

REVA #5: Dissecting and Measuring Cadaveric Human Vagus Nerves

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Appendix 1

List of all gross anatomical landmarks (Table 1) that are used to locate and paint the anatomical levels (Table 2) on the vagus nerve.

Table 1: List of gross anatomical landmarks identified to estimate the locations of levels for painting on the vagus nerve. All skeletal landmarks are directly on the bone, and all soft tissue superficial to the bone has been removed, unless noted with an asterisk (*) where the landmark could not be visually identified and was instead palpated.

Name	Modifier (if applicable)	Description
Superior border of the jugular foramen	Right, left	Identify the jugular foramen, which is the hole in the cranium through which the vagus nerve, glossopharyngeal nerve, spinal accessory nerve, internal jugular vein, and inferior petrosal sinus pass to exit the skull. Locate the superior-most edge.
Inferior border of the jugular foramen	Right, left	Identify the jugular foramen (see row above) and locate the inferior-most edge.
Transverse process of C1 *	Right, left	The most lateral edge of the transverse process of the first cervical vertebra. There may be some tissue superficial to this location.
Angle of the mandible	Right, left	The most lateral surface of the vertex of the angle of the mandible (formed by the junction of the body and ramus of the mandible). The mandibles are removed during dissection and are manually held in place when needed.
Greater horn of the hyoid bone *	Right, left	The most superior edge of the tubercles of the greater horns of the hyoid bone from the lateral side. There may be some tissue (e.g., muscle) superficial to this location.

Carotid bifurcation	Right, left	The most inferior and lateral point on the “Y” shape formed by the bifurcation of the common carotid artery on the vasculature. The carotid bifurcation is moved significantly during dissection but pinned in its approximate pre-dissection location when needed.
Laryngeal prominence		The most anterior location that is formed by the laryngeal prominence of the thyroid cartilage. There may be some tissue (e.g., muscle) superficial to this location.
Superior border of the clavicle	Right, left	The most superior border of the clavicular bone.
Jugular notch of the manubrium		The most superior edge in the notch formed in the midline of the manubrium. The chest wall is removed during dissection and is laid in place when needed.
Sternal angle		The most anterior surface in the sagittal midline of the junction between the manubrium and the body of the sternum. The chest wall is removed during dissection and is laid in place when needed.
Tracheal bifurcation		The most anterior surface of the superior edge of the inside of the upside-down “Y” shape formed by the tracheal bifurcation. The trachea is moved significantly during dissection but manually held in its approximate pre-dissection location when needed.
Esophageal hiatus		The most anterior margin of the esophageal hiatus. Pin(s) is/are placed in the lateral part of the esophagus to mark the site of the hiatus when the diaphragm is incised during dissection.
Aortic hiatus		The most anterior margin of the aortic hiatus. Pin(s) is/are placed in the aorta to mark the approximate site of the hiatus when the diaphragm is incised during dissection.

Table 2: List of anatomical levels on the vagus nerve that are painted. References landmarks in the description from Table 1.

Name of landmark	Modifier of landmark (if applicable)	Section(s) of the vagus nerve that contain the level	Description
Superior border of the jugular foramen	Right, left	Cervical right, cervical left	The location on the vagus nerve or cranial nerve rootlets that emerges superiorly from the jugular foramen.
Inferior border of the jugular foramen	Right, left	Cervical right, cervical left	The location on the vagus nerve that emerges inferiorly from the jugular foramen.

Transverse process of C1 vertebra	Right, left	Cervical right, cervical left	The estimated axial level of the C1 vertebra transverse process landmark on the ipsilateral side vagus nerve.
Angle of the mandible	Right, left	Cervical right, cervical left	The estimated axial level of the angle of the mandible landmark on the ipsilateral side vagus nerve.
Greater horn of the hyoid bone	Right, left	Cervical right, cervical left	The estimated axial level of the tip of the greater horn of the hyoid landmark on the ipsilateral side vagus nerve.
Carotid bifurcation	Right, left	Cervical right, cervical left	The estimated axial level of the carotid bifurcation landmark on the ipsilateral side vagus nerve.
Laryngeal prominence		Cervical right, cervical left	The estimated axial level of the laryngeal prominence landmark on both the right and left vagus nerves.
Superior border of the clavicle	Right, left	Cervical right, cervical left	The location on the vagus nerve that is in the same axial plane as the ipsilateral clavicle.
Jugular notch of the manubrium		Thoracic right, thoracic left	The estimated axial level of the jugular notch of the manubrium landmark on both the right and left vagus nerves.
Sternal angle		Thoracic right, thoracic left	The estimated axial level of the sternal angle landmark on both the right and left vagus nerves.
Tracheal bifurcation		Thoracic right, thoracic left	The estimated axial level of the tracheal bifurcation landmark on both the right and left vagus nerves.
1 cm superior to the start of esophageal plexus		Thoracic right, thoracic left	The estimated location that is 1 cm superior to the start of the esophageal plexus (as determined by the dissector) on the right and left vagus nerves.
Esophageal hiatus on the anterior trunk		Esophageal plexus	The estimated axial level of the esophageal hiatus landmark on the anterior trunk of the vagus.

Esophageal hiatus on posterior trunk		Esophageal plexus	The estimated axial level of the esophageal hiatus landmark on the posterior trunk of the vagus.
Esophageal hiatus (<i>not used for all cadavers</i>)			The estimated axial level of the esophageal hiatus landmark on the vagus nerve in the esophageal plexus that is not a clear anterior or posterior trunk of the vagus.
Aortic hiatus		Subesophageal plexus	The estimated axial level of the aortic hiatus landmark on the closest vagus nerve structure to the landmark or midline. There may be more than one location if there are multiple vagal branches close to the midline.
Inferior border of the cranium (<i>not used for all cadavers</i>)	Right, left	Cervical right, cervical left	The estimated axial level on the vagus nerve where it emerges inferiorly from the cranium.

Appendix 2 – Photo Checklist

All identifiable features (e.g., face, tattoos, etc.) of the cadaver must be removed from photos (or covered during photo shooting) before sharing. Photos should be taken according to the photo checklist below and include a scale bar. Using a tripod and adequate lighting, preferably using multiple light sources, photos should be taken at an angle perpendicular to the imaginary line from the center of the target field of view (target surface) of the cadaver and the camera lens. Before dissection begins, four pre-dissection photos are taken to document the anterior, posterior, left, and right sides of the cadaver. During dissection, photos should be taken at the appropriate depths as identified in the “Depth” section of the photo checklist with as many anatomical levels visible as possible (Appendix 1, Table 2). After dissection, photos are taken of the entire nerve exposed at different painting and removal stages. Image numbers should be recorded from the camera so that images can be appropriately re-named after uploading photo files to a computer. Note definitions below for image naming. For example, CR indicates cervical right (medulla to superior margin of the clavicle).

Table 1. Definition of anatomical regions, terms, and acronyms.

In-Body Section:	Modifiers of Section:	Range:
Cervical (C)	Right (R) or Left (L)	Medulla to superior edge of the clavicle
Upper Thoracic (T)	Right (R) or Left (L)	Superior border of the clavicle where vagus nerve intersects down to 1 cm rostral/superior to the superior end of esophageal plexus
Esophageal plexus (E)	Anterior (A) or Posterior (P)	1 cm rostral/superior to the start of the esophageal plexus to 1 cm caudal/inferior to the anterior and posterior vagal trunks forming
Sub-esophageal (S)	Anterior (A) or Posterior (P)	1 cm caudal/inferior to the formation of the anterior or posterior abdominal vagal trunk off the esophageal plexus to the most inferior ends

Photo Checklist

PRE-DISSECTION (4 photos)				
FULL BODY: Cranium to mons pubis (4 photos)				
	Date Taken	Image Number	Image Name	
1			SR000-Pre-Dissection-Anterior	
2			SR000-Pre-Dissection-Right	
3			SR000-Pre-Dissection-Left	
4			SR000-Pre-Dissection-Posterior	
DURING DISSECTION (21 photos)				
CERVICAL (C): Jugular foramen to Superior border of clavicle (12 photos)				
	Date Taken	Image Number	Image Name	Depth
5			SR000-CR-Superficial	Skin reflected; Cervical branch of facial n / Transverse cervical n OR SCM reflected
6			SR000-CL-Superficial	
7			SR000-CR-Ansa	Loop of ansa cervicalis
8			SR000-CL-Ansa	
9			SR000-CR-Carotid-Sheath	Pre-carotid sheath dissection w/ superficial surface cleaned & mandible muscles removed
10			SR000-CL-Carotid-Sheath	
11			SR000-CR-Carotid-Sheath- Opened	Post-carotid sheath dissection IJV retracted
12			SR000-CL-Carotid-Sheath- Opened	
13			SR000-CR-Mandible-Removed	Underlying muscle/tissue cleaned
14			SR000-CL-Mandible-Removed	
15			SR000-C-Post-Craniotomy	Cerebrum
16			SR000-C-Cerebellum-Removed	Trimmed brainstem
UPPER THORACIC (T): Superior border of clavicle to proximal end of esophageal plexus (6 photos)				
	Date Taken	Image Number	Image Name	Depth
17			SR000-TR-Chest-Wall	Post-skin and pectoralis muscles reflected; abdominal & serratus muscles removed
18			SR000-TL-Chest-Wall	
19			SR000-TR-Chest-Wall- Removed	Post-anterior chest wall removal
20			SR000-TL-Chest-Wall-Removed	
21			SR000-TR-Lungs-Removed	Post bilateral lung removal
22			SR000-TL-Lungs-Removed	

ESOPHAGEAL (E): 1 cm superior to esophageal plexus to esophageal hiatus (2 photos)				
	Date Taken	Image Number	Image Name	Depth
23			SR000-EP-Pre-Dissection	Before trunk isolation starts (R/L). After opening the thoracic cavity, but before deep dissection of the esophageal plexus begins
24			SR000-EA-Pre-Dissection	
SUB-ESOPHAGEAL (S): Esophageal hiatus to distal abdominal plexuses (1 photo)				
	Date Taken	Image Number	Image Name	
25			SR000-S-Abdomen	Omentum removed with abdominal organs visible (anterior view)
POST-DISSECTION (27 photos)				
	Date Taken	Image Number	Image Name	Photo Parameter
Nerve Still in Body - BEFORE PAINT, with landmarks (10 photos)				
26			SR000-CR-Landmarks-Painted	Medulla to superior border of clavicle
27			SR000-CL-Landmarks-Painted	
28			SR000-TR-Landmarks-Painted	Superior border of clavicle to 1 cm superior to the esophageal plexus
29			SR000-TL-Landmarks-Painted	
30			SR000-EP-Landmarks-Painted	1 cm superior to the esophageal plexus to esophageal hiatus (R/L)
31			SR000-EA-Landmarks-Painted	
32			SR000-SP-Landmarks-Painted	Esophageal hiatus to distal abdominal structures (R/L)
33			SR000-SA-Landmarks-Painted	
34			SR000-R-Whole-Nerve-Landmarks-Painted	Medulla to distal abdominal plexuses
35			SR000-L-Whole-Nerve-Landmarks-Painted	
Nerve Still in Body - AFTER PAINT (10 photos)				
36			SR000-CR-Branched-Painted	Medulla to superior border of clavicle
37			SR000-CL-Branched-Painted	
38			SR000-TR-Branched-Painted	Superior border of clavicle to 1 cm superior to the esophageal plexus
39			SR000-TL-Branched-Painted	
40			SR000-EP-Branched-Painted	1 cm superior to the esophageal plexus to esophageal hiatus (R/L)
41			SR000-EA-Branched-Painted	

42			SR000-SP-Branches-Painted	Esophageal hiatus to distal abdominal structures (R/L)
43			SR000-SA-Branches-Painted	
44			SR000-R-Whole-Nerve-Branches-Painted	Medulla to distal abdominal structures
45			SR000-L-Whole-Nerve-Branches-Painted	
REMOVED with vagus still intact on esophagus (2 photos)				
46			SR000-EA-Removed	1 cm superior to the esophageal plexus to esophageal hiatus (anterior/posterior)
47			SR000-EP-Removed	
REMOVED and placed on the grid (5 photos)				
48			SR000-C-Removed	Medulla to superior border of clavicle
49			SR000-T-Removed	Superior border of clavicle 1 cm above esophageal plexus
50			SR000-E-Removed	1 cm above esophageal plexus to esophageal hiatus
51			SR000-S-Removed	Esophageal hiatus to distal abdominal plexuses
52			SR000-Whole-Nerve-Removed	Medulla to distal abdominal plexuses

Appendix 3 – Dissection Notes Template

Dissection Notes SR000

Pre-Dissection Notes

Embalming Information

Embalming location: Identify artery(ies) used for embalming and how many days post-mortem the embalming was performed.

General Impressions

Describe the age, sex, race, and cause of death of the donor as well as any other known past medical history and notable observations about the donor's body before the start of dissection. Also, note the quality of the embalming for the body (e.g., smell, tissue color, mobility of body parts, etc.).

MRI Notes

If a pre-dissection MRI was performed, review the imaging (preferably with the attending neuroradiologist) to determine pathologies and notable anatomical variants present. Note the location of the vagus nerve in the carotid sheath (relative to the internal jugular vein and carotid arteries).

Dissection Notes

Right Cervical Region

- Record observations regarding the RIGHT vagus nerve and its branches in the cervical region that are not already included in the branch naming document.

Left Cervical Region

- Record observations regarding the LEFT vagus nerve and its branches in the cervical region that are not already included in the branch naming document.

Right / Left Thoracic Region

- Record observations regarding the vagus nerve and its branches in the thoracic region that are not already included in the branch naming document.

Abdominal Region

- Record observations regarding the vagus nerve and its branches in the abdominal region that are not already included in the branch naming document.

General

Record general observations, unique features, pathologies, surgeries, and other characteristics of the cadaver, not related to the vagus nerve or its branches (recorded above already), encountered during the dissection.

Appendix 4 – Branch Patterns and Measurements Spreadsheet

Record branches of the vagus nerve and relevant nearby nerves relative to the landmarks identified in the branch patterns table below. Add or reorder rows as necessary for each body dissected. Note the pre-defined paint colors to be used during painting and add paint colors used for branches during painting that are not already defined. Branches should be named according to the REVA vagus nerve termlist. Branch target(s) should be as specific as possible.

Vagus Nerve Branch Patterns

Body Region (C, T, E, SE)	Right or Left	Name of Branch / Structure – Term for internal notes and parenthetical curated term	Paint Color	Branch (BR) or Subbranch (SB)	Branch Point on Vagus	Branch Direction Leaving Vagus	Branch Target	Notes During Painting	Notes During Removal	Notes After Removal
C	L	Superior Border of Jugular Foramen (left level of superior border of jugular foramen)	White	N/A	N/A	N/A	N/A			
C	L	Inferior Border of the Jugular Foramen (left level of inferior border of jugular foramen)	Black	N/A	N/A	N/A	N/A			
C	L									
C	L									
C	L	Transverse Process of C1 Vertebra (left level of C1 transverse process)	Blue	N/A	N/A	N/A	N/A			
C	L									
C	L									
C	L	Angle of the Mandible (left level of angle of the mandible)	Gray	N/A	N/A	N/A	N/A			
C	L									
C	L									
C	L	Greater Horn of the Hyoid Bone (left level of greater horn of hyoid)	Green	N/A	N/A	N/A	N/A			
C	L									
C	L									
C	L	Carotid Bifurcation (left level of carotid bifurcation)	White	N/A	N/A	N/A	N/A			
C	L									
C	L									
C	L	Laryngeal Prominence	Black	N/A	N/A	N/A	N/A			

Body Region (C, T, E, SE)	Right or Left	Name of Branch / Structure – Term for internal notes and parenthetical curated term	Paint Color	Branch (BR) or Subbranch (SB)	Branch Point on Vagus	Branch Direction Leaving Vagus	Branch Target	Notes During Painting	Notes During Removal	Notes After Removal
		(left level of laryngeal prominence)								
C	L									
C	L									
C	L	Superior Border of the Clavicle (left level of superior border of the clavicle)	Blue	N/A	N/A	N/A	N/A			
T	L									
T	L									
T	L	Jugular Notch of the Manubrium (left level of jugular notch)	Gray	N/A	N/A	N/A	N/A			
T	L									
T	L									
T	L	Sternal Angle (left level of sternal angle)	Green	N/A	N/A	N/A	N/A			
T	L									
T	L									
T	L	Tracheal Bifurcation (left level of tracheal bifurcation)	Black	N/A	N/A	N/A	N/A			
T	L	1 cm Above Esophageal Plexus (left level of 1 cm superior to start of esophageal plexus)	White	N/A	N/A	N/A	N/A			
C	R	Superior Border of Jugular Foramen (right level of superior border of jugular foramen)	White	N/A	N/A	N/A	N/A			
C	R	Inferior Border of Jugular Foramen (right level of inferior border of jugular foramen)	Black	N/A	N/A	N/A	N/A			
C	R									
C	R									

Body Region (C, T, E, SE)	Right or Left	Name of Branch / Structure – Term for internal notes and parenthetical curated term	Paint Color	Branch (BR) or Subbranch (SB)	Branch Point on Vagus	Branch Direction Leaving Vagus	Branch Target	Notes During Painting	Notes During Removal	Notes After Removal
C	R	Transverse Process of C1 Vertebra (right level of C1 transverse process)	Blue	N/A	N/A	N/A	N/A			
C	R									
C	R									
C	R	Angle of the Mandible (right level of angle of the mandible)	Gray	N/A	N/A	N/A	N/A			
C	R									
C	R									
C	R	Greater Horn of the Hyoid Bone (right level of greater horn of hyoid)	Green	N/A	N/A	N/A	N/A			
C	R									
C	R	Carotid Bifurcation (right level of carotid bifurcation)	White	N/A	N/A	N/A	N/A			
C	R									
C	R									
C	R	Laryngeal Prominence (right level of laryngeal prominence)	Black	N/A	N/A	N/A	N/A			
C	R									
C	R									
C	R	Superior Border of the Clavicle (right level of superior border of the clavicle)	Blue	N/A	N/A	N/A	N/A			
T	R									
T	R									
T	R	Jugular Notch of the Manubrium (right level of jugular notch)	Gray							
T	R									
T	R									
T	R	Sternal Angle (right level of sternal angle)	Green	N/A	N/A	N/A	N/A			
T	R									
T	R									
T	R	Tracheal Bifurcation	Black	N/A	N/A	N/A	N/A			

Body Region (C, T, E, SE)	Right or Left	Name of Branch / Structure – Term for internal notes and parenthetical curated term	Paint Color	Branch (BR) or Subbranch (SB)	Branch Point on Vagus	Branch Direction Leaving Vagus	Branch Target	Notes During Painting	Notes During Removal	Notes After Removal
		(right level of tracheal bifurcation)								
T	R	1 cm Above Esophageal Plexus (right level of 1 cm superior to start of esophageal plexus)	White	N/A	N/A	N/A	N/A			
E	A	Anterior esophageal plexus trunk A	Dotted Orange							
E	A	Anterior esophageal plexus trunk B	Dotted Teal							
E	P	Posterior esophageal plexus trunk A	Dotted blue							
E	P	Posterior esophageal plexus trunk B	Dotted yellow							
E	A/P	Esophageal plexus cardiopulmonary branches	Pink							
E	A/P	Esophageal plexus branches	Green							
E	A	Esophageal hiatus on anterior trunk (level of esophageal hiatus on anterior trunk)	Black							
E	P	Esophageal hiatus on posterior trunk (level of esophageal hiatus on posterior trunk)	Black							
S	A/P	Aortic hiatus (level of aortic hiatus)	White							
S	A	Gastric branches of anterior trunk	Blue							
S	P	Gastric branches of posterior trunk	Pink							
S	A/P	Pyloric branches	Orange							
S	A/P	Diaphragmatic branches	White							
S	A/P	Hepatic branches	Purple							
S	A/P	Pancreatic branches	Yellow							

Body Region (C, T, E, SE)	Right or Left	Name of Branch / Structure – Term for internal notes and parenthetical curated term	Paint Color	Branch (BR) or Subbranch (SB)	Branch Point on Vagus	Branch Direction Leaving Vagus	Branch Target	Notes During Painting	Notes During Removal	Notes After Removal
S	A/P	Intestinal branches	Teal							

Nerve Measurements

SR000			VAGUS NERVE DIAMETERS (mm)			DISTANCE FROM ANATOMICAL LANDMARK (mm)		
Side	Name of branch / Structure	Color	Medial-Lateral Plane	Anterior-Posterior Plane	Notes	Medial-Lateral Plane	Anterior-Posterior Plane	Notes
L	Superior Border of Jugular Foramen	White	N/A	N/A		N/A	N/A	
L	Inferior Border of the Jugular Foramen	Black	N/A	N/A		N/A	N/A	
L	Transverse Process of C1 Vertebra	Blue						
L	Angle of the Mandible	Gray						
L	Greater Horn of the Hyoid Bone	Green						
L	Carotid Bifurcation	White						
L	Laryngeal Prominence	Black						
L	Superior Border of the Clavicle	Blue				N/A		
L	Jugular Notch of the Manubrium	Gray						
L	Sternal Angle	Green						
L	1 cm Above Esophageal Plexus	White				N/A	N/A	
A	Esophageal Hiatus	Black				N/A	N/A	
<i>Rearrange rows how they appear in the body (superior to inferior)</i>			VAGUS NERVE DIAMETERS (mm)			DISTANCE FROM ANATOMICAL LANDMARK (mm)		
Side	Name of branch / Structure	Color	Medial-Lateral Plane	Anterior-Posterior Plane	Notes	Medial-Lateral Plane	Anterior-Posterior Plane	Notes
R	Superior Border of Jugular Foramen	White	N/A	N/A		N/A	N/A	
R	Inferior Border of Jugular Foramen	Black	N/A	N/A		N/A	N/A	
R	Transverse Process of C1 Vertebra	Blue						
R	Angle of the Mandible	Gray						

R	Greater Horn of the Hyoid Bone	Green						
R	Carotid Bifurcation	White						
R	Laryngeal Prominence	Black						
R	Superior Border of the Clavicle	Blue				N/A		
R	Jugular Notch of the Manubrium	Gray						
R	Sternal Angle	Green						
R	1 cm Above Esophageal Plexus	White				N/A	N/A	
P	Esophageal hiatus	Black				N/A	N/A	