The Brachial Plexus 3D Educational Model

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Abstract

There are a variety of types of brachial plexus injuries that impact the general population, through the limitation or elimination of everyday function. The degree of injury associated with these conditions is dependent on the site and extent of the injury, including ruptures, avulsions and more. The brachial plexus is an elaborate network of nerves associated with the motor and sensory innervation of the upper limbs. The plexus's intricate nature is derived from its anatomical structure and composition of ventral rami, trunks, divisions, cords, and terminal branches. These terminal branches include the ulnar nerve, musculocutaneous nerve, median nerve, axillary nerve, and radial nerve. Given the complexity of the brachial plexus and the potential life-altering injuries medical professionals encounter, it is important for pre-health students to understand the anatomical elements of this major structure. In addition, the knowledge of potential injuries and courses of treatment are equally crucial in the medical field. The use of models in anatomy education is an incredible resource that promotes spatial understanding, improves retention and exam performances as well as overall engagement of students. This creative thesis will enhance student comprehension of the brachial plexus and the spatial understanding of structures within this plexus.

What is The Brachial Plexus?

The brachial plexus is a network of nerves originating in the cervical region, expanding to the axillary region and then coursing throughout the upper limb where it is responsible for motor and sensory innervation. The brachial plexus originates with the C5-T1 ventral rami, defining the root portion of the plexus. As the plexus continues distally, it transforms into trunks, divisions, cords, and terminal branches. In particular, C5 and C6 ventral rami join to form the superior/upper trunk, C7 continues to become the middle trunk and C8 and T1 join to form the inferior/lower trunk. Each of these trunks divides into an anterior and a posterior division. The posterior divisions join to form the posterior cord. The anterior division from the lower trunk continues to become the medial cord, while the anterior division from the middle and upper trunks combine to form the lateral cord. The nomenclature of these cords is based on their spatial relationship to the axillary artery. The posterior cord gives rise to two terminal branches, the axillary and radial nerve. The lateral cord continues to form the musculocutaneous nerve, with contributions to form the median nerve. The medial cord continues to form the ulnar nerve with contributions to the median nerve (Bayot, et. al 2024).

Prevalent side branches include dorsal scapular nerve which is associated with scapular elevation and adduction through the levator scapulae, rhomboid major, rhomboid minor muscles. The long thoracic nerve is associated with the scapular protraction and superior rotation through innervation of serratus anterior. In addition, long thoracic nerve originates on the C5 ventral rami, with contributions from C6

and C7 ventral rami as well. Suprascapular nerve originates on the upper trunk, runs with suprascapular artery, and is associated with shoulder abduction, lateral rotation, and overall stabilization of the glenohumeral joint via supraspinatus and infraspinatus muscles. Upper subscapular nerve is the most proximal branch of the posterior cord, innervating subscapularis muscle, aiding in the medial rotation of the arm and stabilization of the glenohumeral joint. Thoracodorsal nerve is the next proximal branch of the posterior cord and is associated with arm rotation, adduction, and extension via latissimus dorsi muscle and is sometimes referred to as middle subscapular nerve. Lower subscapular nerve is the most distal branch of the posterior cord and innervates subscapularis muscle and teres major, influencing the medial rotation, adduction of the arm and stabilization of the glenohumeral joint. The lateral pectoral nerve innervates pectoralis major, assisting in arm adduction, medial rotation, flexion, and extension. It originates from the lateral cord while the medial pectoral nerve which innervates both pectoralis major and pectoralis minor and therefore also influences the depression and stabilization of the scapula originates from the medial cord (Netter, 2019, p. 473-476). After further investigation, it can be said that the medial and lateral pectoral nerves connect as ansa pectoralis nerve.

Additional side branches include the contributions to phrenic nerve, nerve to subclavius muscle, the medial brachial cutaneous nerve, the medial antebrachial cutaneous nerve, and inferior lateral brachial cutaneous nerve. Alongside the posterior brachial cutaneous nerve, posterior antebrachial cutaneous nerve, superior lateral brachial cutaneous nerve, and lateral antebrachial cutaneous nerve (Netter, 2019). Each of these side branches contribute to the innervation of specific landmarks of the upper limb.

Brachial Plexus Terminal Branches

The Ulnar Nerve

The ulnar nerve originates from the medial cord and courses distally through the arm, wrapping around to the posterior region near the elbow (between the medial epicondyle and the olecranon process. The ulnar nerve continues down the forearm where its deep branch wraps laterally around the hook of the hamate bone in the hand. The deep branch of the ulnar nerve continues branching to innervate all interosseous hand muscles and the third and fourth lumbricals. In particular, the deep branch of ulnar nerve innervates abductor digiti minimi, adductor pollicis, dorsal interosseous muscles, flexor carpi ulnaris, flexor digiti minimi brevis, flexor digitorum profundus (medial portion), third/fourth lumbricals, opponens digiti minimi, and palmar interosseous muscles. The superficial branch of the ulnar nerve innervates the palmaris brevis muscle. Overall, the ulnar nerve primarily innervates the anterior forearm and hand (hypothenar region). Due to these innervation patterns, the ulnar nerve is primarily associated with digit abduction and adduction, flexion of the digits at the metacarpophalangeal joint and extension of the digits at the interphalangeal joints, hand flexion, hand adduction, opposition of the thumb, and grip

(Netter, 2019, p. 473-476). The most common symptom of ulnar nerve damage is the paresis of wrist flexion, forearm extension, and forearm supination/pronation. Ulnar nerve palsy may result in "claw hand," a condition in which the fingers bend forward toward the wrist, with straightening of the fingers being exceedingly difficult, if not impossible. Ulnar nerve palsy and "claw hand" will be discussed in further detail shortly.

The Musculocutaneous Nerve

The musculocutaneous nerve serves as the terminal branch of the lateral cord. It pierces through the coracobrachialis muscle, continuing distally through the arm on the anterior aspect, where it contributes motor innervation. Just above the elbow, the musculocutaneous nerve terminates as the lateral antebrachial cutaneous nerve. The musculocutaneous nerve primarily innervates the anterior arm (motor innervation) and lateral forearm (sensory innervation as the lateral antebrachial cutaneous nerve). In particular, the musculocutaneous nerve innervates the biceps brachii, brachialis, and coracobrachialis muscles. Due to this innervation, the musculocutaneous nerve is associated with forearm flexion, supination, and arm adduction (Netter, 2019, p. 473-476). The most common symptom of musculocutaneous nerve damage is the inability to flex the elbow or shoulder. Musculocutaneous nerve lesions are rare.

The Median Nerve

The median nerve receives contributions from the lateral and medial cords before continuing distally through the anterior forearm (alongside the brachial artery) and passing through the cubital fossa to enter the forearm. The median nerve continues by passing between the deep and superficial head of pronator teres muscle and later, between flexor digitorum profundus and flexor digitorum superficialis. The median nerve passes through the carpal tunnel to innervate named muscles of the hand. To further explain, the median nerve innervates flexor carpi radialis, flexor digitorum profundus (lateral portion), flexor digitorum superficialis, flexor pollicis longus, the first/second lumbricals, palmaris longus, pronator quadratus, and pronator teres. In addition, the recurrent branch of median nerve innervates abductor pollicis brevis, flexor pollicis brevis, opponens pollicis. In all, the median nerve primarily innervates the anterior forearm and thumb. Due to these innervation patterns, the median nerve is associated with thumb abduction, hand flexion, hand abduction, digit flexion, flexion of interphalangeal joints and flexion of metacarpophalangeal joints, and forearm pronation (Netter, 2019, p. 473-476). The most common symptoms of median nerve damage are paresis when flexing the finger and wrist, opposition of the thumbs and pronation, resulting in ape hands.

The Axillary Nerve

The axillary nerve serves as one of the two terminal branches of the posterior cord. It is posterior to the axillary artery and anterior to the subscapularis muscle. The axillary nerve can be seen following the posterior circumflex humeral artery deep into the axilla region, toward the inferior border of subscapularis muscle, deep to the deltoid muscle. The axillary nerve exits the quadrangular space with the posterior circumflex humeral artery, inferior to the teres minor muscle, to innervate the deltoid muscle and teres minor (Okwumabua & Thompson, 2023). In addition, the superior lateral brachial cutaneous nerve, a branch of axillary nerve targeting sensory stimulation, innervates the skin of the lateral mid to upper arm. For this reason, the axillary nerve innervates muscles that contribute to the following actions: medial/lateral arm rotation, flexion of the arm, abduction, and extension of the arm (Netter, 2019, p. 473-476). The most common symptom of axillary nerve damage is an abnormally large angle between the neck and shoulder. We see this in newborn patients, where a lack of Moro reflex or the abduction and adduction startle reflex indicate an overstretch and therefore damage to the C5 and C6 ventral rami.

The Radial Nerve

The radial nerve serves as the second terminal branch of the posterior cord. The radial nerve can be seen posterior to the brachial artery, diving into the triangular interval (bounded by the long head of triceps brachii medially, teres major superiorly and the humerus laterally) with profunda brachii (deep brachial) artery. The two structures course down the posterior arm, between the medial head of triceps brachii muscle and long head of triceps brachii muscle, nearing the radial groove of the humerus before entering the lateral intermuscular septum. Soon enough, the radial nerve emerges between the brachialis and brachioradialis muscles in the cubital fossa. At this point, the radial nerve splits into a superficial sensory branch and a deep motor branch (turning into the posterior interosseous nerve after piercing the supinator muscle). The radial nerve innervates abductor pollicis longus, anconeus, brachioradialis, extensor carpi radialis brevis (deep branch), extensor carpi radialis longus, supinator (deep branch), and triceps brachii muscle. In addition, the radial nerve continues as the posterior interosseous nerve to innervate extensor carpi ulnaris, extensor digiti minimi, extensor digitorum, extensor indicis, extensor pollicis brevis, and extensor pollicis longus muscles. In all, the radial nerve primarily innervates the posterior forearm and arm. Due to these innervation patterns, the radial nerve is associated with wrist, elbow, and metacarpophalangeal joint extension alongside supination of the forearm (Netter, 2019, p. 473-476). The most common symptoms of radial nerve damage include wrist drop or paresis in extending the hand. The concept of wrist drop will be discussed in more detail shortly.

General Innervation Patterns for the Upper Limb

Region/Muscle:	Nerve Innervation:
Pectoralis major and minor muscles	Lateral pectoral nerve and medial pectoral nerve
Anterior arm	Musculocutaneous nerve
Anterior forearm and thumb	Median nerve
Deltoids and teres minor muscles	Axillary nerve
Posterior arm and posterior forearm	Radial nerve
Hand	Ulnar nerve
Subscapularis muscle	Upper subscapular nerve and lower subscapular nerve
Latissimus dorsi muscle	Thoracodorsal nerve
Teres major muscle	Lower subscapular nerve

Brachial Plexus Injuries

It is important to note that each of the terminal branches of the brachial plexus have contributions from multiple ventral rami, C5, C6, C7, C8, T1, forming a helpful network. For example, the median

nerve receives segmental innervation from C5, C6, C7, C8 and T1 while musculocutaneous nerves consist of segmental innervation from C5 and C6. With multiple ventral rami contributing to their innervation, damage to one ventral ramus will not limit all function of the terminal branches.

Different Types of Brachial Plexus Injuries

When a nerve impingement or damage occurs at a location distal to the ventral rami, it can result in sensory dysfunction such as numbness, pain, tingling, and burning. Depending on the location of the impingement and contributions from other branches or divisions, motor deficits may also occur, including palsies and, in some cases, paralysis. There are several types of brachial plexus injuries including brachial plexus neuropraxia, brachial plexus rupture, brachial plexus neuroma, brachial neuritis, and brachial plexus avulsions (Johns Hopkins, 2024). Brachial plexus neuropraxia occurs when a brachial plexus root/ventral ramus is compressed or placed under traction/stretch. Compression neuropraxia is most common and can simply occur when the head is abnormally rotated. Typically, patients suffering from neuropraxia to the brachial plexus recover without significant intervention and maintain 90-100% function of the injured area. A brachial plexus rupture also occurs when a nerve is stretched, however, results in either a partial or complete tear of the nerve. Due to its association with extreme pain, a brachial plexus rupture often requires surgery and depending on the severity and location, may allow for the regain of function. Brachial neuritis, commonly referred to as Parsonage-Turner syndrome, is rare and has an unknown origin, although recent studies suggest it may be correlated with autoimmune function. It presents as sudden pain in the shoulder and upper arm, leading to paresis and in some cases, loss of sensation. Finally, a brachial plexus avulsion occurs when the ventral rami (C5, C6, C7, C8, or T1) completely dissociates from the spinal cord (Johns Hopkins, 2024). Often associated with pain and following a traumatic force event, avulsions are challenging to treat surgically and often result in permanent muscle loss, motor paresis and paralysis.

Causes/Examples

The cause of a brachial plexus injury is dependent on a variety of factors but is typically traced back to blunt trauma, injuries in athletes, gunshot interference, medical trauma such as surgical procedures or improper injection placement, cancer, and/or radiation therapy (Johns Hopkins, 2024). It is also important to note that obstetric brachial plexus injuries or damage to the brachial plexus during birth occurs in 1 to 2 out of every 1,000 births. The risk of this damage has been linked to babies born to diabetic mothers, resulting in a more challenging vaginal delivery, breech position, shoulder dystocia of the baby (when the baby’s shoulder remains lodged underneath the mother's pubis), and abnormally long labors. Each of these circumstances puts extreme stress on the brachial plexus, potentially resulting in

paresis or paralysis of the newborn upper limb. Examples of newborn brachial plexus injuries include Erb's palsy and Klumpke's palsy (Johns Hopkins, 2024).

Brachial plexus injuries of clinical significance include Claw Hand and Wrist Drop. Claw hand, also known as ulnar nerve palsy, occurs when there is hyperextension at the metacarpophalangeal (MP) joints and flexion of the proximal and distal interphalangeal (IP) joints, in all or some of the digits. Muscles involved in the flexion of the MP joints include flexor digitorum superficialis, flexor digitorum profundus, flexor pollicis longus, dorsal interossei, palmar interossei and lumbricals. Damage to the ulnar nerve along its course causes paralysis of the interossei muscles and weakness of the third and fourth lumbricals, leading to paresis of metacarpophalangeal (MP) joint flexion and Interphalangeal (IP) joint extension, causing the symptoms of claw hand. Trauma that can result in claw hand/ulnar nerve palsy includes a stab wound near the wrist, fractures to the hook of the hamate upon impact, to the medial epicondyle of the humerus, or to the clavicle. Another common brachial plexus injury is wrist drop, also known as radial nerve palsy (Bayot, et. al 2024). This condition is caused by a compression within the axillary region, often associated with long term use of crutches or falling asleep on your extended arm as it hangs over a chair, hence wrist drop's third title, Saturday night palsy. Another cause of wrist drop includes a fracture to the midshaft of the humerus, leading to nerve damage or compression to the nerve, as the result of inflammation and edema. In particular, the radial nerve innervates many of the wrist and digit extensor muscles. Damage to this region will limit extension, causing the wrist to drop or be overly flexed. In all, each of these conditions are heavily influenced by the innervation patterns, and anatomical course of the brachial plexus that when damaged, prevents full function, which depending on the source, may or may not be regained.

Nonsurgical and Surgical Treatment Options

In a clinical setting, when a patient presents with sensory and motor concerns synonymous to those of a brachial plexus injury, there are a variety of potential courses of action. Diagnostic tests including X-rays, MRI, CT scans, nerve conduction studies and electromyogram are potential indicators of injury (Johns Hopkins, 2024). X-rays serve as useful tools to identify fractures or bone injury that could produce fragments or sharp edges that in turn, can puncture or tear the brachial plexus nerves. An MRI and CT scan create contrast utilizing dyes to visualize the course of nerves, allowing for the identification of a partial or complete disruption to the pathway. Nerve conduction studies and the use of electromyograms serve as a resource to test nerve function and electrical activity, once again pinpointing if any innervation has been impaired.

Depending on the severity of the brachial plexus injury, various clinical approaches may be taken. Nonsurgical treatment is a possibility for mild injuries to the brachial plexus and include physical therapy

for function restoration and occupational therapy to remaster practical skills for daily function. Other nonsurgical options include the use of corticosteroid creams/injections and general medications for pain management, as well as the aid of braces, splints, or compression sleeves to minimize movement and allow for regeneration/reinnervation when necessary (Johns Hopkins, 2024). Brachial plexus surgeries serve as a secondary treatment option for more extreme injuries and are recommended to take place within six months of the injury and/or failed attempts of non-surgical treatment for the best chance of recovery (Pirela-Cruzi, 2005). Brachial plexus surgeries include a direct nerve repair where a torn nerve is reconnected after a clean cut (Johns Hopkins, 2022). Most commonly, the surgeon will remove any unsalvageable tissue (neurolysis - the removal of scar tissue from an area to improve function) prior to suturing or gluing the two previously connected nerves back together. A nerve graft is another commonly performed surgical technique where a piece of nervous tissue is removed from another region of the patient's body (or from a donor's viable tissue) and attached between the split ends of the injured nerve. This procedure is most common when the gap between split nerves is too large, if too much of the nerve is unsalvageable and requires removal, or if the split is not clean enough to successfully re-anchor together. Finally, a nerve transfer is a practical possibility for advanced brachial plexus injuries where a new pathway is created using a donor nerve to encourage regrowth in a new, more refined framework (Johns Hopkins, 2024).

Up and Coming Research/Advancements

Medical advancements have driven the discovery of new techniques for treating brachial plexus injuries, importantly promoting return of function. One of the newest forms of research include the use of nerve allografts and immune modulators such as FK 506 to elevate the chance of recovery from nerve reconstruction surgeries. Immune modulators play a role in recovery due to the regenerative properties of T cells by down regulating the activity of protective immune cells that target non-self-material. FK 506 is a lactone immunosuppressant derived from macrocyclic lactones (chemical derivatives of microorganisms within soil) that averts the rejection of allograft nerves following surgical implantation. (Tang, et. al 2022) The development of new medications during the recovery process will highlight the positive outcomes of nerve transfers/grafts, encouraging a successful recovery and therefore uninterrupted regrowth and regaining of function/innervation patterns.

Advantages of Model-Based Learning

It is psychologically understood that our cognitive skills and past experiences alter our ability to retain information and store it in our long-term memory. Individuals can be grouped into three main categories - visual learners, auditory learners, and kinesthetic learners - based on the approach that best allows them to learn and comprehend the provided information. Visual learners may utilize maps, charts

and whiteboards to best visualize the information provided and formulate an overall picture. Auditory learners thrive when speaking or listening to the material, often resorting to repetition to ensure active recall. Kinesthetic learners are most successful when utilizing hands-on resources, including models. Overall, the adaptation of metacognitive skills in learners, including the self-awareness of one's strengths and personalized learning processes heavily correlates to successful retaining of information (Flavin, 2019). Hence why kinesthetic learners often turn to models throughout their educational experience.

Model-based learning serves as a benefit to the student population, regardless of personalized learning style. In all, models have been proven to promote spatial understanding, elevate engagement and collaboration, improve retention/exam performance, and reduce cognitive load. To begin, in a 2016 study 86% of students reported advanced spatial understanding, a crucial skill in anatomy, when compared to their comprehension of 2D images (Azer, et. al 2016). Models allow for the manipulation of structures and exploration from different angles to best understand their relationship to other structures and patterns. The Journal of Medical Education emphasizes that 92% of surveyed participants agreed that 3D models were more engaging than their anatomy textbook and encouraged collaboration with their peers (Bolger et. al 2021). Overall, increased rates of engagement and interaction are related to better retention and exam performance. A 2015 study showed a 12% increase in practical exam scores in students who relied on 3D models as a study tool, compared to students studying with traditional 2D study tools (Yasmine & Violato, 2015). Next, 3D models have been associated with a decreased cognitive load. The Advances in Health Sciences Education journal released an article emphasizing a 15-20% decline in cognitive load of students using 3D models in an educational environment (Yasmine & Violato, 2015). This data is correlated to the complex nature of 2D resources and an increased effort attempting to “make sense of” a 2D depiction that is more recognizable in a three-dimensional approach. By eliminating this added layer of cognitive load, students can focus on the content itself, rather than the mode of delivery. In general, 3D models in anatomy reduce the challenges associated with visualizing a 3-dimensional structure from the pages of a 2-dimensional textbook. Three dimensional models can additionally provide support for students prior to a lab session where identifying a structure is challenging. With the intention of supporting kinesthetic learning in the anatomy classroom and for the multitude of benefits listed above, the brachial plexus model was created.

Models are not solely beneficial resources in anatomy classes but can flourish in all fields, including medicine, chemistry, engineering, and architecture. 3D models in the field of medicine serve as an educational resource for health professions, consider 3D models for the use of surgical simulations, as well as patients to explain a condition or method of treatment (Meyer-Szary, et. al 2022). Chemistry can utilize models to emphasize atomic level relationships and interactions, an otherwise challenging concept to convey due to the inability to see an atom with the naked eye. Engineers’ frequently utilize 3D models

to prototype new inventions while architects rely on 3D models to analyze the structural integrity of new structures as well as visualize three-dimensional spaces for design purposes. In all, the benefits of 3D models are endless, serving as versatile and efficient tools in research, education, and professional application, across a wide array of fields.

Honors Thesis Project Reflection

My Honors Thesis, "The 3D Educational Model of the Brachial Plexus," consists of a 3D printed model and research component. Due to the complex nature of the brachial plexus, my honors Thesis 3D model of the brachial plexus, color-coordinated and labeled, aims to create a user-friendly study resource for anatomy students to ensure adequate understanding and real-life application of the plexus. I found a pre-designed 16-piece life size brachial plexus model by a user that goes by the name of "DaveMakesStuff" on Thingiverse.com, a commonly used online community where users can share and discover pre-designed 3D models. DavemakesStuff collaborated with nurse anesthesiologist and nurse practitioner, Eric Kramer and colleagues from the National Universities Doctoral Nurse Anesthesiology program. The model is licensed under an Attribution-NonCommercial-Sharealike 4.0 International Deed. This licensure allows for the average individual to utilize the pre-designed model format as well as adapt the original design to their liking, through the removal or addition of structure. The terms of this deed state that appropriate credit, and a link to the licensure must be provided on the model or accompanying resources (Creative Commons, 7). In addition, any alterations to the model must be noted. Furthermore, the model cannot be utilized for commercial purposes.

Carefully following these guidelines, a link to the license is found in the work cited portion of this research paper as well as on the base of the 3D model. It is important to note that alterations to the original model were made to add structures like dorsal scapular nerve, suprascapular nerve, lower subscapular nerve, thoracodorsal nerve, and upper subscapular nerve. These alterations were made within the Solid Works software and reprinted on a Prusa Slicer 3D printer within the Colorado State University Idea2Product (I2P) lab. Following the alterations and printing of all 16 components of the model, support were removed, and a primer was applied. Following that, a layer of white spray paint was used to create a uniform appearance throughout the model. The brachial plexus was painted using different colored acrylic paints to encourage it to stand out from its surrounding structures and allow easy identification of the different sections of the plexus. To further explain, the ventral rami, trunks, divisions, cords, and terminal branches were each painted a distinct color, with black numbering on each part of each category. For example, the ventral rami were all painted blue with black numbering that coincided with the "key" for each of the 5 ventral rami which each have their own label – C5 (1), C6 (2), C7 (3), C8 (4), T1 (5). Within the key, the blue 1 denoted the C5 ventral rami. This technique was continued throughout each of the 5

sections of the brachial plexus and their individual components. After labeling and painting each section, a layer of ModPodge sealant was added to ensure the paint did not wear over time. In addition, the model was constructed using Gorilla superglue to ensure an adequate and long-lasting hold. The axillary artery was attached to the model using Neodymium 6 mm x 3 mm magnets to allow students to remove the structure to better visualize the brachial plexus.

In all, this process has served as an incredibly rewarding opportunity to dive into a topic of interest, advance my critical thinking and problem-solving skills, enhance research writing skills, promote self-discipline, and time management as well as contribute original work to Colorado State University's Human Anatomy program. Not only has this opportunity strengthened my academic knowledge of the Brachial Plexus, but it has also introduced me to the many benefits of model-based learning and the modern technology of 3D printing. As a fourth year Biomedical Sciences student, I had the privilege of completing BMS 301 and BMS 575. During my time in the cadaver lab, my greatest struggle was mastering the anatomical structure and general functions/innervation patterns of the brachial plexus. The purpose of this project was to help visualize a concept that prior to the investigation of a human cadaver, is purely presented in a 2D fashion. The completed model will be donated to Colorado State University's cadaver lab upon its completion with the intention of assisting future students in their academic endeavors and overall understanding of the human brachial plexus.

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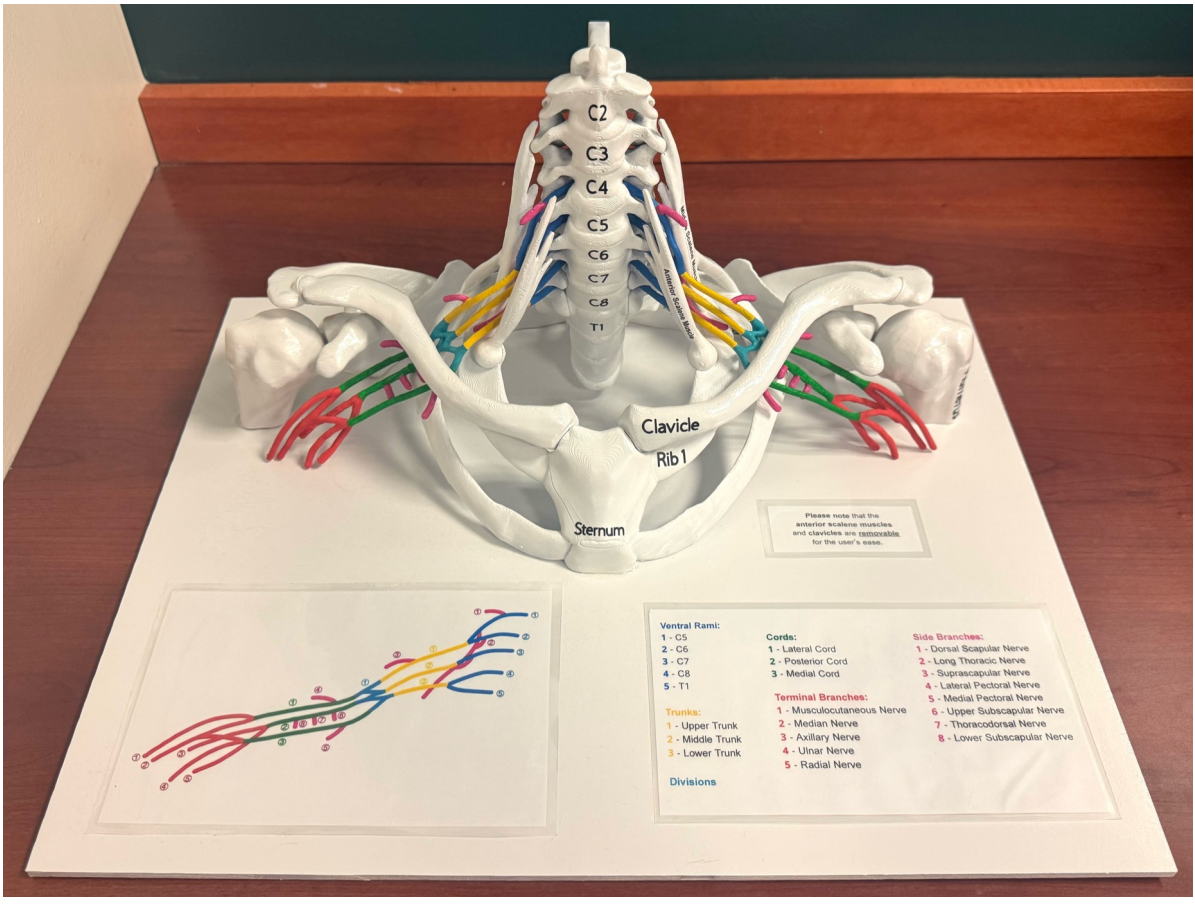

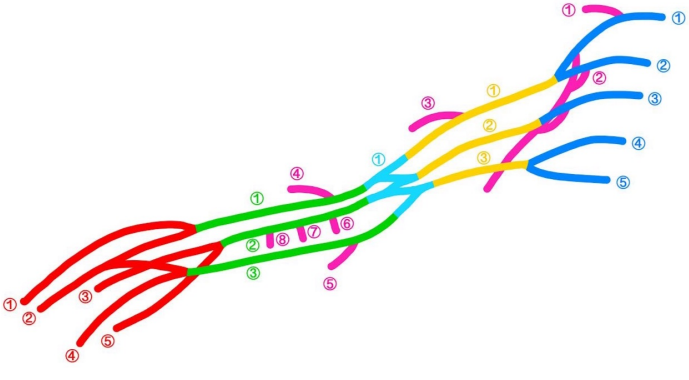

Ventral Rami:
1 - C5
2 - C6
3 - C7
4 - C8
5 - T1

Trunks:
1 - Upper Trunk
2 - Middle Trunk
3 - Lower Trunk

Divisions

Cords:
1 - Lateral Cord
2 - Posterior Cord
3 - Medial Cord

Terminal Branches:
1 - Musculocutaneous Nerve
2 - Median Nerve
3 - Axillary Nerve
4 - Ulnar Nerve
5 - Radial Nerve

Side Branches:
1 - Dorsal Scapular Nerve
2 - Long Thoracic Nerve
3 - Suprascapular Nerve
4 - Lateral Pectoral Nerve
5 - Medial Pectoral Nerve
6 - Upper Subscapular Nerve
7 - Thoracodorsal Nerve
8 - Lower Subscapular Nerve