



NOV 20, 2023

OPEN ACCESS



DOI:
dx.doi.org/10.17504/protocols.io.x54v9p341g3e/v1

Protocol Citation: Steven O'Neill 2023. Dissection of the Carotid Sinus Nerve and Carotid Bifurcation for MicroCT. **protocols.io**
<https://dx.doi.org/10.17504/protocols.io.x54v9p341g3e/v1>

License: This is an open access protocol distributed under the terms of the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited

Protocol status: Working
 We use this protocol and it's working

Created: Oct 22, 2023

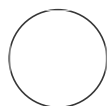
🌐 Dissection of the Carotid Sinus Nerve and Carotid Bifurcation for MicroCT

Steven O'Neill^{1,2}

¹Case Western Reserve University School of Medicine;

²Case Western Reserve University Department of Anatomy

CWRU Department of Anatomy



Steven O'Neill
 Case Western Reserve University

ABSTRACT

Dissection of the carotid sinus nerve begins with the exposure and subsequent removal of the zygomatic arch and angle of the mandible. The region superior to the styloid process and inferior to the jugular foramen is slowly microdissected until the carotid sinus nerve is observed descending inferiorly from or within the region of the glossopharyngeal nerve. Once all relevant structures have been identified and appropriate measurements made, a specimen of the carotid bifurcation with all associated structures of interest is removed. Structures on this specimen are painted for identification and then photographed as necessary.

Keywords: Carotid Sinus
Nerve, CSN,
Glossopharyngeal Nerve,
Cranial Nerve IX, Vagus
Nerve, Cranial Nerve X,
Intercarotid Plexus,
Dissection

Neck Dissection

- 1 Dissection to the **carotid sinus nerve (CSN)** begins with placing the human cadaver in the supine position and rotating the neck towards the contralateral side from which is intended for dissection.
- 2 Palpate for the **sternocleidomastoid (SCM) muscle**; follow this muscle from its inferior origins at the manubrium and clavicle towards its superior insertion at the mastoid process and identify its anterior border.
- 3 With a scalpel, create an incision along the anterior border of the SCM from the manubrium to the mastoid. Continue this incision circumferentially along the anterior border of the ear until reaching the superior most portion of the ear, then continue superiorly along the scalp for ~5 cm.
- 4 Begin an additional incision from the **lateral canthus** of the eye and extend the incision posteriorly until it joins with the incision just anterior to the **tragus** of the ear. The skin superior to this horizontal incision will be regarded as the supratragal flap; skin inferior to this incision will be considered as the infratragal flap.
- 5 Reflect the supra- and infratragal flaps as anteriorly as possible, using instrumentation as appropriate to anchor these sections of tissue away. The infratragal flap should be a continuous unit from the lateral canthus to the manubrium; however, additional anterior incisions along the inferior border of the mandible may be necessary to achieve better mobilization of the tissue. The infratragal flap(s) must be reflected as anteriorly as possible in order to palpate the **lesser cornu of the hyoid**. Explore the region lateral to the hyoid and identify the **carotid sheath**.
 - 5.1 The dissector may care to preserve the **facial artery**, as it holds potential utility in identifying the external carotid artery (ECA) within the carotid sheath.

- 6 Next, create complete exposure of the **zygomatic arch**, the **temporomandibular joint (TMJ)**, and the **angle of the mandible**. All attachments and anatomic structures—including the parotid gland and duct; facial nerve, artery, and vein; temporalis; masseter; muscles of facial expression, etc.—may be sacrificed to achieve this goal.
- 7 Using an autopsy saw, remove the **zygomatic arch** and **mandible** posterior to the 2nd molar. Take care to avoid destroying the structures deep to the mandible.
 - 7.1 Removal of the zygomatic arch is achieved with two vertically-oriented saw cuts, one at the anterior-most and one at the posterior-most regions of the arch.
 - 7.2 Removal of the mandible is achieved with one vertically-oriented saw cut posterior to the 2nd molar, dislocation of the TMJ, and separation of the **medial and lateral pterygoid muscles** from the deep surface (the latter two tasks best achieved using a scalpel blade). The **inferior alveolar artery and nerve** will be transected.
- 8 With the hyoid serving as a distal attachment landmark, identify the **stylohyoid muscle** as it splits around the **posterior belly of the digastric muscle**. Trace the stylohyoid towards its proximal attachment at the **styloid process**. At the styloid process, identify the **stylopharyngeus muscle** and the **styloglossus muscle**.
- 9 Using microdissection instruments, slowly and carefully dissect the region superior to the styloid process and inferior to the **jugular foramen** in order to visualize the trunk of the **glossopharyngeal nerve (CN IX)**. Elevation of the stylopharyngeus muscle will reveal the **nerve to stylopharyngeus**, a useful structure which may be followed proximally to its bifurcation off the descending CN IX.
 - 9.1 Visibility within this suprastyloid region is variable, yet particularly dependent on the length and orientation of the styloid process and its associated musculature. To gain access to the area deep to these structures, it may be necessary to either 1) detach the stylohyoid muscle, styloglossus muscle, posterior digastric muscle, and stylohyoid ligament at their distal attachments and reflect these structures posteriorly or 2) cut the styloid process at the skull base and reflect the styloid and its attached musculature anteriorly. Either of these options are acceptable, insofar as the dissector is able to utilize the *in situ* position of the styloid to obtain accurate spatial measurements with the surrounding landmarks of interest.
 - 9.2 The branching pattern of CN IX can be extremely convoluted in this region depending on where its branching pattern occurs along its superior-inferior axis; consider that in addition to the CSN, CN IX

has additional branches including the **nerve to stylopharyngeus**, the **pharyngeal branches of CN IX**, the **tonsillar branches of CN IX**, and the **lingual branches of CN IX**-- moreover, all of these nerves are in close proximity to the **vagus nerve (CN X)**, the **hypoglossal nerve (CN XII)**, and the **cervical sympathetic chain (CSC)**. Of particular note, CN X and the CSC may randomly contribute fibers to the CSN at any point along its course to establish the **intercarotid plexus**. These factors collectively make a fully exposed dissection of this narrow region challenging and may cause accurate identification of the true CSN to be a potentially difficult task. Slow, blunt microdissection of this region is required.

- 10** The true CSN will be traveling inferiorly and will rapidly associate with the **internal carotid artery (ICA)** as it courses inferiorly towards the **carotid bifurcation**; all other branches of CN IX will course anteriorly. It may be necessary to dissect around the ICA just inferior to the **foramen lacerum** to identify the CSN.

- 10.1** The CSN is a structure of high anatomic variation. Multiple trunks, a number of branching and converging patterns, and associations with CN X and the CSC have all been recorded in the literature. Familiarity and review of these variants (Figure 1) will surely aid the dissector.

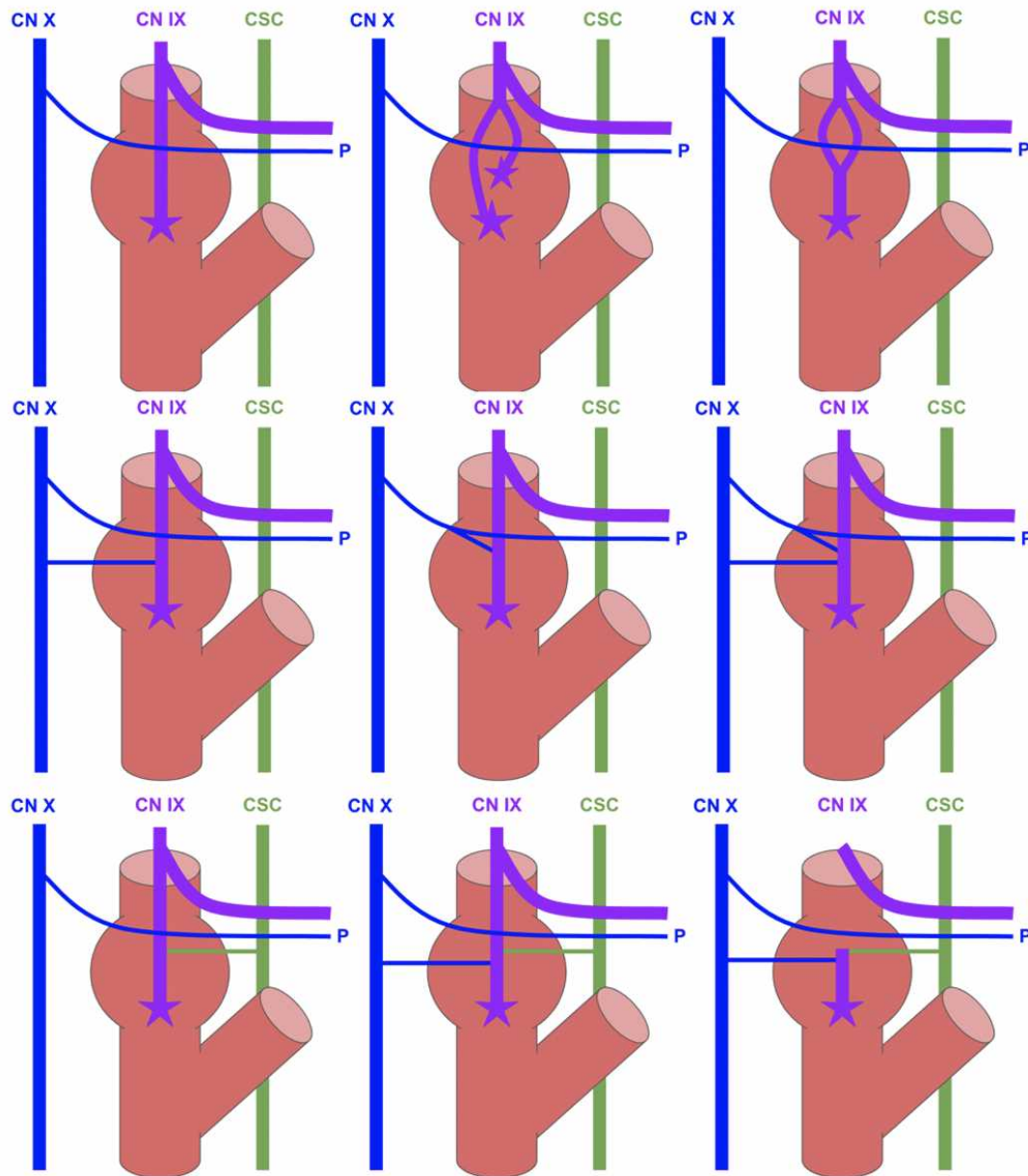


Figure 1. Common variations of the CSN (terminating at the star) with the vagus nerve (CN X), the pharyngeal branch of CN X (P), and cervical sympathetic chain (CSC) depicted at the carotid bifurcation.

- 10.2 Avoid significant distal dissection of the CSN so as to preserve its in vivo course towards the **carotid sinus**.

Once the CSN has been identified, the following spatial measurements are made:

- 11
- 1) Jugular foramen (JF) to carotid sinus nerve bifurcation from CN IX (CSNB)
 - 2) CSNB to the carotid bifurcation (CB)
 - 3) CB to lesser cornu of hyoid
 - 4) Styloid tip to JF
 - 5) Styloid tip to CSNB
 - 6) Mastoid to JF
 - 7) Tragus of ear to CSNB
- 12
- If not already observed throughout the dissection, locate the **cervical sympathetic chain (CSC)**. This can be achieved through regional blunt dissection below the level of the carotid bifurcation. Once all necessary landmarks have been visualized and all relevant measurements recorded, begin the process of removing the desired specimen for microCT.
- 12.1
- The desired specimen is ~9 cm in length and includes the following structures: the trunk of CN IX superior to the bifurcation of the CSN, CN X, CN XII, the CSC, and the carotid bifurcation.
- 13
- Inferior to the carotid bifurcation, transect the **common carotid artery**, **internal jugular vein**, CN X, and the CSC. Once these structures have been transected, raise them superiorly to gain access to the **prevertebral fascial plane**. Continue to raise the transected structures and separate their attachments to the neck, transecting additional structures as necessary in order to obtain a rectangular block of tissue. Upon liberating this specimen up to the level of the **jugular foramen**, transect the exiting structures as proximally as possible. At this point, the specimen will be liberated.
- 14
- Using a minimal amount of colored dyes, mark the proximal and distal extents of all structures of interest. Photograph as necessary. Once completed, place the specimen in a Falcon tube filled with 10% formalin solution. At this point, the dissection is complete and the specimen is appropriate to be prepared for microCT.