



UNDERGRADUATE SUMMER VACATION SCHOLARSHIP AWARDS – FINAL SUMMARY REPORT FORM 2020/21

NB: This whole report will be posted on the Society's website therefore authors should NOT include sensitive material or data that they do not want disclosed at this time.

Name of student:

Eimear Byrne

Name of supervisor(s):

Sourav Bhattacharjee

Project Title: (no more than 220 characters)

The humeral supracondylar foramen in feline species and its evolutionary significance

Project aims: (no more than 700 words)

The humeral *supracondylar foramen* noticed in the medio-distal part of the humeri in feline species, climbing mammals and marsupials has confused anatomists for long. The foramen appears to pierce the humeral shaft and contains the median nerve and brachial artery of the forelimbs. Its function remains unsettled, although the current understanding supports its role in protecting the vessels and nerves of the feline elbow joints—as the elbow joints in animals like cats are known to be quite dynamic. However, such a hypothesis/theory lacks evidence and, thus, falls short of being a robust narrative. Interestingly, a vestige of the supracondylar foramen can be noticed in humans in the form of a bony spur—the *supracondylar process*, at ~5 cm distance from the medial epicondyle of the human humeri with ~1% occurrence. Occasionally, the spur is attached to the humeral medial epicondyle by a fibrous band known as the *ligament of Struthers*. Interestingly, such supracondylar processes with the ligament are usually asymptomatic in human, and often diagnosed as an accidental finding. However, the ligament of Struthers is known to cause compression of the median nerve and brachial artery, sometimes with compression of even the ulnar nerve—in humans causing paresthesia/claudeication of the forearm muscles, with or without ischemia necessitating surgical intervention. It is hypothesized that the ligament of Struthers is the embryologic remnant of the now extinct *coracobrachialis longus* (or Wood's) muscle⁵ noticed in the apes. One explanation given behind the extinction is the lack of adductor function required in human arms, or terrestrial mammals, once they discarded their primitive arboreal lives. While the ligament of Struthers exists in humans as a band of connective tissue, in feline species, it gets ossified to form an osseous foramen, i.e., the supracondylar foramen.

The driving hypothesis is that the osseous foramen, as found in cats now, is not part of the distal humeral shaft, but rather an ossified remnant of a now obsolete muscular head—thus, will differ from the remaining humeral shaft in anatomy and internal architecture.

Aims and objectives

- ✓ To develop a database of feline humeral CT scans including slices of the foramen.
- ✓ To use digital tools, such as FIJI®, to generate 3D rendering of the humeral shaft illustrating the internal architecture of the bones, especially those in the vicinity of the foramen.
- ✓ To mathematically analyze the data and develop models including extraction of numerical read-outs, that can further be subjected to data analyses using software like OriginPro®.
- ✓ To investigate how the foramen and the osseous arch around it is connected to the remaining humeral shaft, and if any anatomical disparity exists between the two.

Project Outcomes and Experience Gained by the Student (no more than 700 words)**Experience gained by the student**

Understanding the principles of computed tomography (CT)
 Investigating how CT data are gathered and analyzed
 Introduction toward micro-CT technique
 Learning the skills of CT data analyses in 3D with the help of ImageJ and 3D Slicer software
 Writing and presentation skills

Project outcomes

The outer margin of feline supracondylar foramen lacks a typical osseous structure
 CT evidence points toward the existence of a ligamentous structure
 The data are of evolutionary significance
 Follow up studies ongoing
 Manuscript under preparation

Please state which Society Winter or Summer Meeting the student is intending to present his/her poster at:

Anatomical Society Winter Meeting 2021 (Dublin, Ireland)

Proposed Poster Submission Details (within 12 months of the completion of the project) for an AS Winter/ Summer Meeting – (no more than 300 words)

The abstract will be submitted by the end of November 2021

Brief Resume of your Project's outcomes: (no more than 200-250 words).

The title of your project and a brief 200-250 word description of the proposed/completed project. The description should include sufficient detail to be of general interest to a broad readership including scientists and non-specialists. Please also try to include 1-2 graphical images (minimum 75dpi). NB: Authors should NOT include sensitive material or data that they do not want disclosed at this time.

The mysterious supracondylar foramen in feline humeri has baffled anatomists for long. Not only due to its unconventional location but also due to the important structures (median nerve and brachial artery) that pass through the foramen make it an intriguing anatomical feature. A characteristic ligament of Struthers is noted in humans (1% of cases), and in some cases, calcification of the ligament is known to cause symptoms in the forearm. In this project, we aimed to investigate if a similar finding can be made where the outer edge of the feline humeral supracondylar foramen is rather an ossified ligament rather than a piece of bone—as opined in many textbooks. To this end, we employed high-resolution micro-CT scans to probe the internal anatomy of the associated structures in the vicinity of the foramen, including the thin slice of the outer edge. The assimilated data reveal that the outer margin of the feline supracondylar foramen lacks a typical osseous structure which in turn bears evolutionary significance. Further studies on the foramen with micro-CT data analyses are currently ongoing.

Other comments: (no more than 300 words)

Not applicable

Data Protection/GDPR: I consent to the data included in this submission being collected, processed and stored by the Anatomical Society. **Answer YES or NO in the Box below**

Yes

Graphical Images: If you include graphical images you must obtain consent from people appearing in any photos and confirm that you have consent. A consent statement from you must accompany each report if relevant. A short narrative should accompany the image. **Answer N/A not applicable, YES or NO in the box below**

Not applicable
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Yes

Signature of student:

Date:

Signature of supervisor:

Date:

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