

# Mouse Cranioskeletal Atlas

A collection of reference images and drawings of anatomical structures in the crania of C57BL/6J mice.

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Most of this document makes up an appendix to my Ph.D. thesis, completed in 2016 under the supervision of Tim Cox at the University of Washington and Seattle Children's Research Institute in Seattle, WA.

$\mu$ CT scans were acquired with a Skyscan 1076  $\mu$ CT scanner (Bruker microCT). 3D reconstructions were segmented with Analyze 9.0 where necessary and rendered in Drishti.<sup>a</sup>

Sketches were drawn in and images were pseudocolored using GIMP.

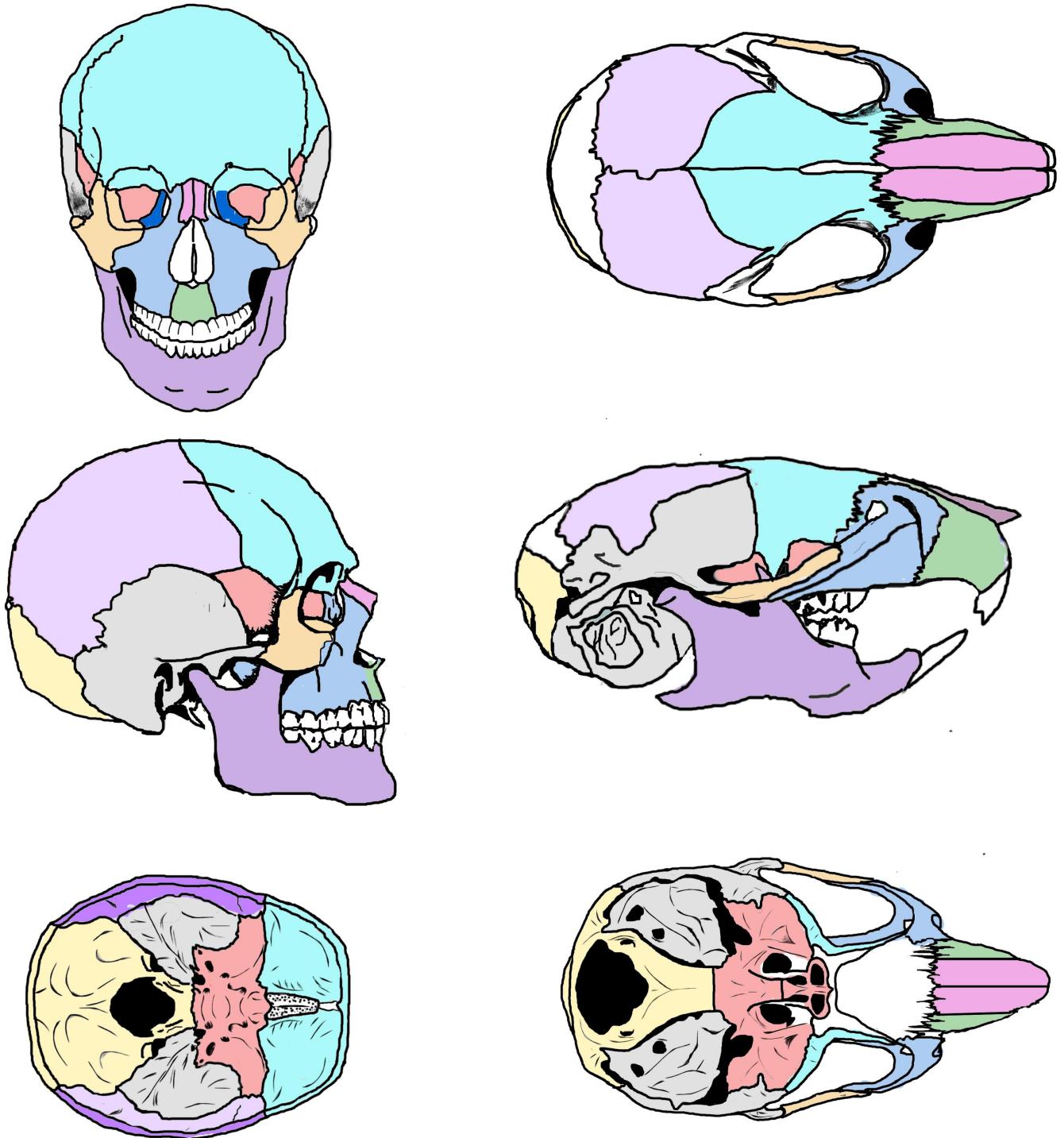
CC BY-NC-SA

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<sup>a</sup>Ajay Limaye (2012). "Drishti: a volume exploration and presentation tool". In: doi: 10.1111/12.935640.

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**Figure 1:** Homology

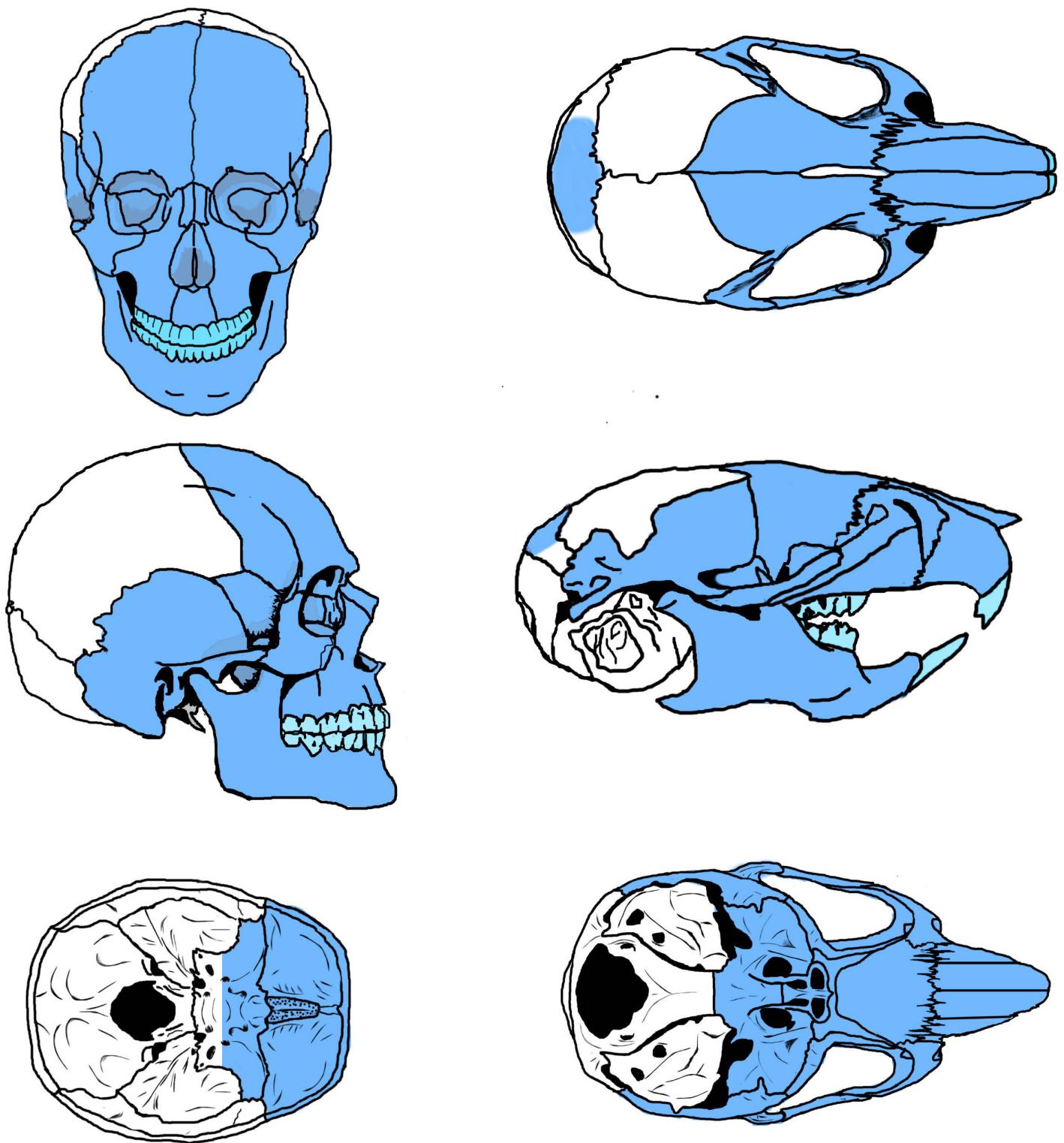
Craniofacial bones are conserved between humans and mice.<sup>a</sup>

<sup>a</sup>Carl Gans (1993). "Evolutionary Origin of the Vertebrate Skull". In: ed. by James Hanken and Brian K Hall; Joan T Richtsmeier, Laura L Baxter, and Roger H Reeves (2000). "Parallels of Craniofacial Maldevelopment in Down Syndrome and Ts65Dn Mice". In: *Dev Dyn* 145(August 1999), pp. 137–145.

### Key

Green, premaxilla  
 Blue, maxilla  
 Purple, mandible  
 Pink, nasal bones  
 Light blue, frontal bones  
 Yellow-orange, zygomatic

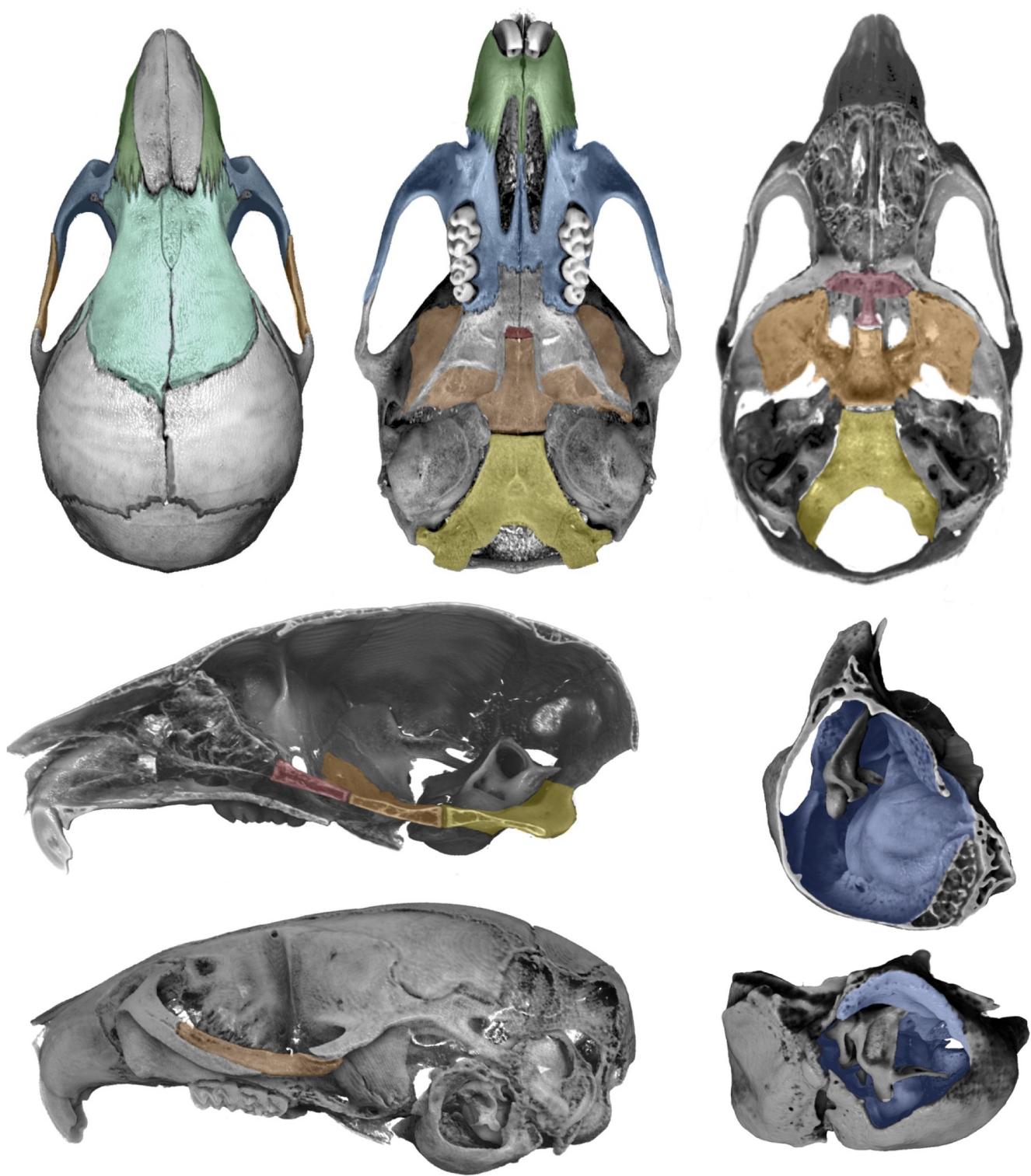
Salmon, sphenoid  
 Gray, temporal bones and bulla  
 Light purple, parietal bones  
 Light yellow, occipital  
 White, mouse interfrontal and interparietal bones



**Figure 2:** Bones of CNCC origin

Bones derived from cranial neural crest cells.<sup>a</sup>

<sup>a</sup>Brandeis McBratney-Owen et al. (2008). "Development and tissue origins of the mammalian cranial base". In: *Dev Biol*; Geoffrey H Sperber, Steven M Sperber, and Geoffrey D Guttman (2010). *Craniofacial Embryogenetics and Development*. 2nd. People's Medical Publishing House: Shelton, CT.



**Figure 3:** Cranial bones

$\mu$ CT scan rendering of C57BL/6J crania at postnatal day 28.

**Key**

Green, premaxilla

Blue, maxilla

Light green, frontal and interfrontal bones

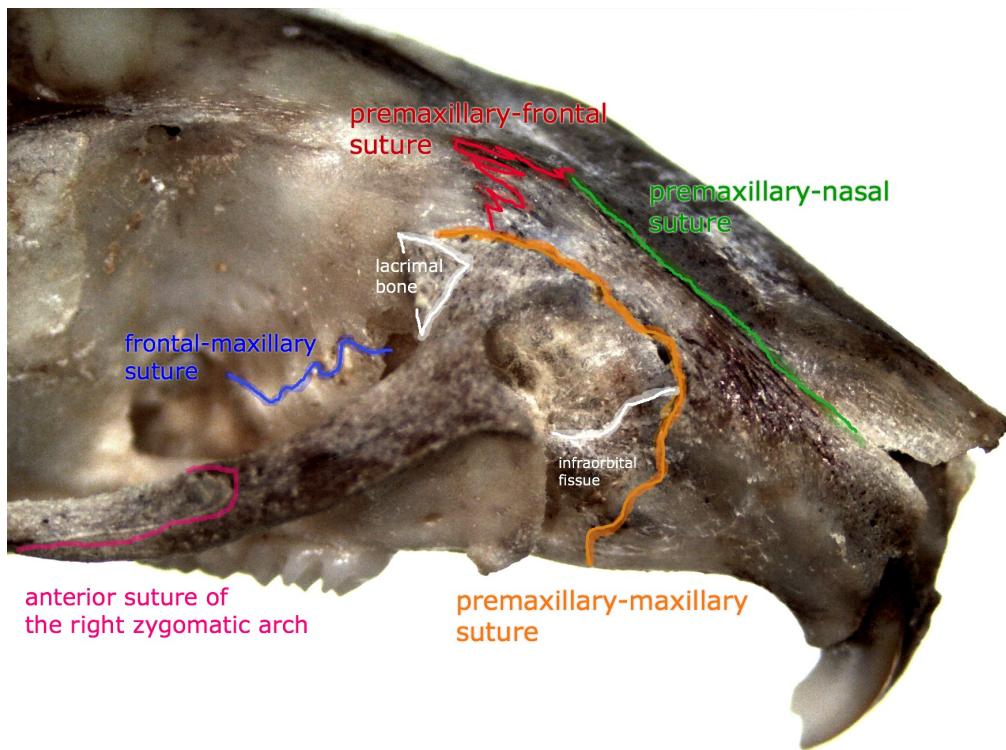
Red, presphenoid

Orange, basisphenoid

Yellow, basioccipital

Dark blue, middle ear

Slightly different orange, jugal bone

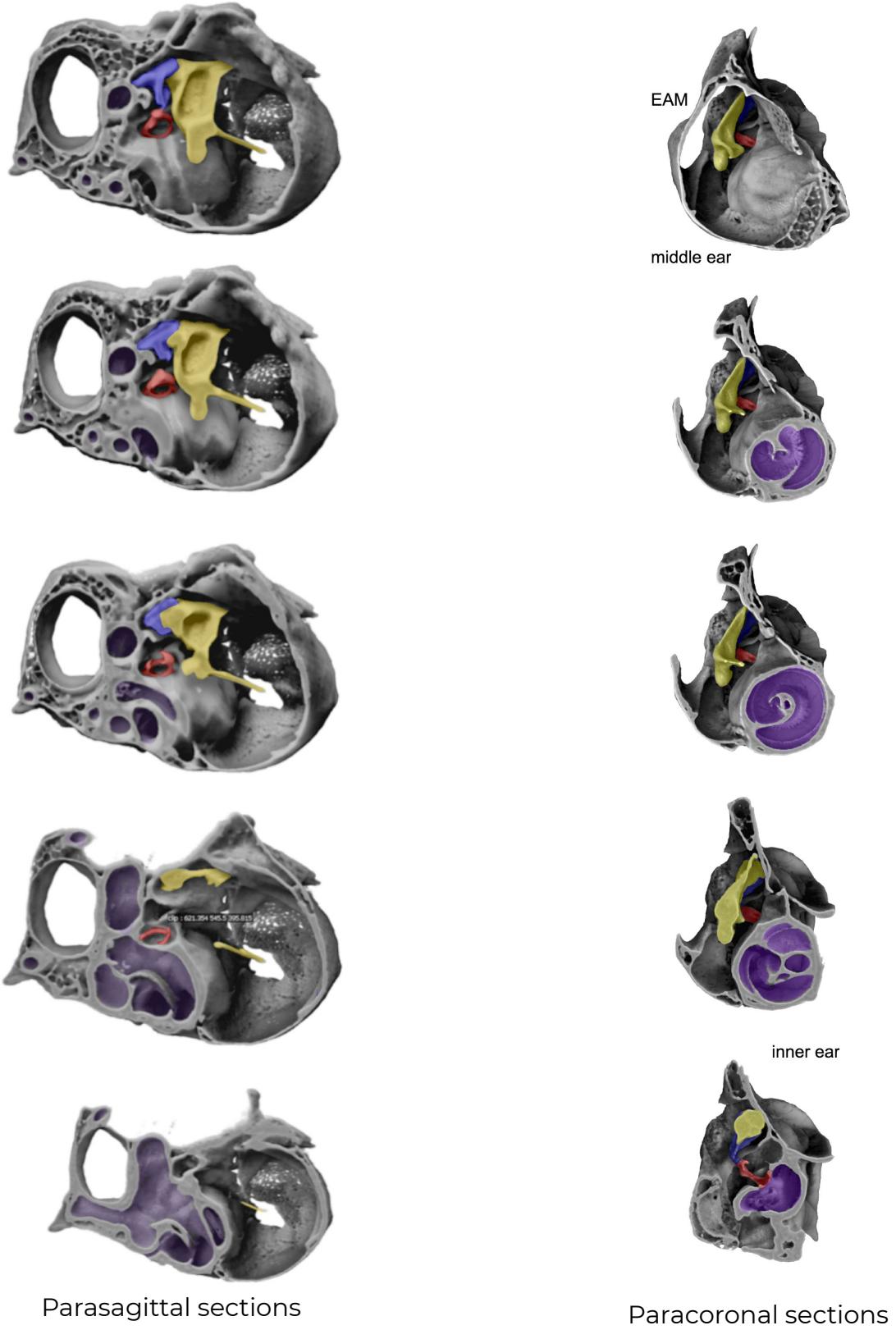


**Figure 4:** Facial sutures

Photograph of an adult C57BL/6J skull with labeled facial sutures.

**Key**

- Pink, anterior suture of the zygomatic
- Red, premaxillary-frontal
- Orange, premaxillary-maxillary
- Green, premaxillary-nasal
- Blue, frontal-maxillary



## Figure 5: Tympanic bulla

Pseudosections through a disarticulated tympanic bulla, showing the position of the ossicles.  
 $\mu$ CT scan rendering from a C57BL/6J mouse older than 50 days.

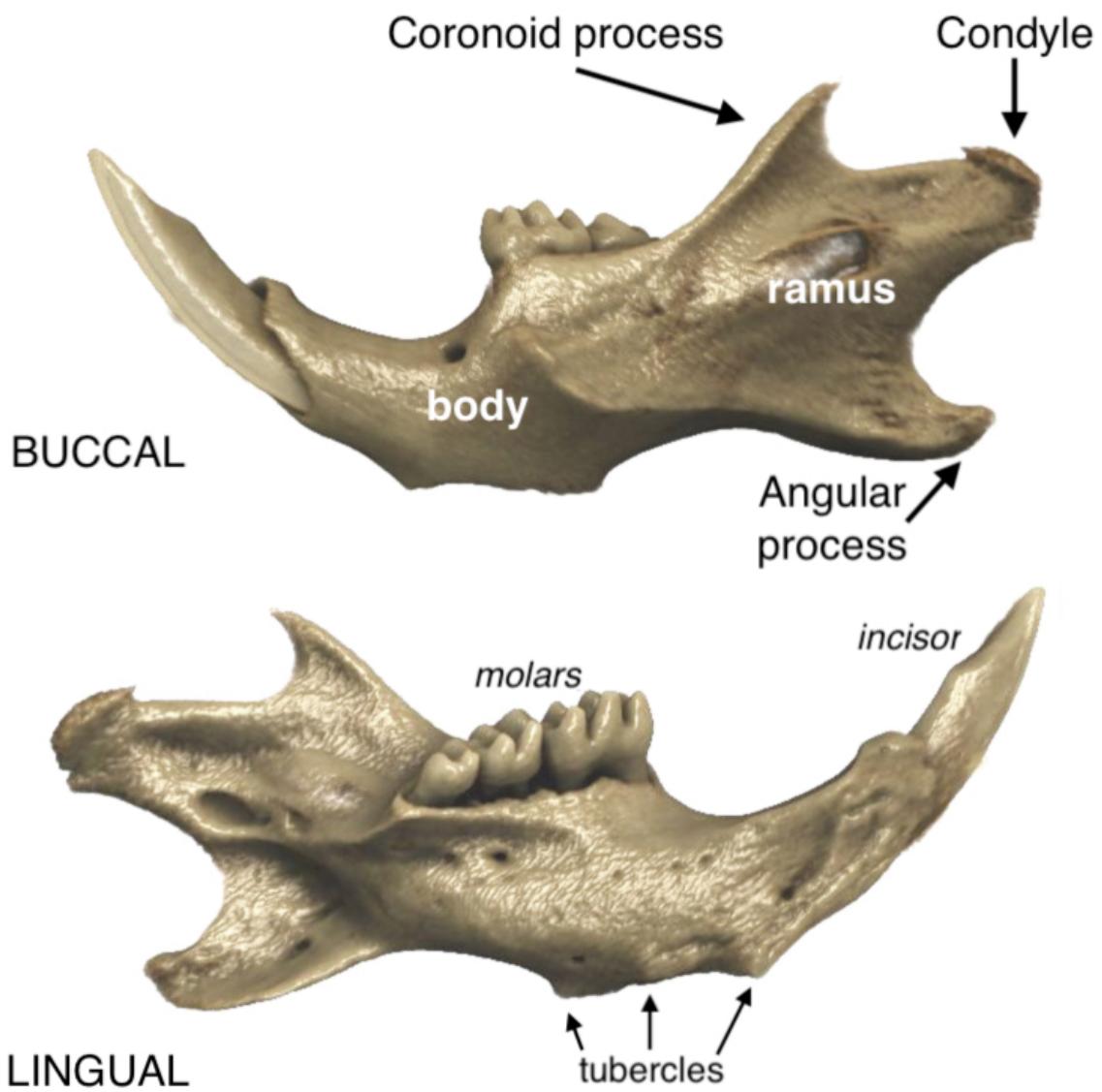
### Key

*Yellow*, incus

*Blue*, malleus

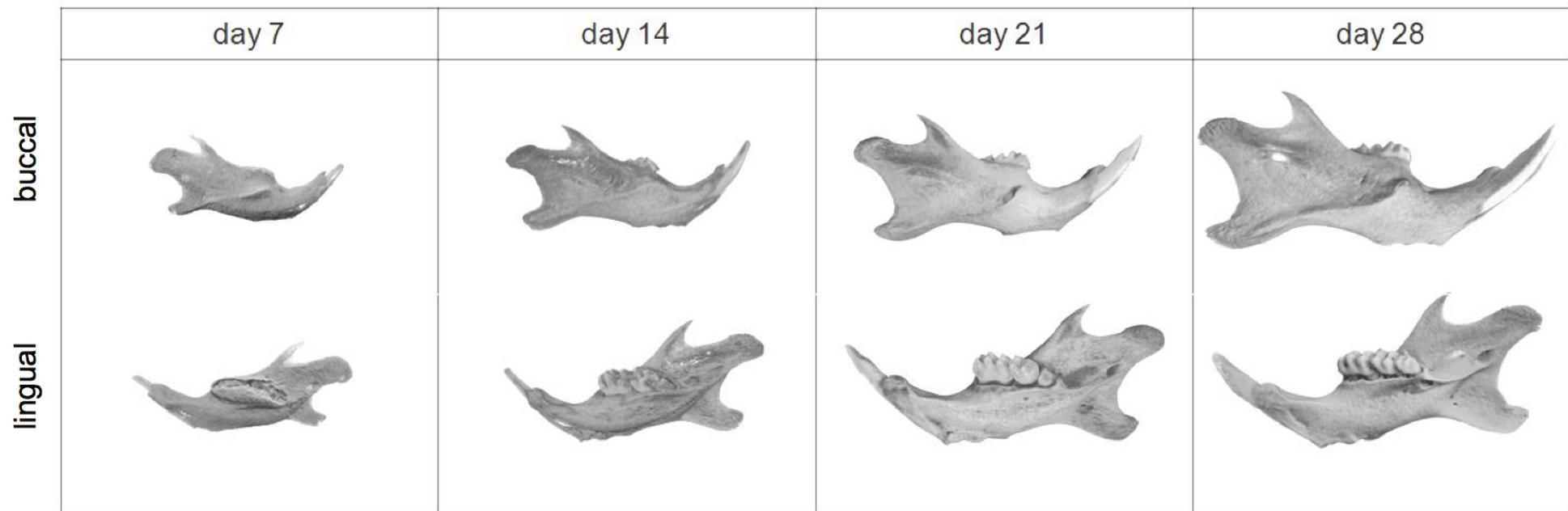
*Red*, stapes

*Purple*, inner ear



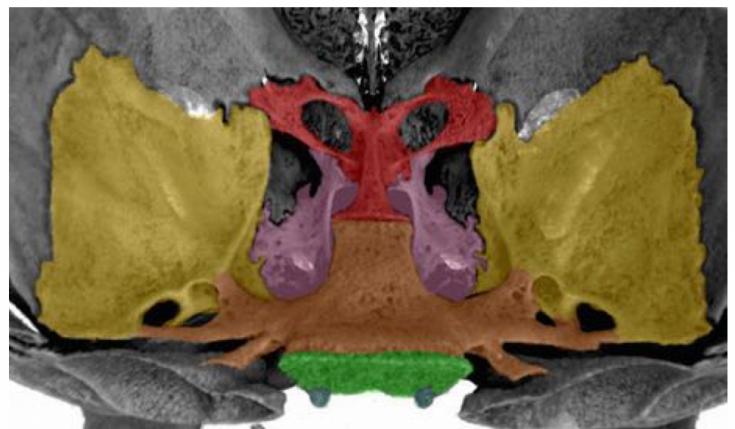
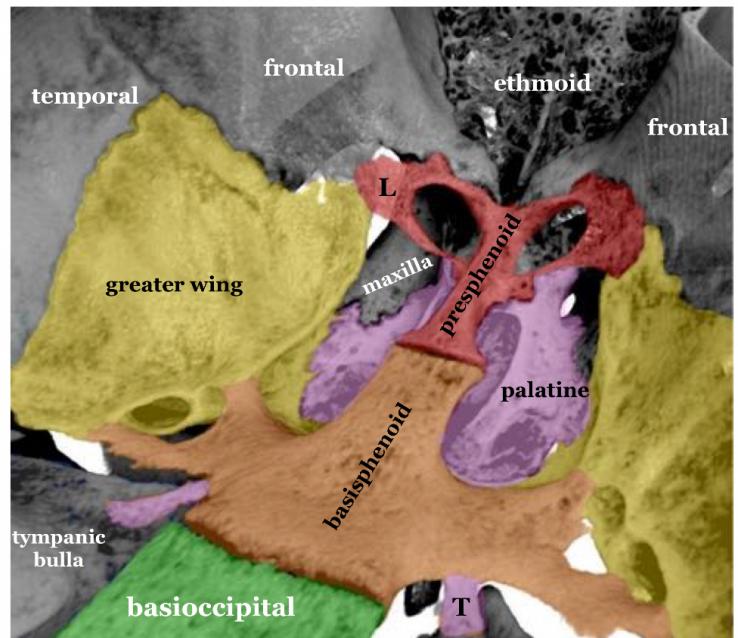
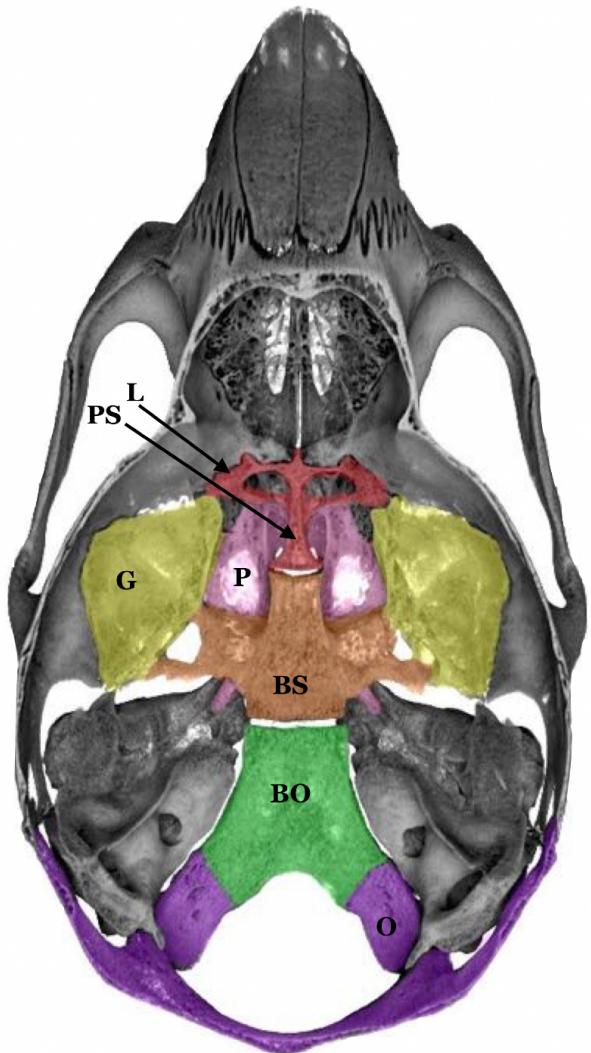
**Figure 6:** Hemimandible

$\mu$ CT scan renderings of lingual and buccal sides of an adult mouse hemimandible.



**Figure 7:** Hemimandibular morphology over the first month of life

$\mu$ CT scan renderings of mouse hemimandibles at postnatal days 7, 14, 21 and 28.



**Figure 8:** Cranial base anatomy

$\mu$ CT scan rendering of the C57BL/6J cranial base at postnatal day 28.

#### key

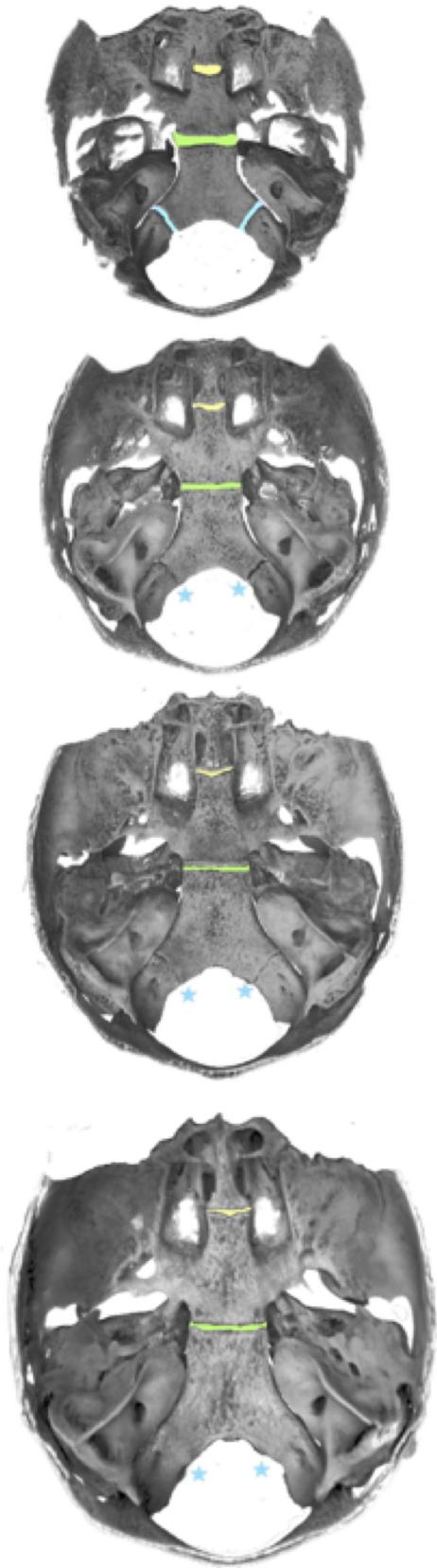
Red, presphenoid

Orange, basisphenoid with Yellow, greater wing of the sphenoid

Pink, palatine

Green, basioccipital

Purple, exoccipital



**Figure 9:** Cranial base morphology over the first month of life  
µCT scan renderings of the C57BL/6J cranial base at postnatal days 7, 14, 21 and 28.

**Key**

Yellow, presphenoid synchondrosis

Green, sphenooccipital synchondrosis

Blue, basioccipital-exoccipital synchondrosis



**Figure 10:** Cervical vertebra

$\mu$ CT scan rendering of the cervical vertebral stack of a 28 day old *sbse* mutant.

**key**

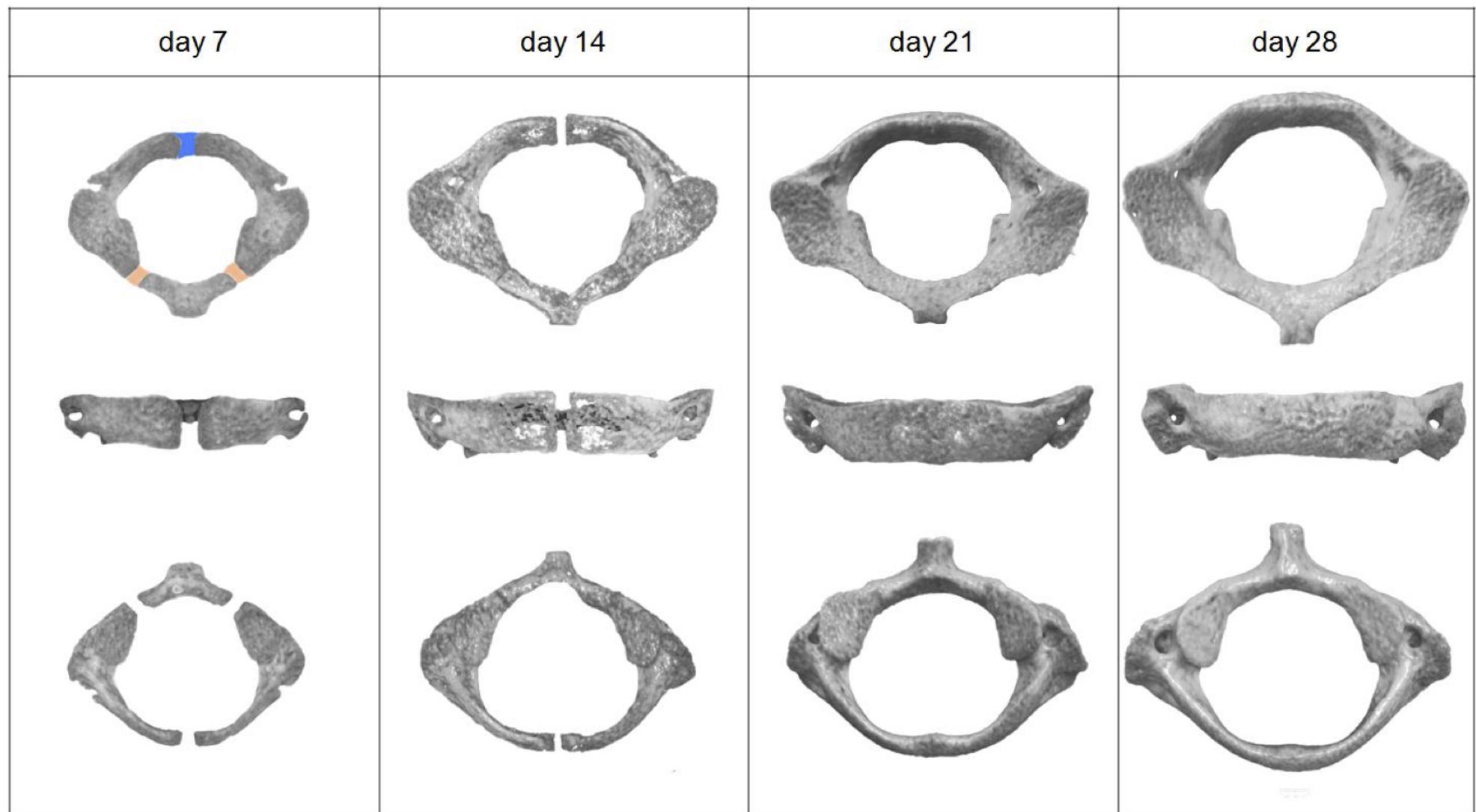
Red, C1 (Atlas)

Orange, C2 (Axis)

Yellow, C3

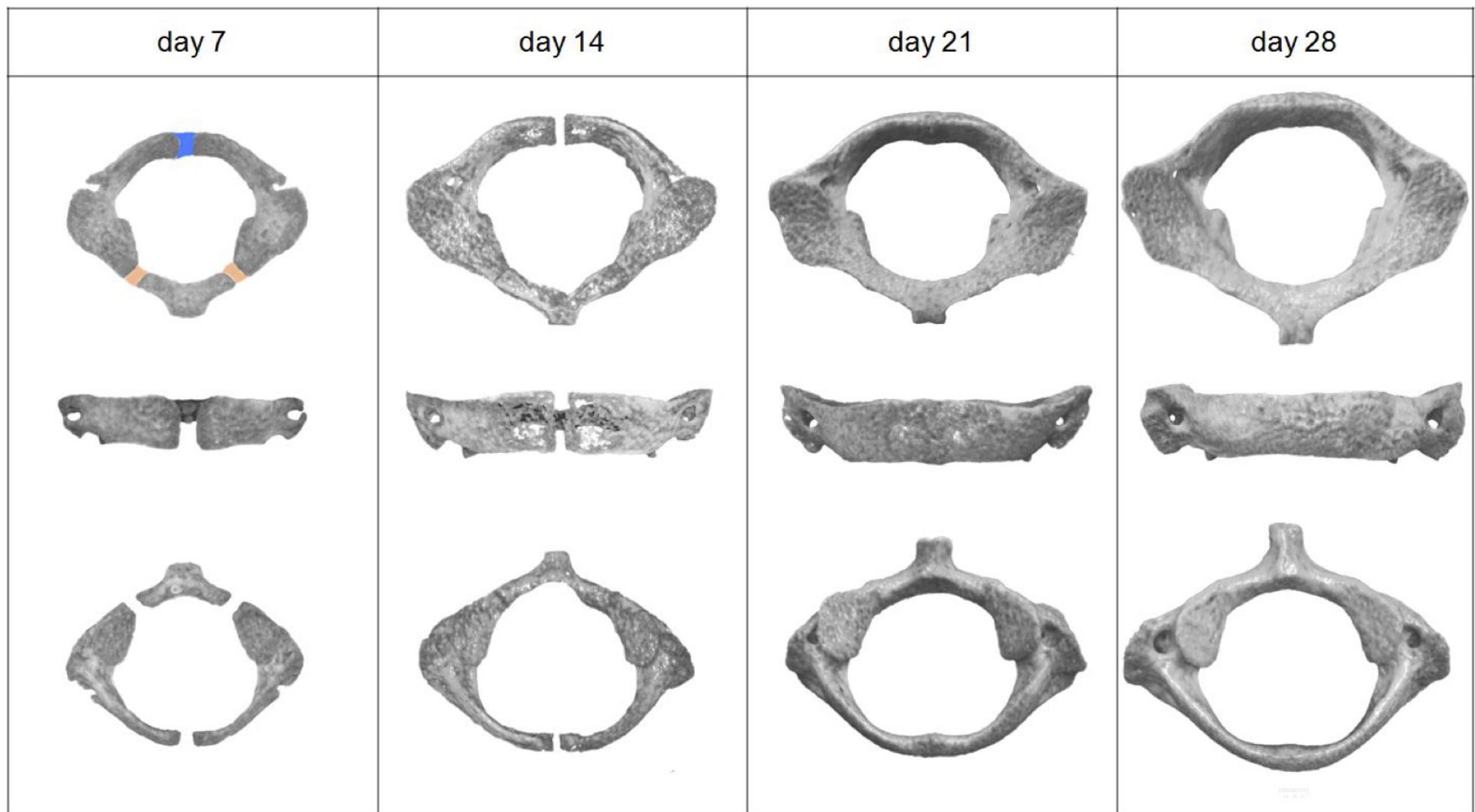
Green, C4

Blue, C5



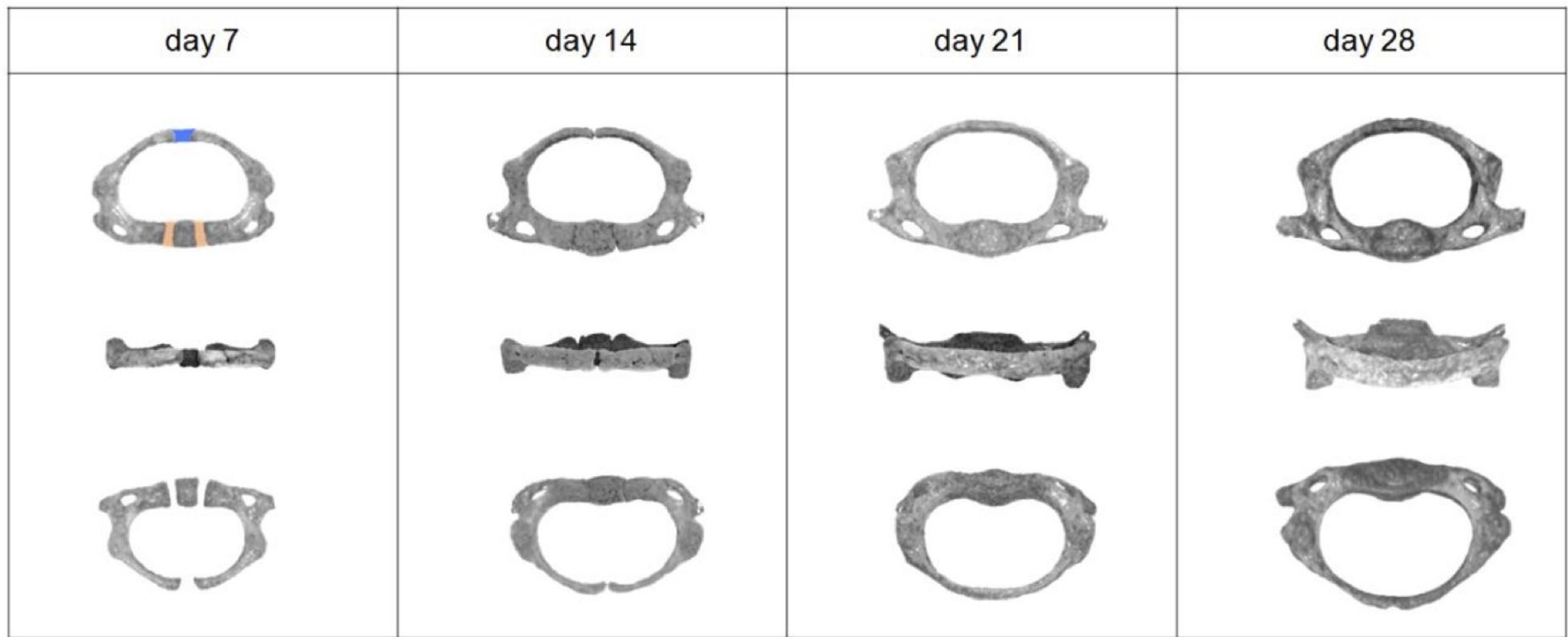
**Figure 11:** C1 morphology over the first month of life

$\mu$ CT scan renderings of representative mouse cervical vertebra 1 (C1) at postnatal days 7, 14, 21 and 28.



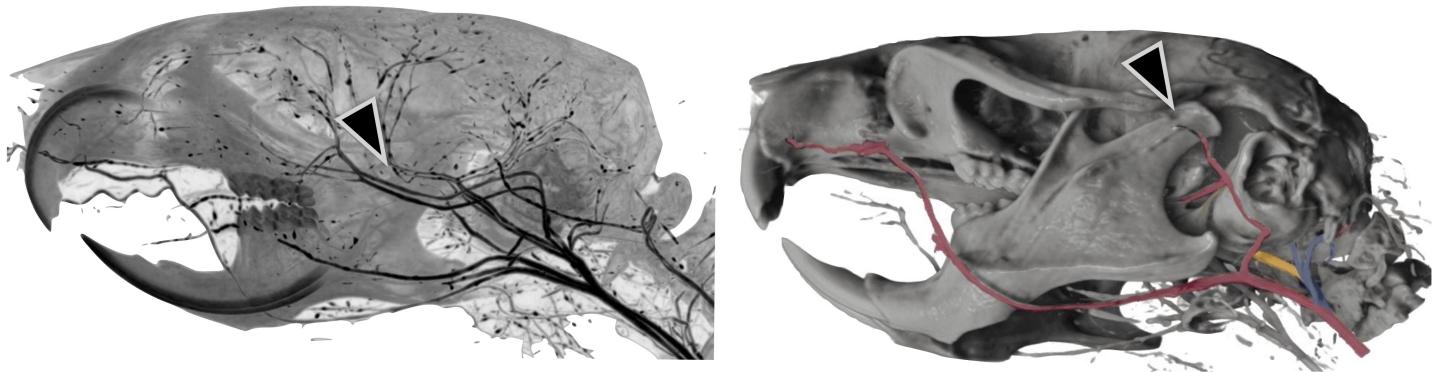
**Figure 12:** C2 morphology over the first month of life

$\mu$ CT scan renderings representative of mouse cervical vertebra 2 (C2) at postnatal days 7, 14, 21 and 28.



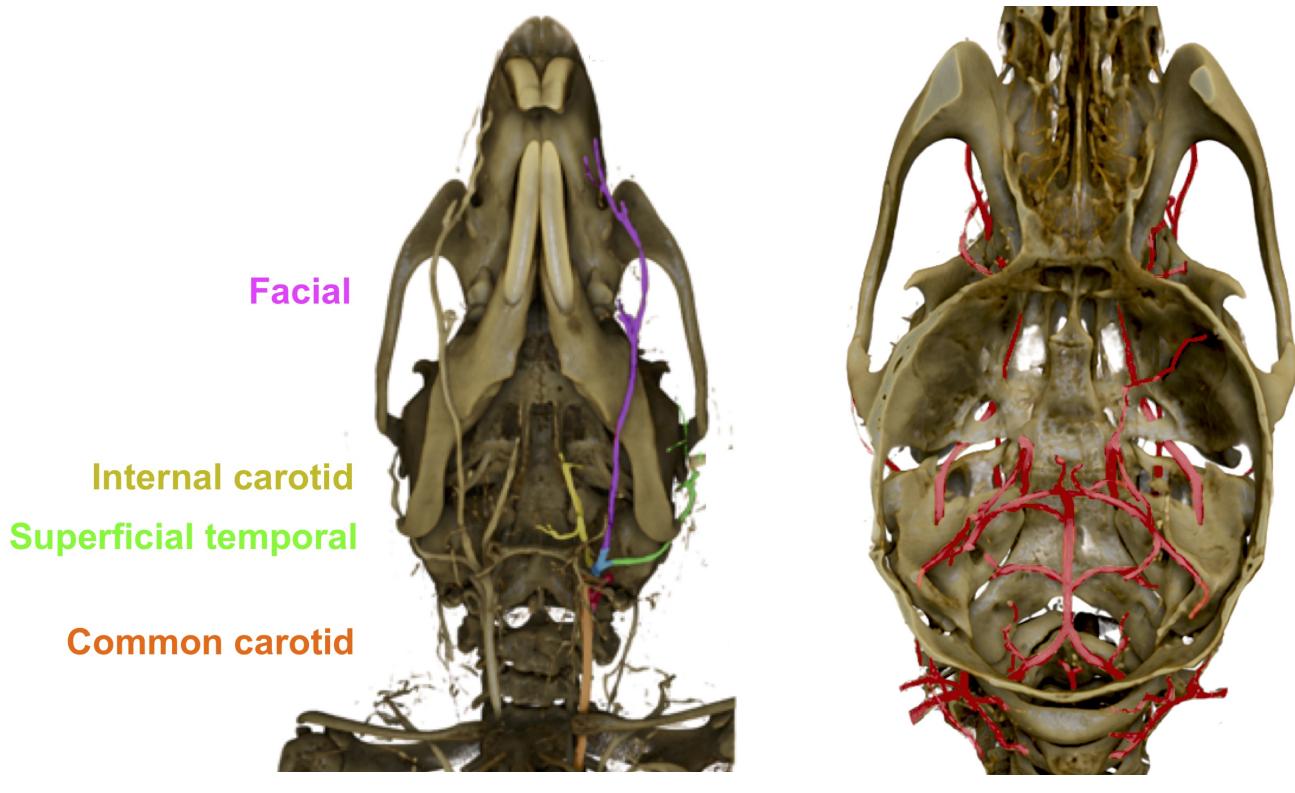
**Figure 13:** C3 morphology over the first month of life

$\mu$ CT scan renderings representative of mouse cervical vertebra 3 (C3) at postnatal days 7, 14, 21 and 28.



Lateral view

*Black arrowhead, mandibular condyle*

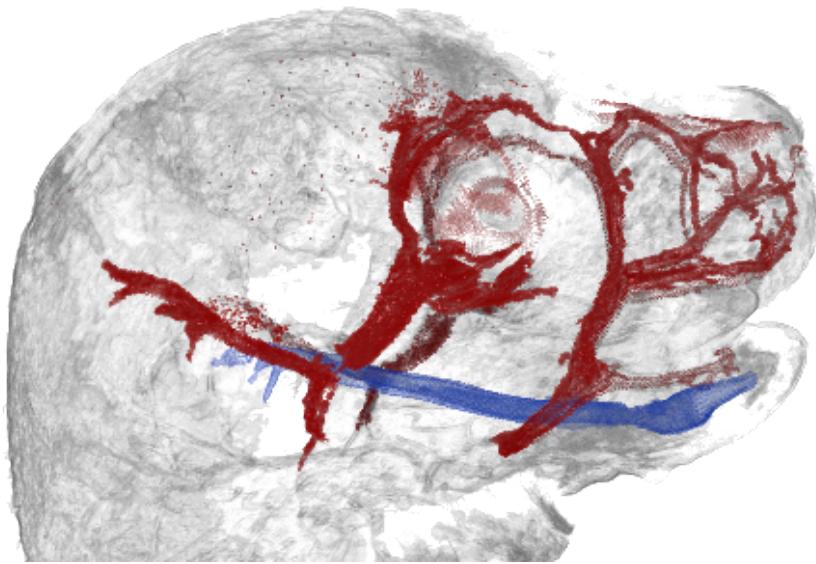


Ventral view with major vessels

Dorsal endocranial view

## Figure 14: Cranial vasculature

$\mu$ CT scan renderings of the cranium of a 145 day old C57BL/6J mouse after perfusion with radioopaque contrast media.

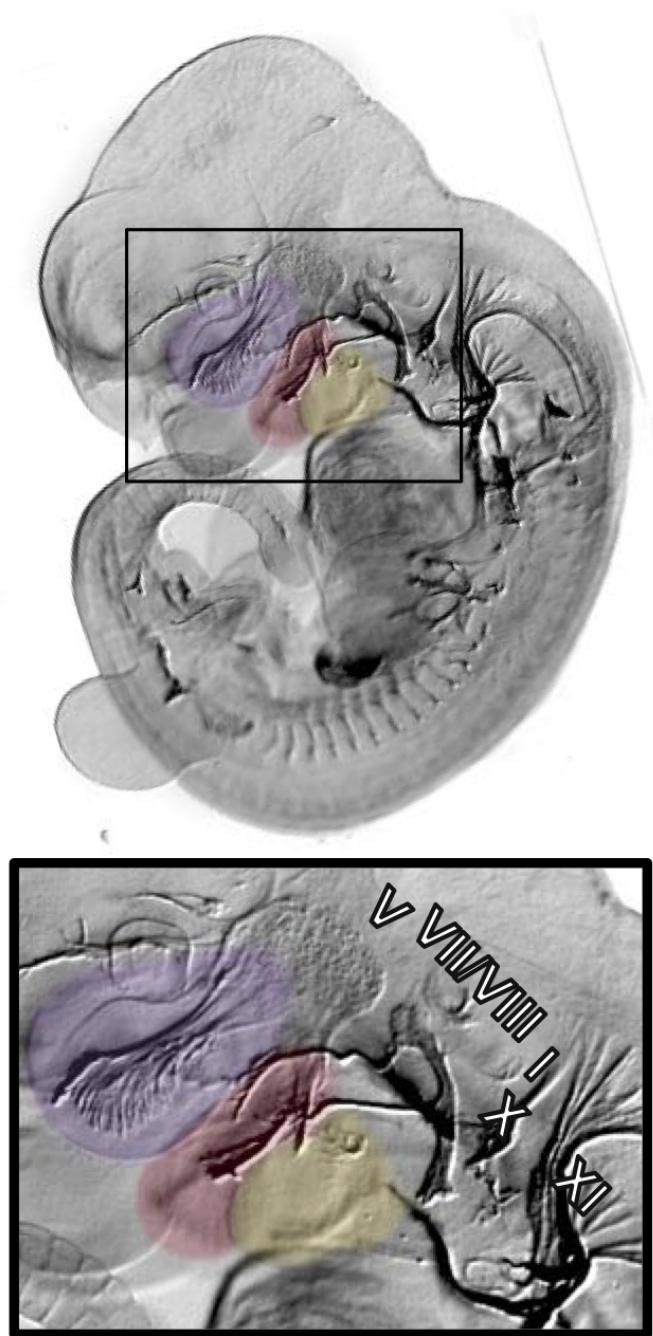


**Figure 15:** Meckel's cartilage and superficial vasculature

Meckel's cartilage and superficial cranial vasculature in an embryonic mouse pup stained with Alcian blue to label cartilage. The image was generated by segmenting an OPT (Optical Projection Tomography) scan reconstruction and selectively rendering the mandibular cartilage, vasculature, and skin. Absent from this image is the nasal capsule and endochondral bone anlage.

**Key**

Blue, Meckel's cartilage  
Red, Superficial craniovasculature



**Figure 16:** Embryonic cranial nerves

Cranial nerves in the embryonic day 11 C57BL/6J mouse, labeled with mouse a-rat neurofilament (2h3) antibody and stained with DAB.

**Key**

Purple and red, branchial arch 1  
Yellow, branchial arch 2

CN V trigeminal  
CN VII facial  
CN VIII vestibulocochlear  
CN IX glossopharyngeal  
CN XI accessory

## REFERENCES

- Gans, Carl (1993). "Evolutionary Origin of the Vertebrate Skull". In: ed. by James Hanken and Brian K Hall.
- Limaye, Ajay (2012). "Drishti: a volume exploration and presentation tool". In: DOI: 10.1117/12.935640.
- McBratney-Owen, Brandeis et al. (2008). "Development and tissue origins of the mammalian cranial base". In: *Dev Biol*.
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- Sperber, Geoffrey H, Steven M Sperber, and Geoffrey D Guttman (2010). *Craniofacial Embryogenetics and Development*. 2nd. People's Medical Publishing House: Shelton, CT.