi, Richard Sandberg; University of Manchester, School of Natural Sciences, Kent State University, NEOMED, University of Melbourne</i>
1:45 pm	<b>46-2</b>	New insights on cetacean locomotion: a quadrupedal species from the middle Eocene of Peru as a transition toward a fully aquatic lifestyle	<i>Apolline Alfsen, Christian de Muizon, Giovanni Bianucci, Olivier Lambert, Rodolfo Salas-Gismondi, Mario Urbina, Oliver Hampe, Eli Amson; Museum für Naturkunde, Muséum National d'Histoire Naturelle, University of Pisa, Institut royal des Sciences naturelles de Belgique, Universidad Peruana Cayetano Heredia, Museo de Historia Natural-UNMSM, Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Museum für Naturkunde Stuttgart</i>
2:00 pm	<b>46-3</b>	Middle Jurassic fossils from England and Scotland document early stages in salamander evolution	<i>Marc Jones, Roger Benson, Pavel Skutschas, Elsa Panciroli, David Ford, Armin Schmitt, Stig Walsh, Susan Evans; Natural History Museum London, University of Oxford, Saint Petersburg State University, Oxford University Museum of Natural History, National Museums Scotland, UCL</i>
2:15 pm	<b>46-4</b>	Reconstruction undulatory swimming in the first secondarily aquatic amniote	<i>Andréas Jannel, Jörg Fröbisch, Vincent Fernandez, Antoine Verrière; Museum für Naturkunde, European Synchrotron Radiation Facility</i>
2:30 pm	<b>46-5</b>	Morphology and kinematics of amphibious marine vertebrates for transition to biorobotic systems	<i>Frank Fish, Caitlyn Swiston, Matt Wileyto, Rebecca Kramer-Bottiglio, Megan Leftwich, James Tangorra, Harry Kwatny; West Chester University, George Washington University, Drexel University</i>
2:45 pm	<b>46-6</b>	Early tetrapod lower jaw shape and performance across the water-land transition	<i>Laura Porro, Emily Rayfield; University College London, University of Bristol</i>
3:00 pm	<b>46-7</b>	Whole-body volumetric modelling of the early tetrapod <i>Ichthyostega</i>	<i>Catherine Strong, Peter Bishop, Stephanie Pierce; Harvard University</i>
3:15 pm	<b>46-8</b>	Hear far, wherever you are: the evolution of amphibious hearing in seals	<i>James Rule, Travis Park, Justin Adams, Hazel Richards, Camille Grohé, Alistair Evans, Tahlia Pollock, Natalie Cooper; Natural History Museum, Monash University, Université de Poitiers</i>
3:30 pm	<b>46-9</b>	Comparing axial versus appendicular change across secondarily aquatic amniotes	<i>Kiersten Formoso; University of Southern California</i>

<b>P3-1</b>	Turbinal skeleton of <i>Myocastor coypus</i> (Rodentia, Mammalia)	<i>Irina Ruf, Quentin Martinez, Renate Rabenstein, Pierre-Henri Fabre; Senckenberg Forschungsinstitut und Naturmuseum Frankfurt, State Museum of Natural History, Institut des Sciences de l'Evolution de Montpellier, Université de Montpellier</i>
<b>P3-2</b>	Variation of the crocodylian chondrocranium	<i>María Victoria Fernandez Blanco, Ingmar Werneburg; Museo de La Plata, University of Tübingen</i>
<b>P3-3</b>	Postnatal ontogeny of the midface and turbinals in <i>Eptesicus fuscus</i>	<i>Tim Smith, Kathryn Stanchak, Sarah Downing, Veronica Rosenberger, Thomas Eiting, Abigail Curtis, Sharlene Santana; Slippery Rock University, University of Washington, Burrell College of Osteopathic Medicine</i>
<b>P3-4</b>	Ontogenetic co-evolution of genitalia in Northern Pacific rattlesnakes ( <i>Crotalus oregans</i> )	<i>Megan Folwell, Kate Sanders, Jenna Crowe-Riddell, Rachel Keeffe, Emily Taylor, Patricia Brennan; UofA, University of Adelaide, La Trobe University, Mount Holyoke College, California Polytechnic State University</i>
<b>P3-6</b>	Tweaking the chicken beak: Investigating the shape and development of the chicken ( <i>Gallus gallus</i> ) beak from embryo to adult	<i>Kathleen Garland, John Abramyan, Meredith Taylor, Akinobu Watanabe, Alistair Evans; Monash University, University of Michigan-Dearborn, New York Institution of Technology</i>
<b>P3-7</b>	Comparative Morphology of Olfactory Bulbs Mammals Different Ecological Groups	<i>Olha Pokotylo, Yaroslav Stepanyuk; Lesya Ukrainka Volyn National University</i>
<b>P3-8</b>	The first 3D cranial and myological reconstruction of the highly flattened remains of <i>Askeptosaurus italicus</i> (Diapsida: Thalattosauriformes)	<i>Dylan Bastiaans, Eva Herbst, Thomas van de Kamp, Marcus Zuber, Torsten Scheyer; University of Zurich, Karlsruhe Institute of Technology (KIT)</i>
<b>P3-9</b>	Convergent evolution and innervation patterns of caudal ear muscles in distantly related constant-frequency echolocating bats	<i>Tzu-Chin Chi, Masaki Takechi, Fumiya Meguro, Toshiko Furutera, Taro Nojiri, Karen Sears, Alexa Sadier, Vuong Tan Tu, Junpei Kimura, Daisuke Koyabu; Seoul National University, Juntendo University, University of Tsukuba, University of California, Los Angeles, Vietnam Academy of Science and Technology, City University of Hong Kong</i>

# MONDAY, 31 JULY 2023

<b>P3-10</b>	The propatagium as an evolutionary novelty in the lineage towards birds	<i>Yurika Uno, Tatsuya Hirasawa; The University of Tokyo</i>
<b>P3-11</b>	Lung differentiation in the brown anole <i>Anolis sagrei</i> (Squamata: Iguania) embryos	<i>Oliwia Kobędza, Magdalena Kowalska, Paweł Kaczmarek, Weronika Rupik; University of Silesia in Katowice</i>
<b>P3-12</b>	Craniofacial malformations in squamate embryos	<i>Julita Jakubiec, Magdalena Kowalska, Weronika Rupik, Paweł Kaczmarek; University of Silesia in Katowice</i>
<b>P3-13</b>	Evolutionary developmental perspective for the early evolution of the pectoral fin	<i>Tatsuya Hirasawa, Ryota Umeyama; The University of Tokyo</i>
<b>P3-14</b>	Development and evolution of the jaw joint and middle ear structures in the dinosaur-bird lineage	<i>Takumi Watanabe, Tatsuya Hirasawa; The University of Tokyo</i>
<b>P3-15</b>	Replacement, regeneration, or maintenance? Deployment of the dental developmental toolkit in skin denticles of adult small-spotted catshark ( <i>Scyliorhinus canicula</i> )	<i>Karly Cohen, Gareth Fraser; University of Florida</i>
<b>P3-16</b>	Who nose the flow: nasal dermal denticle morphology and water flow	<i>Amani Webber-Schultz, Kayla Hall, Ayi Ajavon, Adam Summers, Brooke Flammang, Lauren Simonitis; New Jersey Institute of Technology, Rutgers University, University of Washington, Georgia State University, Florida Atlantic University, University of Washington's Friday Harbor Labs</i>
<b>P3-17</b>	Quantifying mammalian locomotion using cluster analysis	<i>Sophia Anderson, Philip Cox, Eloy Gálvez-López; University of York, University College London</i>
<b>P3-18</b>	The evolution of cochlea shape in primates and other euarchontans	<i>Joaquin del Rio, Alexander Stoessel, Nils Krommer; Max Planck Institute for Evolutionary Anthropology</i>
<b>P3-19</b>	A preliminary analyze of cranial variations in three <i>Amphisbaenia</i> species	<i>Leandro Hohl, Aldo Vassallo, Adrià Casinos, Concepcion Azorit, Oscar Rocha-Barbosa; Universidade do Estado do Rio de Janeiro, Instituto de Biologia Roberto Alcântara Gomes, Universidad Nacional de Mar del Plata, , University of Barcelona, Universidad de Jaén</i>
<b>P3-20</b>	Effect of early-life stress on skeletal development in a tropical agamid lizard	<i>Subhasmita Patro, Maria Thaker; Indian Institute of Science</i>

**5:00 PM – 6:00 PM**

**Plenary 4**

**Auditorium C**

5:00 pm

From Development to Deep Time: Reconstructing the Evolution of Tetrapod Diversity with a Phenomic Approach

*Anjali Goswami; The Natural History Museum, London*

# Tuesday, 1 August 2023

8:00 AM – 9:30 AM

Session 47

Auditorium C

## Development, Genetics, Biomechanics, and Evolution of the Spine in Vertebrates (Part 1)

*Chairs: Christine Böhmer, Maxime Taverner, Roman Khonsari*

- |         |      |  |   |
|---------|------|--|---|
| 8:00 am | 47-1 | On the evolution and recapitulation of the vertebral column  | Shigeru Kuratani, Tatsuya Hirasawa; RIKEN Center for Biosystems Dynamics Research, The University of Tokyo  |
| 8:30 am | 47-2 | The control of transitions during vertebrate body formation  | Moises Mallo, Patricia Duarte, Ana Novoa, Anastasiia Lozovska, Rion Brattig Correia; Instituto Gulbenkian de Ciencia  |
| 9:00 am | 47-3 | Evolutionary morphology of the neck-to-trunk boundary in artiodactyls and the iconic case of the looong neck of giraffes | John Nyakatura, Marilena Müller, Luisa Merten, Sandra Schüller, Christine Böhmer, Alana Sharp, Jan Wölfer; Humboldt Universität zu Berlin, Christian-Albrechts-Universität zu Kiel, University of Liverpool |

8:00 AM – 9:30 AM

Session 48

M2-M3

## Morphological Medley

*Chair: Alexander Stoessel*

- |         |      |   |  |
|---------|------|---|--|
| 8:00 am | 48-1 | Combination of qualitative and quantitative data reveals unique patterns in the post cranial anatomy and taxonomy of Sphenacodontidae (Synapsida: Sphenacodontidae) | Jacqueline Lungmus; Sam Noble Oklahoma Museum of Natural History, University of Oklahoma   |
| 8:15 am | 48-2 | Morphological Variation and Ecological Signals in Extant Crocodylomorph Endocasts   | Alexander Beyl, Amy Balanoff, Paul Gignac, Jeroen Smaers, Akinobu Watanabe, Eric Wilberg, Alan Turner; Stony Brook University, Johns Hopkins University, University of Arizona, New York Institute of Technology College of Osteopathic Medicine   |
| 8:30 am | 48-3 | Endocast morphology differs significantly within North American river otters  | Leigha Lynch, Dominik Valdez, Alexander Claxton, Christopher Heesy, Kari Allen, Haley O'Brien, Ryan Felice; Midwestern University, Oklahoma State University Center for Health Sciences, Washington University St. Louis, University of Arizona Health Sciences, University College London         |
| 8:45 am | 48-4 | How does brain region size and neuronal investment compare in ecologically diverse snakes?  | Jenna Crowe-Riddell, Natasha Stepanova, Ramon Nagesan, Brianna Mims, Taylor West, Mike Lee, Kate Sanders, Alice Clement, Alison Davis Rabosky, Shaun Collin; La Trobe University, University of Michigan, Museum of Zoology, EEB, Flinders University, University of Adelaide, La Trobe University |

8:00 AM – 9:30 AM

Session 49

M7-M8

## Tissues: Mechanics, Molecules, and Microscopy

*Chair: Donald Davesne*

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|---------|------|--|--|
| 8:00 am | 49-1 | Bone microstructure across ocean depth in teleost fishes   | Donald Davesne, Léo Botton-Divet, Vincent Fernandez, Eli Amson; Museum für Naturkunde, Humboldt-Universität zu Berlin, European Synchrotron Radiation Facility, Museum für Naturkunde Stuttgart  |
| 8:15 am | 49-2 | Molecular markers of bone marrow tissues in modern and ancient samples                             | Luke Brosnan, Kliti Grice, Amy Elson, Sifra Bijl, Stephen Poropat, Auraya Manaprasertsak, Emma Hammarlund, William Rickard, Lorenz Schwark, Sophie Sanchez; Western Australian Organic and Isotope Geochemistry Centre, Curtin University, Uppsala University, Lund University, Christian-Albrechts-University of Kiel |
| 8:30 am | 49-3 | Mechanical Behavior of Sea Turtle Shells throughout Ontogeny                                       | Ivana Serra, Jeanette Wyneken; Florida Atlantic University   |
| 8:45 am | 49-4 | Regional mechanical properties of mineralized cartilage from shark vertebrae                       | Marianne Porter, Maria Uribe Mejia, Jamie Knaub, Aubrey Clark, Delaney Frazier; Florida Atlantic University  |
| 9:00 am | 49-5 | Setal morphology of Sphaerodactylus geckos: Microscopic diversity in some of the smallest amniotes | Aaron Griffing, Zildjian Brooks, Tony Gamble, Juan Daza; Princeton University, Marquette University, Sam Houston State University  |
| 9:15 am | 49-6 | Relationship between skull roof bone microanatomy and ecological traits in rodents                 | Antonia Kaffler, Ignacio Lazagabaster, Eli Amson, Johannes Müller; Museum für Naturkunde, Leibniz-Institut für Evolutions- und Biodiversitätsforschung, Centro Nacional de Investigacion sobre la Evolucion Humana   |

**10:00 AM – 11:30 AM****Session 50****Auditorium C****Development, Genetics, Biomechanics, and Evolution of the Spine in Vertebrates (Part 2)***Chairs: Maxime Taverner, Roman Khonsari, Christine Böhmer*

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|----------|-------------|--|---|
| 10:00 am | <b>50-1</b> | Break-neck pace: analysing the interplay between integration and evolutionary rate in avian neck evolution | Ryan Marek, Ryan Felice; University College London  |
| 10:15 am | <b>50-2</b> | Functional regionalization of the backbone along the land-to-water transition in mammals                   | Amandine Gillet, Katrina Jones, Stephanie Pierce; Museum of Comparative Zoology, Harvard University, University of Manchester |
| 10:30 am | <b>50-3</b> | Morphological indicators of hunting behaviour in the carnivoran axial skeleton                             | Julia Schwab, Borja Figueirido, Katrina Jones; University of Manchester, University of Málaga                                 |
| 10:45 am | <b>50-4</b> | Evolution of intervertebral joint function in Crocodylomorpha assessed via automated digital methods       | Charles Bates, Katrina Jones, John Hutchinson; University of Manchester, Royal Veterinary College                             |

**10:00 AM – 11:30 AM****Session 51****M7-M8****Special Session in Honor of Walter J. Bock***Chair: Dominique Homberger*

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|----------|-------------|--|--|
| 10:00 am | <b>51-1</b> | Walter J. Bock 1933-2022: Evolutionary Biologist, Functional Morphologist, and Science Organizer | Dominique Homberger; Louisiana State University, Baton Rouge |
| 10:30 am | <b>51-2</b> | Testable Narratives of Evolution: Walter J. Bock's Account of Historical Explanation in Biology  | Bradley Wood; University of Montana Western                  |

**10:00 AM – 11:30 AM****Session 52****M2-M3****Visceral Organs: Form and Function***Chair: Patricia Brennan*

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|----------|-------------|--|--|
| 10:00 am | <b>52-1</b> | Reproductive impacts of differential extensibility of cloacal and vaginal wall tissues in the American alligator | Diane Kelly, Brandon Moore, Patricia Brennan; University of Massachusetts, Stephens College, Mount Holyoke College                                       |
| 10:15 am | <b>52-2</b> | How does the pancreas of lizards develop? Lessons from the brown anole <i>Anolis sagrei</i> (Squamata: Iguania)  | Magdalena Kowalska, Paweł Kaczmarek, Weronika Rupik; University of Silesia in Katowice, Institute of Biology, Biotechnology and Environmental Protection |
| 10:30 am | <b>52-3</b> | Female Reproductive Organ Anatomy and CRISPR Gene Editing in the Brown Anole                                     | Bonnie Kircher, Richard Behringer; University of Texas MD Anderson Cancer Center   |
| 10:45 am | <b>52-4</b> | Intra-horn insemination in the alpaca: Copulatory wounding and deep sperm deposition                             | Patricia Brennan, Stephen Purdy, Sarah Bacon; Mount Holyoke College, Nunoa Project   |
| 11:00 am | <b>52-5</b> | Shape differences in the hemipenes of rattlesnakes in a hybrid zone  | Rachel Keeffe, Dylan Maag, Brandon Hedrick, Rulon Clark, Patricia Brennan; Mount Holyoke College, San Diego State University, Cornell University         |

**1:30 PM – 4:00 PM****Session 53****M7-M8****Morphological Methods and Databases***Chair: Rui Diogo*

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|---------|-------------|--|---|
| 1:30 pm | <b>53-1</b> | he Visible Ape Project: A free, comprehensive, web-based anatomical atlas to raise public awareness about apes and conservation  | Rui Diogo; Howard University  |
| 1:45 pm | <b>53-2</b> | The openVertebrate (oVert) Project: successes and shortcomings from the past six years   | David Blackburn, Jaimi Gray, Doug Boyer, Julie Winchester, Edward Stanley; University of Florida, Florida Museum of Natural History, Duke University  |
| 2:00 pm | <b>53-3</b> | No scalpel required: using diffusible iodine-based contrast-enhanced Computed Tomography for high-throughput imaging of the anatomy of natural history specimens in 3D | Jaimi Gray, Edward Stanley, Coleman Sheehy, Zachary Randall, Laura Rincón Rodríguez, David Blackburn; Florida Museum of Natural History, University of Florida  |
| 2:15 pm | <b>53-4</b> | Finite element model validation in biomechanics using a 3D scanning Laser Doppler Vibrometer   | Ananth Srinivas-Nurani, Arend von der Lieth, Jen Bright, Emily Rayfield, David Goldsby, Lauren Sallan; University of Pennsylvania, Polytec Inc., University of Hull, University of Bristol, Okinawa Institute of Science and Technology |
| 2:30 pm | <b>53-5</b> | Nothing to yawn about: comparing multiple measures of primate gape   | Rachel Smith, Hanna Barrett, Justice Skinner, Elizabeth Whichard, Adam Hartstone-Rose; North Carolina State University  |



## TUESDAY, 1 AUGUST 2023

2:45 pm	<b>53-6</b>	A Deep Learning pipeline to quantify cranial suture morphology from 3D scans	<i>Yichen He, Heather White, Anjali Goswami, Enrico Grisan; Natural History Museum, London South Bank University</i>
3:00 pm	<b>53-7</b>	Character coding for soft tissue structures, exemplified for reptile myology	<i>Omar Ragalado Fernandez, Ingmar Werneburg; University of Tübingen</i>
3:15 pm	<b>53-8</b>	Taking a step aside from classical geometric morphometrics: could landmark-free approaches build the future of biological shape characterization?	<i>Maxime Taverne, Robin Magnet, Maks Ovsjanikov, Anne-Claire Fabre, Roman Khonsari, Jean Feydy; Hôpital Necker - Enfants Malades, Ecole Polytechnique, NMBE/UniBe, INRIA Paris Centre de Recherche des Cordeliers</i>
3:30 pm	<b>53-9</b>	Buffered Lugol's Iodine Preserves DNA Fragment Lengths in Fixed Museum Specimens	<i>Paul Gignac, Dominik Valdez, Ashley Morhardt, Leigha Lynch; University of Arizona, Midwestern University, Washington University School of Medicine in St. Louis</i>
3:45 pm	<b>53-10</b>	A Bayesian approach to dating the cetacean phylogenetic tree using correlated quantitative characters.	<i>Joseph Minus, Anjali Goswami, Sandra Álvarez-Carretero, Ellen Coombs, Morgan Churchill, Mario dos Reis; Queen Mary University of London, The Natural History Museum, University College London, Smithsonian National Museum of Natural History, University of Wisconsin</i>

**1:30 PM – 4:00 PM**

**Session 54**

**M2-M3**

### Taking a Breath: The Mechanics and Evolution of Tetrapod Ventilation

*Chairs: Robert Brocklehurst, Katrina Jones*

1:30 pm	<b>54-1</b>	Evolution of lung ventilation in tetrapods	<i>Elizabeth Brainerd; Brown University</i>
2:00 pm	<b>54-2</b>	Origin and evolution of lung and gas bladder ventilation in air-breathing fish	<i>Elska Kaczmarek; Brown University</i>
2:15 pm	<b>54-3</b>	Rib kinematics in lizards provide insight into the evolution of ventilation and locomotion	<i>Robert Cieri; University of British Columbia</i>
2:30 pm	<b>54-4</b>	The subpectoral diverticulum in Buteo: not just another air sac	<i>Emma Schachner, Brandon Hedrick, Andrew Moore, Aracely Martinez, Raul Diaz Jr., Scott Echols, Karl Bates; University of Florida, Cornell University, Stony Brook University, Louisiana State University Health Sciences Center, California State University Los Angeles, The Medical Center for Birds, University of Liverpool</i>
2:45 pm	<b>54-5</b>	Breathing inside a box & how it constrains movement	<i>Jonathan Codd; University of Manchester</i>
3:00 pm	<b>54-6</b>	Thoracic cage morphology coadapts with aerobic capacity in artificially selected High Runner mice	<i>Katrina Jones, Elizabeth Webb, Nicole Schwartz, Theodore Garland; University of Manchester, University of California, Riverside</i>
3:15 pm	<b>54-7</b>	The key innovation of the mammalian respiratory system	<i>Tatsuya Hirasawa, Shigeru Kuratani; The University of Tokyo, RIKEN Center for Biosystems Dynamics Research</i>

**1:30 PM – 3:45 PM**

**Session 55**

**Auditorium C**

### The Land Down Under (Australian Animals)

*Chair: Vera Weisbecker*

1:30 pm	<b>55-1</b>	Genus at Work: Cranial shape diversity in a recent radiation of marsupial herbivores	<i>Rex Mitchell, Sally Potter, Mark Eldridge, Vera Weisbecker; Flinders University, Macquarie University, Australian Museum</i>
1:45 pm	<b>55-2</b>	Shapes and traits that don't match: the thylacine as a mammalian evolutionary curiosity	<i>Vera Weisbecker, Andrew Pask, Axel Newton, Douglass Rovinsky; Flinders University, The University of Melbourne</i>
2:00 pm	<b>55-3</b>	Morphological and ecological correlates of inner ear labyrinth in limb-reduced Australian skinks (Scincidae: Sphenomorphinae)	<i>Marco Camaiti, James Wiles, Rocio Aguilar, Mark Hutchinson, Christy Hipsley, David Chapple, Alistair Evans; Monash University, Museums Victoria, South Australian Museum, University of Copenhagen</i>
2:15 pm	<b>55-4</b>	Locomotor joint moments in Varanid lizards and the scaling of locomotion in sprawling tetrapods	<i>Christofer Clemente, Robert Cieri, Taylor Dick, Peter Bishop, John Hutchinson; University of the Sunshine Coast, University of British Columbia, University of Queensland, Harvard University, Royal Veterinary College</i>
2:30 pm	<b>55-5</b>	A new diminutive durophagous Miocene dasyuromorphian (Marsupialia, Malleodectidae) from the Riversleigh World Heritage Area, northern Australia	<i>Timothy Churchill, Michael Archer, Suzanne Hand, Troy Myers, Anna Gillespie, Robin Beck; University of New South Wales, University of Salford</i>
2:45 pm	<b>55-6</b>	Three new late Oligocene thylacinids (Marsupialia: Thylacinidae) from the Riversleigh World Heritage Area	<i>Timothy Churchill, Michael Archer, Suzanne Hand; University of New South Wales</i>
3:00 pm	<b>55-8</b>	Morphological and ecological shifts in Australian reptile community assemblies over time, using fossil records	<i>Jessica Fenker, Rocio Aguilar, Till Ramm, Jane Melville; Museums Victoria, Museum für Naturkunde - Leibniz Institute for Evolution and Biodiversity Science</i>

## TUESDAY, 1 AUGUST 2023

- 3:15 pm **55-9** Utilising Geometric Morphometrics to identify snake and varanid fossils to answer macroecological questions  
Utilising Geometric Morphometrics to identify snake and varanid fossils to answer macroecological questions  
*Ammresh, Rocio Aguilar, Scott Hocknull, Emma Sherratt, Alistair Evans, Jane Melville; Monash University, Melbourne Museum, Museums Victoria, Queensland Museum, The University of Adelaide*
- 3:30 pm **55-10** Impacts of Quaternary climate change on shaping past reptile and frog species and communities along eastern Australian.  
*Juan Pedro Valbuena Fernandez, Rocio Aguilar, Jane Melville; Museums Victoria, Monash University*

<b>4:00 PM – 5:00 PM</b>	<b>P4</b>	<b>Auditorium A/B/D</b>
<b>P4-1</b>	Investigating the relationship between neck length and vertebral morphology at the cervicothoracic transition in ungulates	<i>Lena Golombiewski, Destina Ocak, Marilena Müller, Luisa Merten, John Nyakatura, Christine Böhmer; Christian-Albrechts-Universität zu Kiel, Humboldt-Universität zu Berlin</i>
<b>P4-2</b>	The effects of shape and complexity on the performance of mammal teeth	<i>Alistair Evans; Monash University</i>
<b>P4-3</b>	Quantifying nasal Airflow in large carnivores using computational fluid dynamics (CFD)	<i>Alejandro Pérez-Ramos, Manuel Burgos, Daniel Sanz-Prieto, Francisco Pastor, Baptiste Mulo, Israel Sánchez Lite, Markus Bastir, Borja Figueirido; University of Málaga, Universidad Politécnica de Cartagena, Museo Nacional de Ciencias Naturales - Spanish National Research Council, Universidad de Valladolid., ZooParc de Beauval &amp; Beauval Nature, Servicio de Radiodiagnostico del Hospital Clínico Universitario</i>
<b>P4-4</b>	Directional Asymmetry in Limb Bone Shape of the North American River Otter	<i>Dominik Valdez, Brandon Vera Covarrubias, Leigha Lynch; Midwestern University</i>
<b>P4-5</b>	Skull morphology variability in island Arctic foxes ( <i>Vulpes lagopus</i> ) are not correlated with ecology or development	<i>Alberto Martín-Serra, Olga Nanova, Ceferino Varón-González, Borja Figueirido; Universidad de Malaga, Zoological Museum, M.V. Lomonosov Moscow State University, Muséum National d'Histoire Naturelle</i>
<b>P4-6</b>	Anomaluromorph rodents: evolution through masticatory muscle anatomy	<i>Léa Da Cunha, Pierre-Henri Fabre, Lionel Hautier; Institut des Sciences de l'Evolution de Montpellier, Université de Montpellier</i>
<b>P4-7</b>	Comparative anatomy of pelvic girdles in climbing fish	<i>Takashi Maie; University of Lynchburg</i>
<b>P4-8</b>	A strepsirrhine primate from the late Oligocene Nsungwe Formation, southwestern Tanzania	<i>Nancy Stevens, Patrick OConnor, Eric Roberts, Theresa Orr, Cassy Mtelega; Ohio University, James Cook University, University of Dar es Salaam</i>
<b>P4-9</b>	Insights into the brain-braincase relationship across the Sarcopterygii, Lissamphibia and Lepidosauria	<i>Corinne Mensforth, Marc Jones, Livia Miron, John Long, Alice Clement; Flinders University, Natural History Museum London</i>
<b>P4-10</b>	Assessing Morphological Variation in the Avian Quadrate Through 3D Geometric Morphometrics	<i>Philip Morris, Sebastian Alvarez de Araya, Alec Baines, Israel Molina, Kaleb Smallwood, Ryan Carney; University of Birmingham, University of South Florida, The George Washington University</i>
<b>P4-11</b>	Parallel evolution of trabecular bone and bone marrow haematopoiesis	<i>Sophie Sanchez, Jordi Estefa, Luke Brosnan, Paul Tafforeau, Sifra Bijl, Emma Hammarlund, Alice Clement, Jozef Klembara, Grzegorz Niedzwiedzki, Camille Berruyer, Stephen Poropat, William Rickard, Auraya Manaprasertsak, Kliti Grice; Uppsala University, Western Australian Organic and Isotope Geochemistry Centre, Curtin University, Australia, European Synchrotron Radiation Facility, Lund University, Flinders University, Comenius University in Bratislava</i>
<b>P4-12</b>	The Olfactory Anatomy of the Archaic Oligocene Odontocete, Archaeodelphis	<i>Stephen Godfrey; Calvert Marine Museum</i>
<b>P4-13</b>	Developmental morphology of squamate lungs, with special reference to the bizarre lungs of chameleons	<i>Aaron Griffing, Michael Palmer, Tony Gamble, Natasha Shylo, Paul Trainor, Celeste Nelson; Princeton University, Marine Biological Laboratory, Marquette University, Stowers Institute for Medical Research</i>
<b>P4-14</b>	Structural specialization of nuchal ligament in American bison and gaur	<i>Megu Gunji; Toyo University</i>
<b>P4-15</b>	Australian herpetological biodiversity under the spotlight of CT scanning using paleontological collections from the Quaternary period	<i>Rocio Aguilar, Jane Melville, Scott Hocknull, Jay Black; Museums Victoria, Queensland Museum, University of Melbourne</i>
<b>P4-16</b>	First description of the air-breathing behaviors of Australian lungfish ( <i>Neoceratodus forsteri</i> )	<i>Elska Kaczmarek, Samantha Gartner, Elizabeth Brainerd; Brown University, University of Chicago</i>
<b>P4-17</b>	Digitized endocasts and brains: measurements and analyses of the evolution of 172 fossil and extant vertebrate specimens	<i>Harry Jerison, Catherine Early, Andrew Farke, Ashley Morhardt; University of California, Los Angeles, Science Museum of Minnesota, Raymond M. Alf Museum of Paleontology, Washington University</i>

## TUESDAY, 1 AUGUST 2023

- |              |   |  |
|--------------|---|--|
| <b>P4-18</b> | Body-support-dependency of the torsional stiffness in the forearm of Asian black bear ( <i>Ursus thibetanus</i> )                         | <i>Akira Fukuhara, Hayato Amaike, Megu GUNJI, Yoichi Masuda, Kenjiro Tadakuma, Akio Ishiguro; Tohoku University, Toyo University, Osaka University</i>   |
| <b>P4-19</b> | A physical model for reproducing the passive dynamics of limbs in walking and running horses  | <i>Tatsuya Yoshida, Kazuhiro Miyashita, Aritsune Kobayashi, Yoichi Masuda, Megu Gunji, Akira Fukuhara, Yuji Takahashi, Ohmura Hajime, Kenjiro Tadakuma, Masato Ishikawa; Osaka University, Toyo University, Tohoku University, JRA Equine Research Institute</i> |
| <b>P4-20</b> | In-vitro experiment using alligator teeth to test the relationship between diets, frequency of food contact, and dental microwear texture | <i>Kodai Usami, Daniela E. Winkler, Tai Kubo, Mugino Kubo; The University of Tokyo, Kiel University, Zoological Institute, Okinawa Institute of Science and Technology</i>   |
| <b>P4-21</b> | Comparative organogenesis of squamates: state of the art and challenges   | <i>Zitong Zhang, Gerardo Antonio Cordero, Ingmar Werneburg; University of Tübingen, University of Lisbon</i>   |
| <b>P4-22</b> | Vertebral fusion in a colubriiform snake (Reptilia, Serpentes) from the late Oligocene Rukwa Rift Basin of Southwest Tanzania             | <i>Jacob McCartney, Cassy Mtelela, Eric Martin Roberts, Patrick M. OConnor, Nancy Jeanne Stevens; Nazareth University, University of Dar es Salaam, James Cook University, Ohio University</i>   |
| <b>P4-23</b> | Temporal changes in sauropodomorph morphology and their locomotor allometry inferred from Jurassic and Cretaceous trackways               | <i>Kohei Yamaguchi, Tai Kubo, Mugino O. Kubo; The University of Tokyo, Okinawa Institute of Science and Technology</i>   |

**5:00 PM – 6:00 PM**

**Plenary 5**

**Auditorium C**

5:00 pm

Life and movement: The unbreakable bond

*Virginia Abdala; Universidad Nacional de Tucumán. IBN CONICET-UNT*

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