

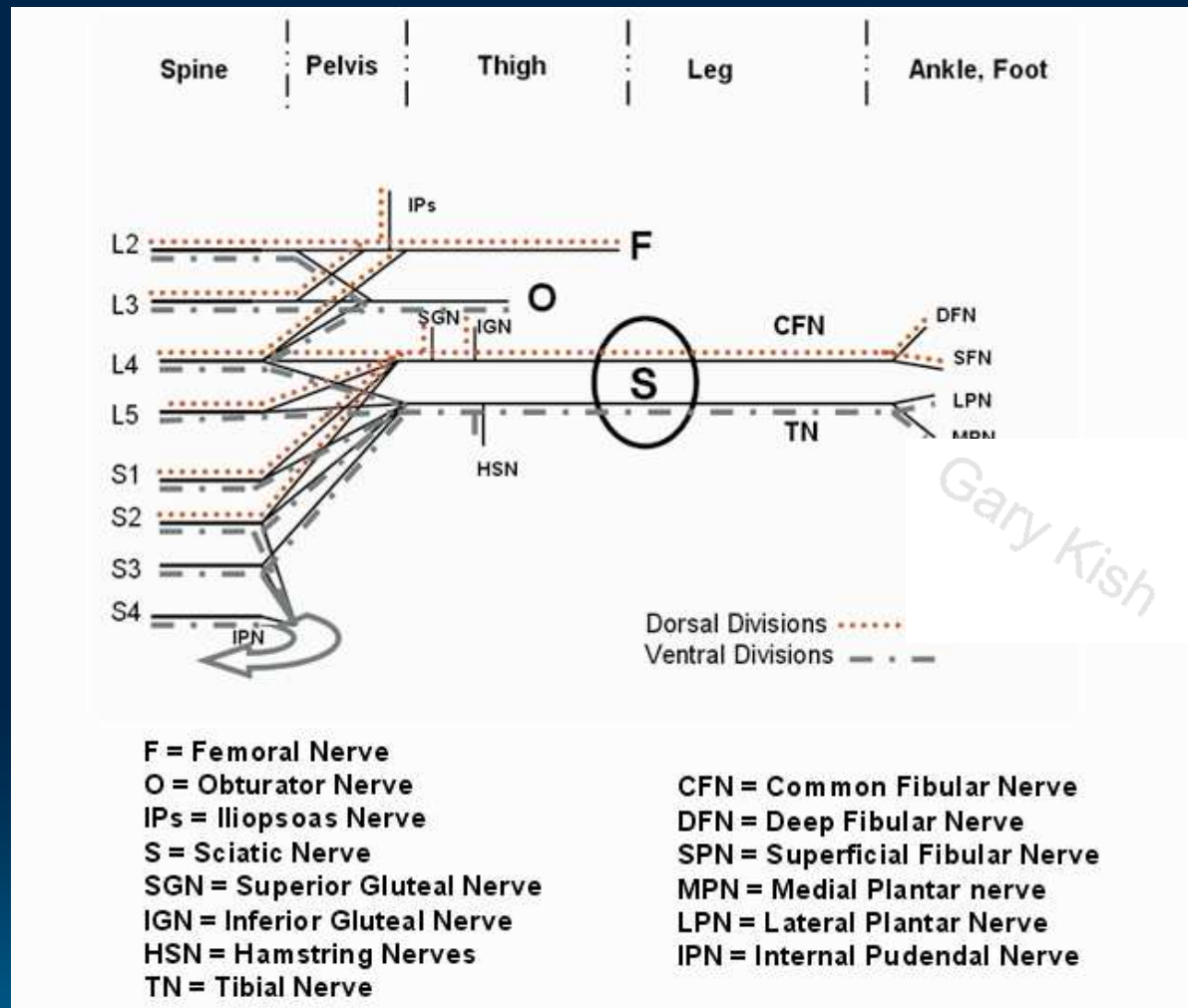
The LumboSacral Plexuses

Learn The Easy Way
Step By Step Diagrams

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Looks complicated!



But... draw the steps, repeat a couple times and its yours.
 All you need: paper, pen and two colored pencils and 5 minutes

4 Lumbar 4 Sacral

L2 _____

L3 _____

L4 _____

L5 _____

S1 _____

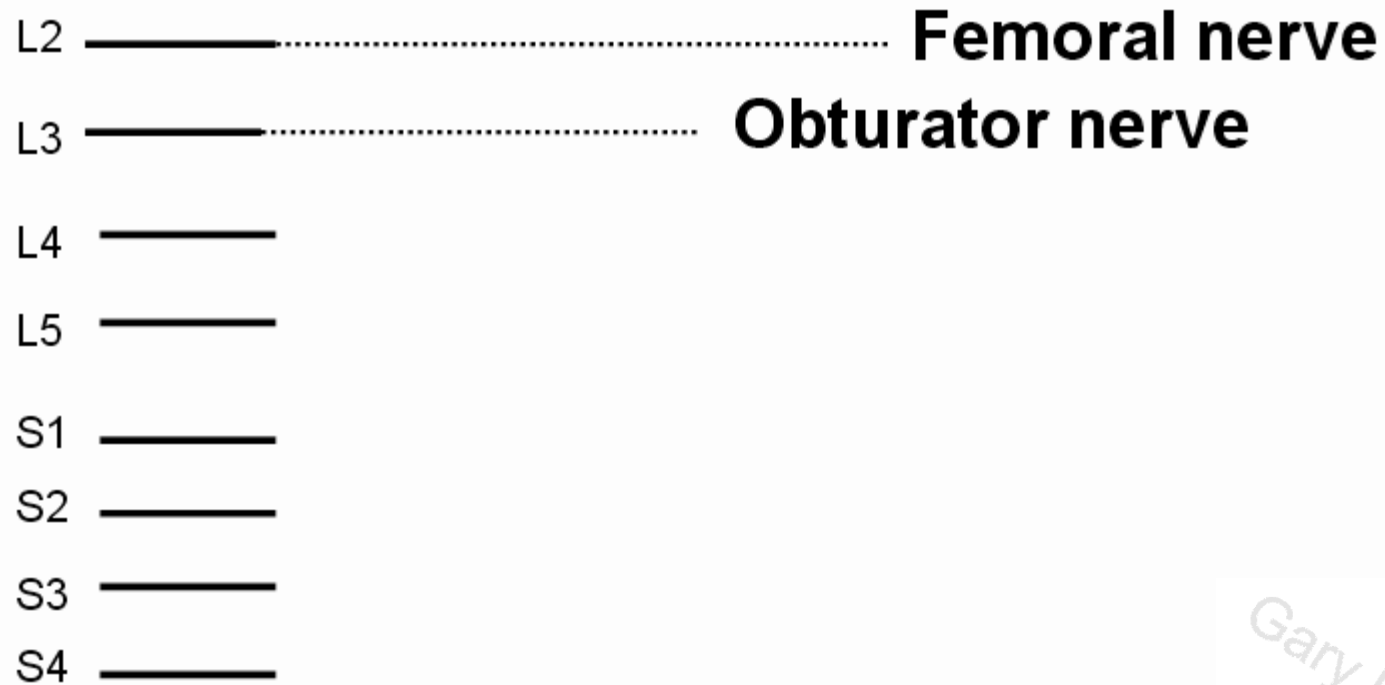
S2 _____

S3 _____

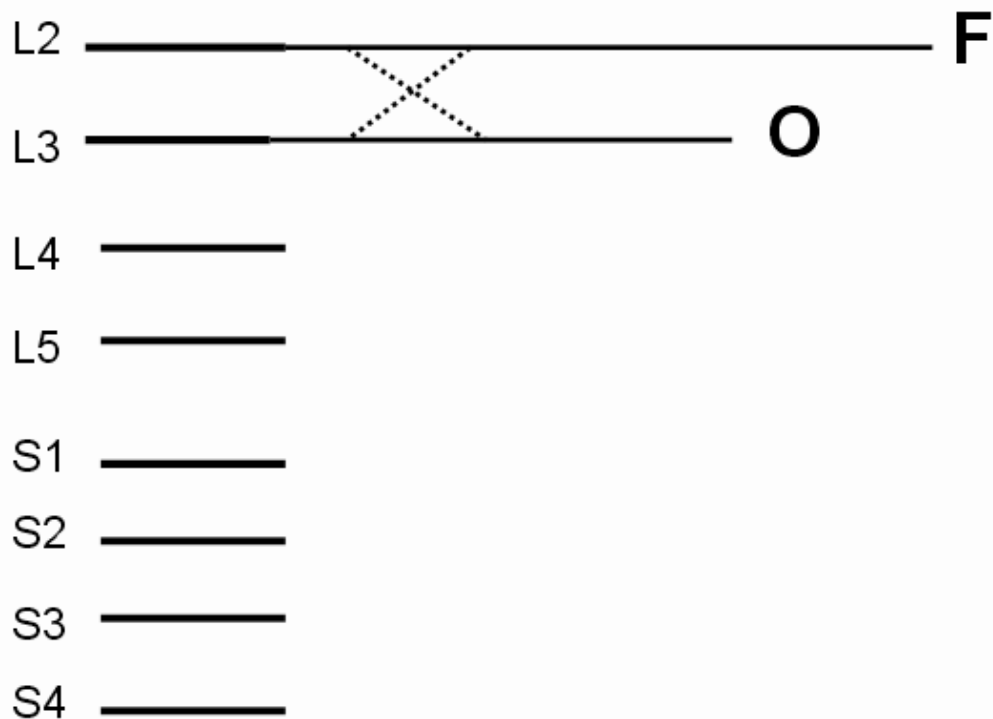
S4 _____

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Step One: Draw 8 horizontal lines to the left side. These represent the anterior (ventral) rami of lumbar and sacral nerve roots L 2 through S4, the contributors to the mixed peripheral nerves of the LumboSacral plexuses



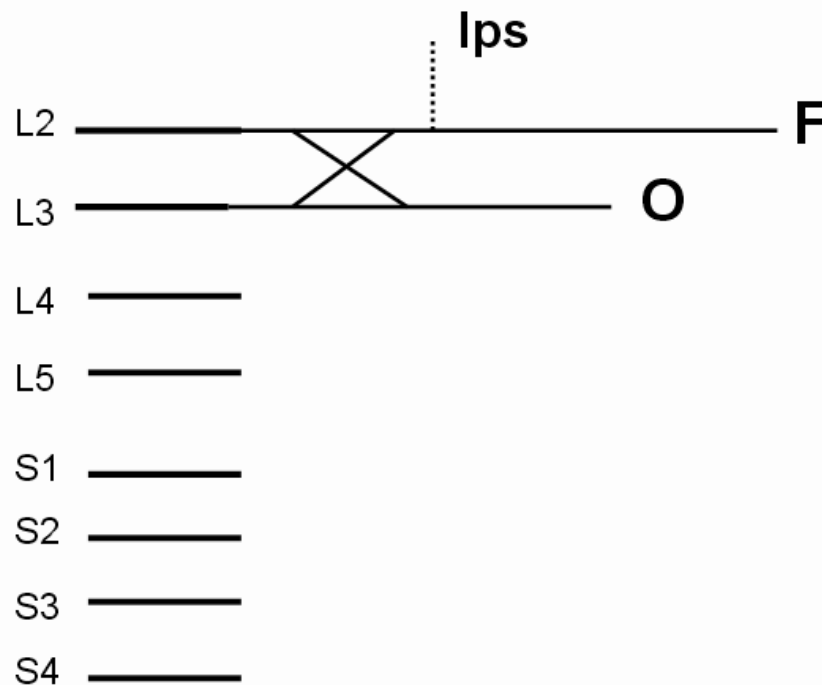
Step two: Add horizontal extensions from L2 and L3 to represent the femoral nerve (longer) and obturator nerve (shorter).



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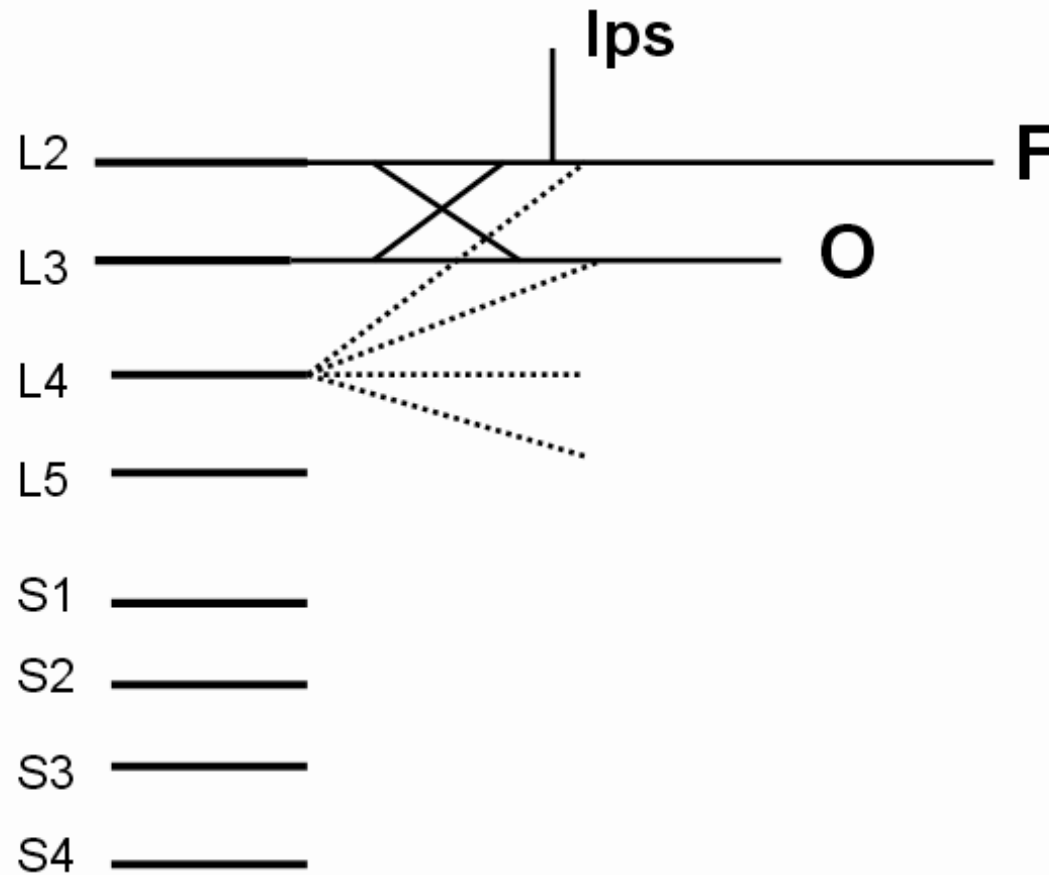
Step 3: Draw an "X" between L2 and L3. This indicates the nerve pathways from these 2 anterior rami to the Femoral and Obturator nerves

Add Iliopsoas nerve line to F

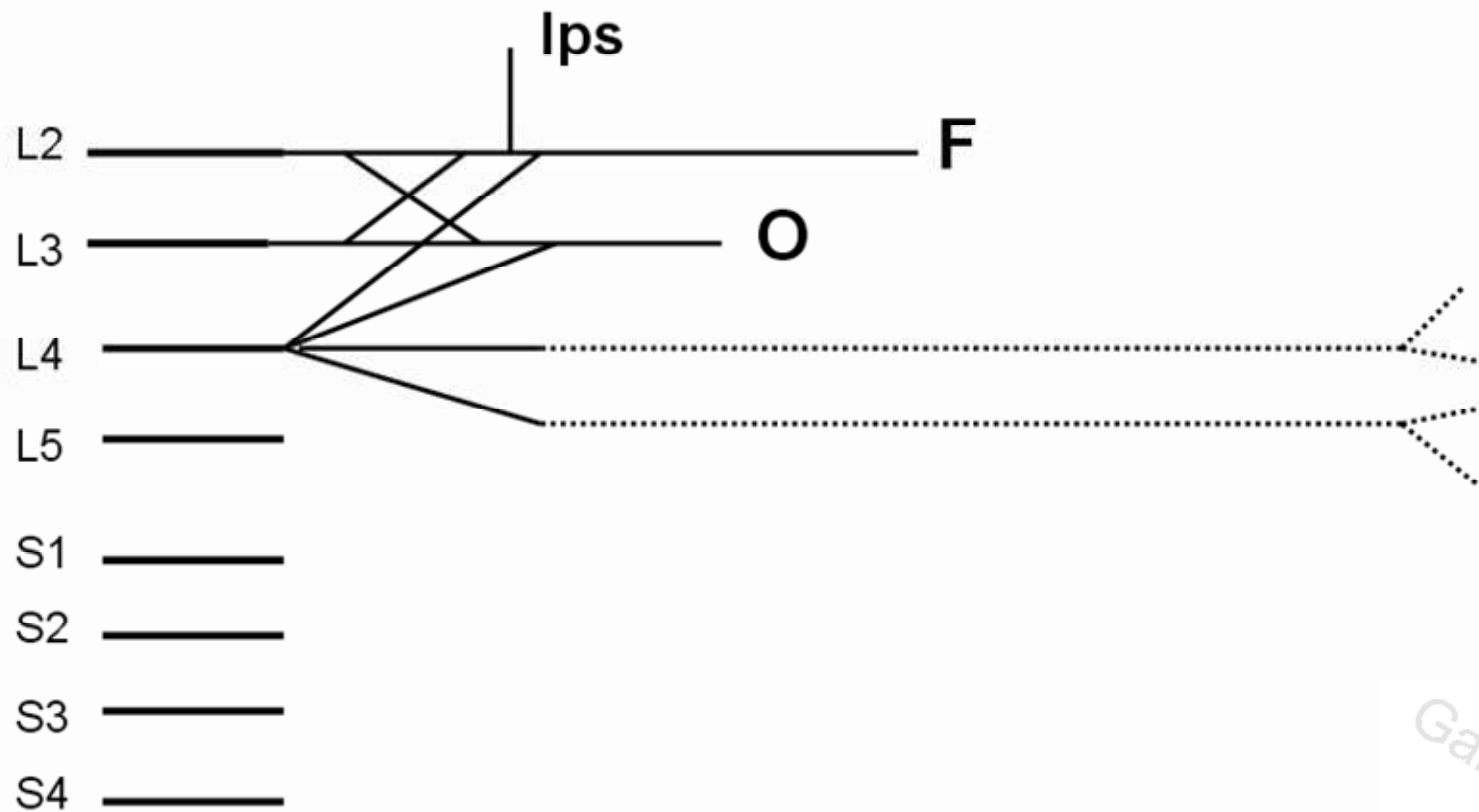


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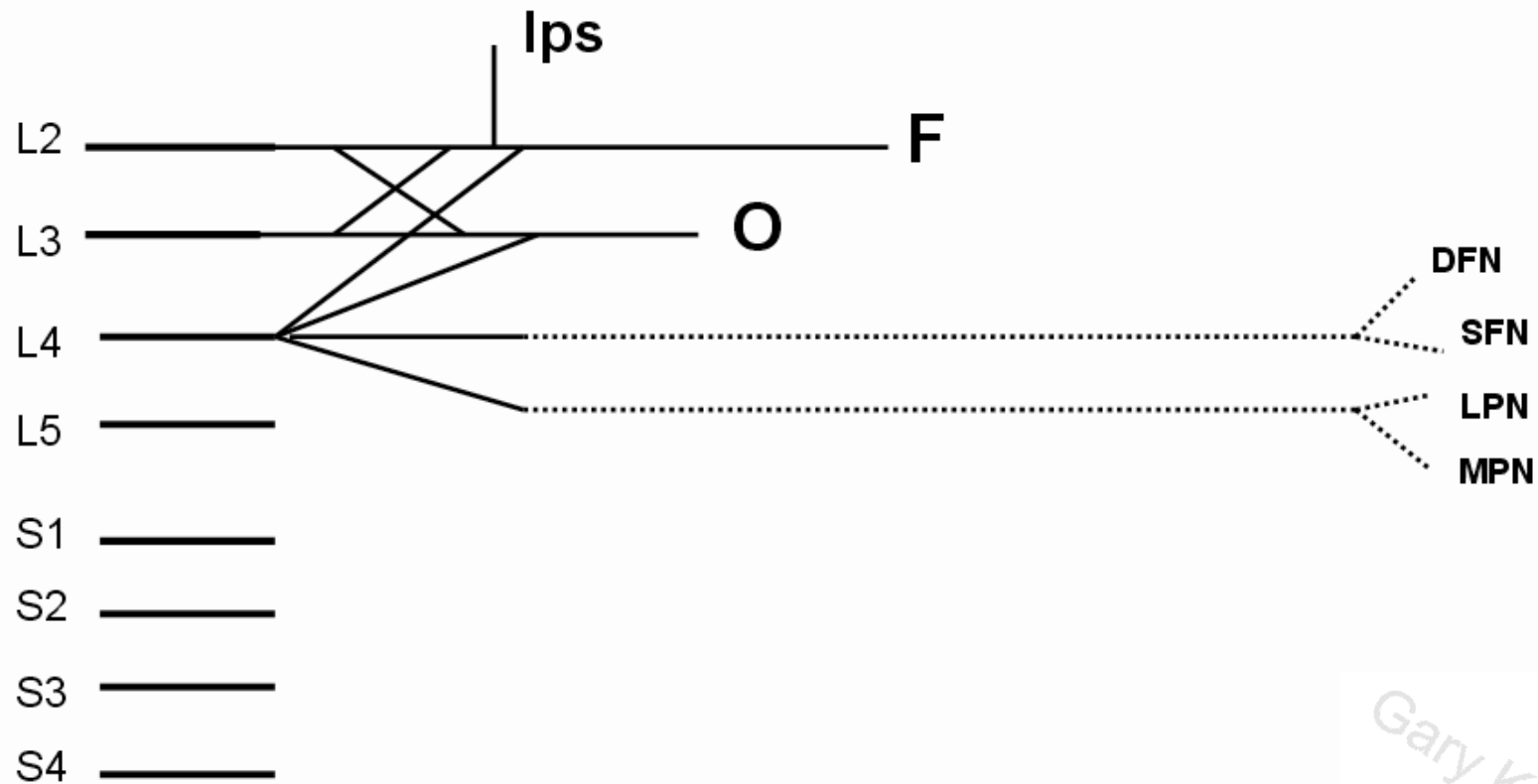
Step 4: Immediately beyond the "X" insert a vertical line to the top horizontal line. This new line represents the nerve to the iliopsoas



Step 5: "The L 4 Four Tine Fork". Draw 4 divergent lines from L4: one to the "F" line, second to the "O" line, third straight across, and the fourth to the level of L5. This "4 tine fork" represents the contributions of L4 to the femoral nerve, Obturator nerve, and the Common Fibular and Tibial components of the Sciatic nerve

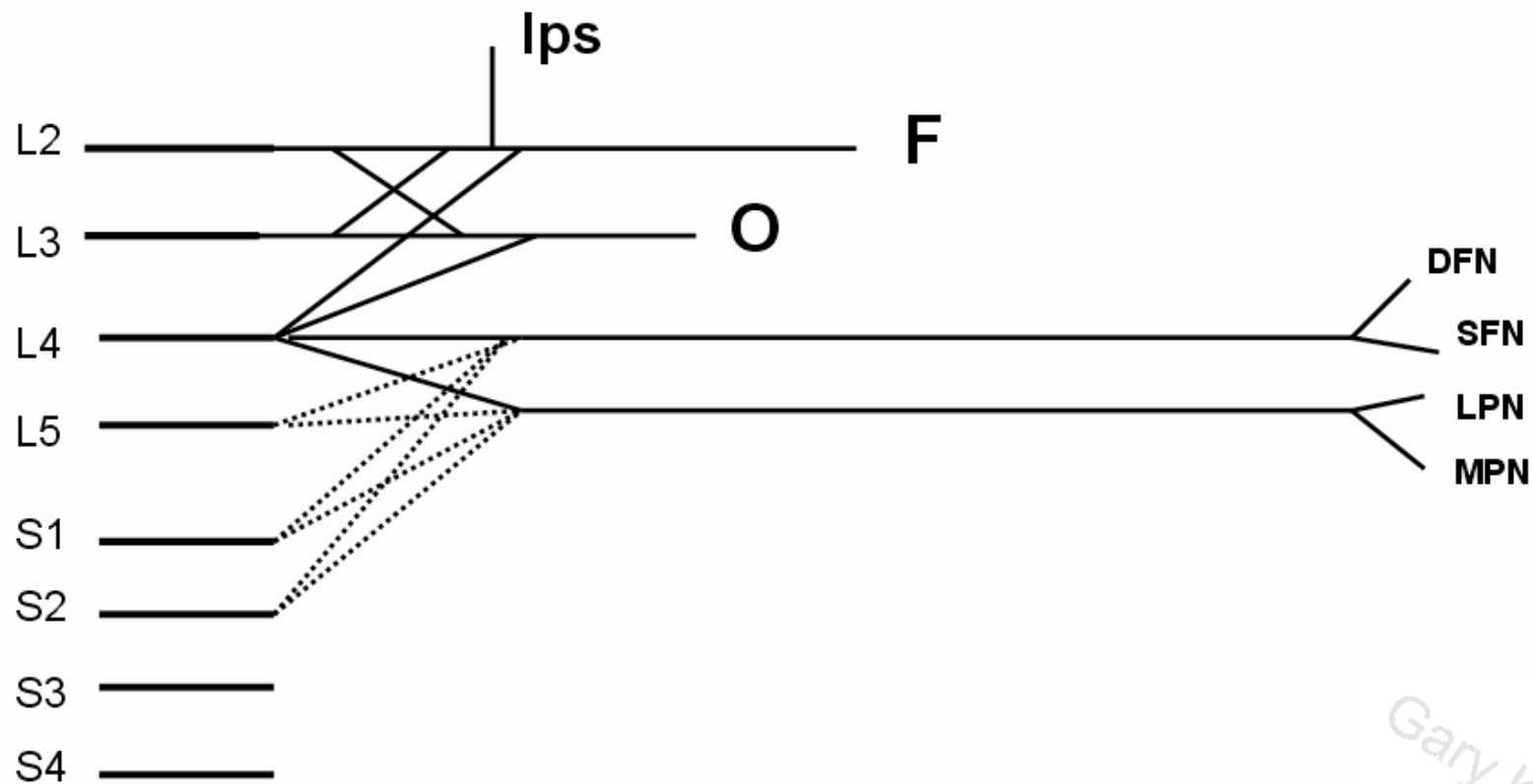


Step 6: Draw long horizontal lines from the two lower tines of the L4 fork ending each in V extensions. These resultant "legs and feet" denote the main body of the sciatic nerve and terminal branches



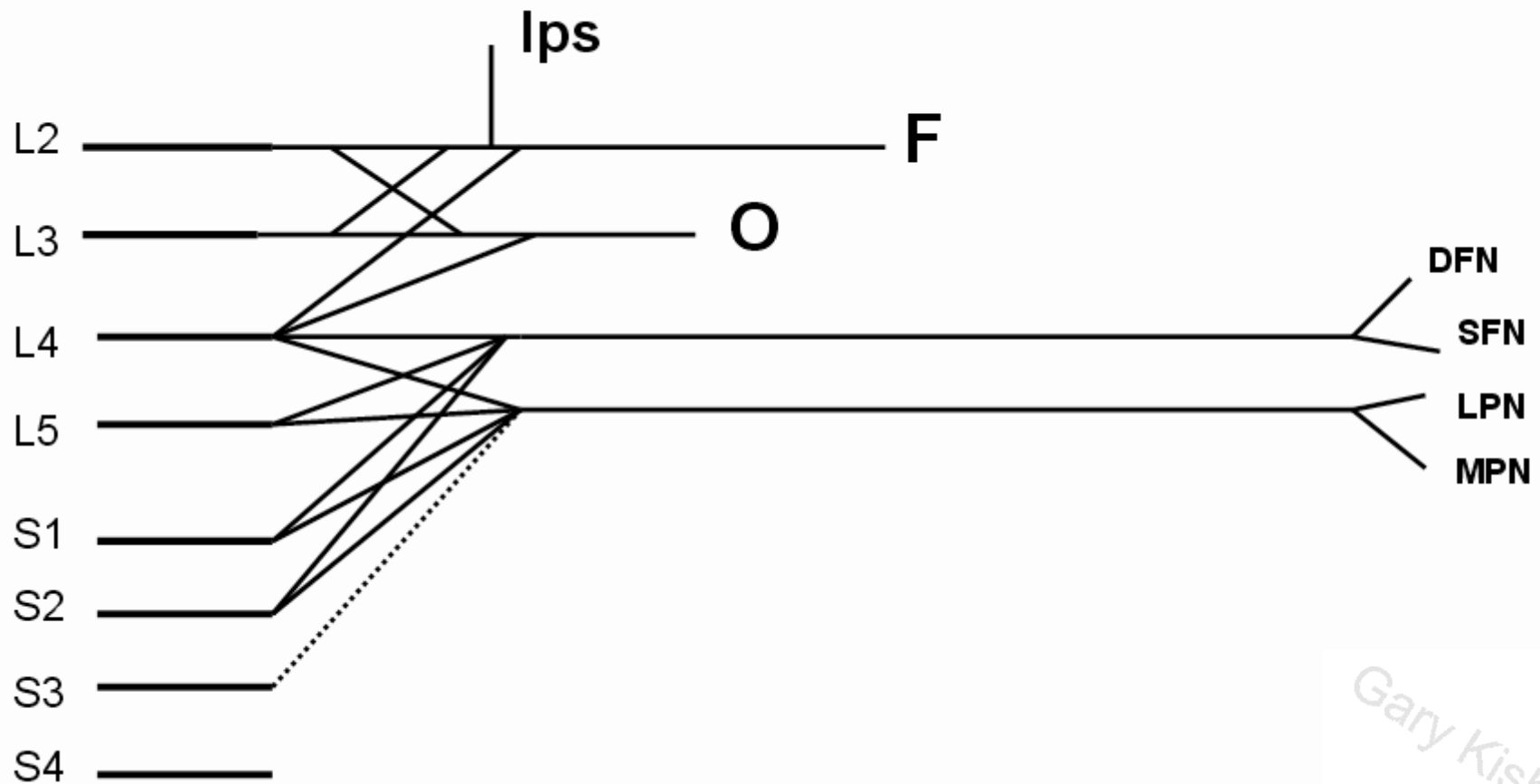
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Step 7: Label the terminal branches of the Common Fibular and Tibial nerves from top to bottom: DFN, SFN, MPN and LPN. Refer to the index in Figure 1 for terminology.

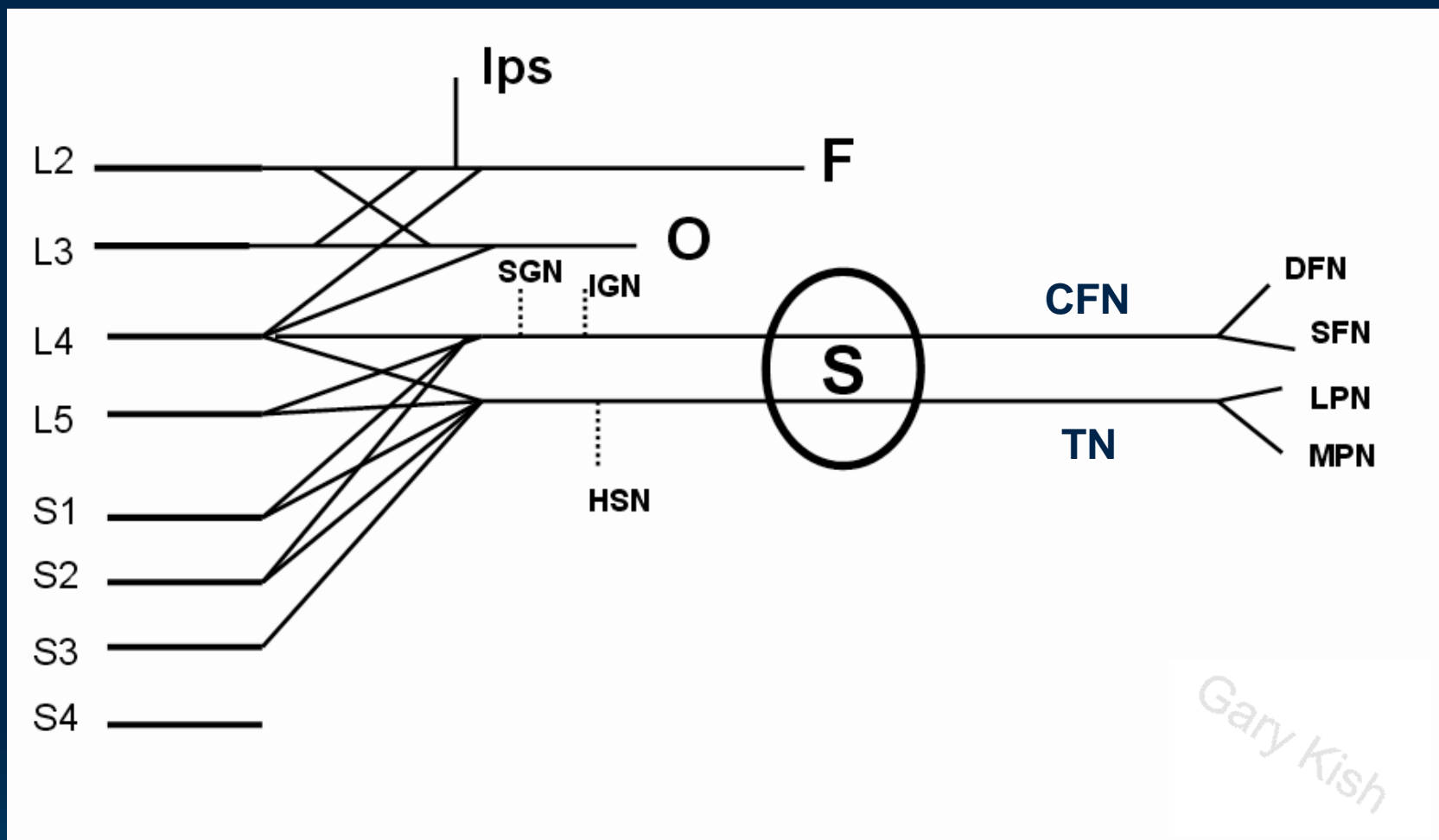


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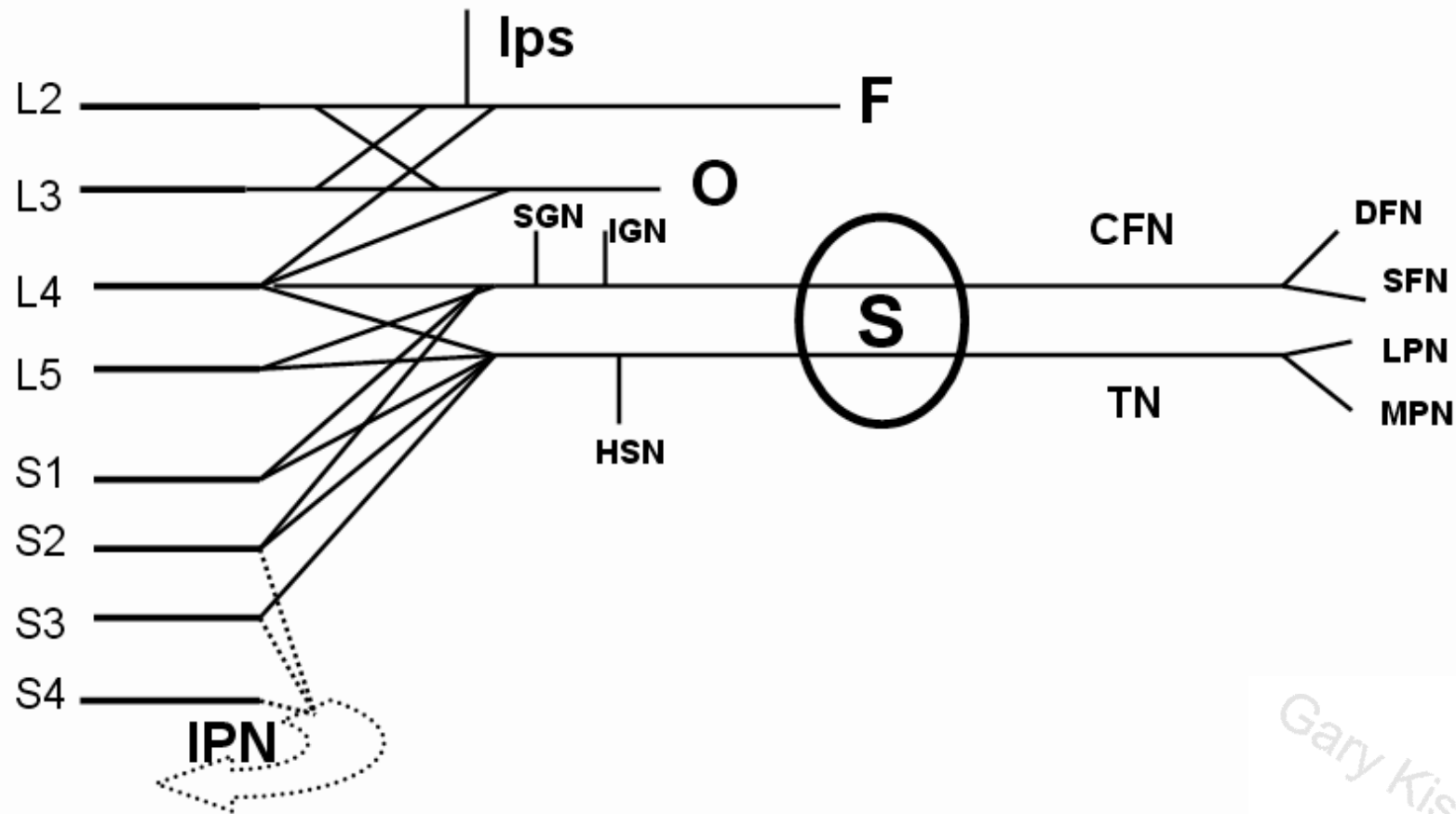
Step 8: Draw three Vs from L5, S1 and S2 to the long horizontal lines. These represent contributions of these nerve roots to both components of the Sciatic nerve.



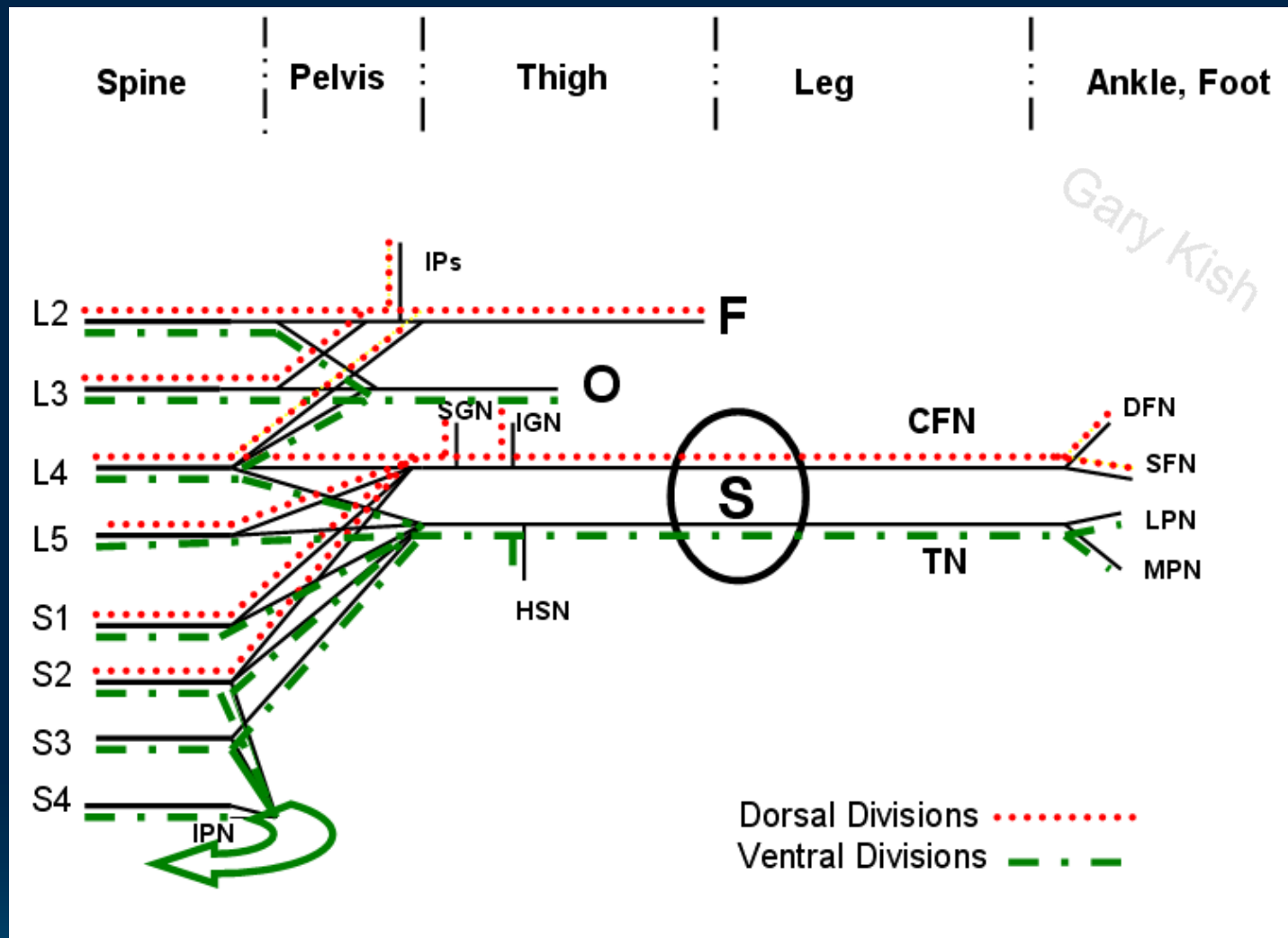
Step 9: Connect the S3 nerve root to the lower long horizontal line. This line completes the nerve root contributions to the sciatic nerve and its terminal branches



Step 10: Circle the two long horizontal lines with a "S" to symbolize the coalescence above the knee, and then the divergence at the knee of the common fibular (CFN) and tibial (TN) branches. Above the "S", add vertical lines: two from the upper line denoting superior (SGN) and inferior gluteal (IGN) nerves and one from the lower line designating the nerves to the hamstring muscles (HN).



Step 11: Connect three lines from S2, 3 and 4 to a curved arrow pointing back to the to the nerve root lines. The arrow represents the internal pudendal nerve (IPN). The direction of the arrow serves as a reminder that this nerve exits the pelvis through the lower part of the greater sciatic foramen and reenters the pelvis through the lesser sciatic foramen



Step 12: Using colored pens or pencils, trace the dorsal divisions (red....) and ventral (green_ _) from the anterior rami to the terminal branches. This step demonstrates that femoral and common fibular nerves are from dorsal divisions while obturator and tibial nerves are from ventral divisions. Refer to the completed diagram and terminology index.

The LumboSacral Plexuses A Diagrammatic Teaching Method

For first and second year medical students, the nervous plexuses to the extremities are a bewildering array of nerves with complex interconnections. They are demanding to understand, and then challenging to remember in the midst of an oral examination or later in a clinical situation. The sequential diagram “Learn the Brachial Plexus in 5 minutes or Less” has been met with favor on both sides of the medical degree (Romm and Chu, 2005). For students it has erased a major obstacle in the understanding of upper extremity neuromuscular anatomy, and for practitioners facilitates accurate recognition of injured nerve pathways.

Invariably during the teaching year, the question arises: “what about the lumbar and sacral plexus?” In an attempt to unravel the equally formidable lower extremity plexuses, a step by step diagram of the combined LumboSacral plexus has been devised (Figures 1-13). By building the diagram from the anterior primary rami through the divisions and then the terminal branches, the finished product (Figure 1), though standing alone appears formidable, can be faithfully recreated after a few attempts. The insights and internet browsing of the students of the University of Debrecen Medical School have been quite helpful in the development of the method (van Heukelom, 2006). The resultant diagrams have been received favorably by these students as they learn to integrate nerve and muscle functional anatomy of the lower extremity. The diagrams include the major mixed peripheral nerves to the lower extremity and the perineum. For the sake of clarity, it does not include the pure sensory nerves or the multilevel innervations of the iliopsoas and hamstring muscles. These nerves of the lumbar and sacral plexuses can be added after the basic diagram has been mastered. A readily apparent feature of the step by step process is the recognition that the sciatic nerve is truly two nerves: the common fibular (peroneal) and the tibial nerve, originating from different divisions and dividing at variable anatomical junctures in the pelvis and thigh (Gray, 2000).

Special note should be taken of the terminology of the divisions. In various texts

and illustrations, either dorsal/ventral or posterior/anterior terms are assigned (Gray, 2000; Netter, 2006; Agar and Moore, 2005). Of interest, Terminologia Anatomica does not assign a code number to the divisions in the lumbar, sacral or coccygeal plexuses or nerve categories (FCAT 2000). For the diagrams of this study, the terms *dorsal* and *ventral* divisions have been chosen rather than *posterior* and *anterior* to better reflect the embryonic origins and final destinations of the terminal branches (Sadler, 2006). For example, the femoral nerve motor fibers can be traced from the dorsal portion of the anterior primary rami of L2, L3 and L4 nerve roots, coalesce through the dorsal divisions of these roots, and innervate the muscles of the dorsal thigh. Likewise, the sensory nerves fibers of the lateral plantar nerve begin on the ventral aspect of the foot travelling in the ventral leg and thigh through the ventral divisions of the anterior primary rami of spinal nerves to the dorsal roots of S1 and S2.

In addition to an isolated memory aid, the completed diagram can be used in conjunction with the adult myotome innervations and dermatome patterns (Last, RJ 1963; Netter FH; Kish 2007) resulting in a clearer overall understanding of extremity torsional development and surface anatomy.

The thirteen diagrams include the completed LumboSacral Plexuses with dorsal and ventral divisions in color and a terminology index (Figure 1). The subsequent twelve diagrams are the steps to arrive at completion (Figures 2-13). These are arranged sequentially from the anterior rami of nerve roots L2 through S4, dorsal and ventral divisions, major peripheral mixed nerves, and finally the terminal branches. The LS plexuses diagram is not “an aid in memorization of anatomy facts” such as the catchy phrases and poems found on the internet, rather a method to grasp concepts, use the information dynamically, and then retain it.

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References

1. Agur Anne MR, Dalley AF. 2005. Grant's Atlas of Anatomy. 11th Ed. Philadelphia, Baltimore MD. Lippincott Williams & Wilkins. 848 p.
2. Federative Committee on Anatomical Terms. 2000. Terminologia Anatomica: International Anatomical Terminology. Stuttgart, Germany: Thieme 292 p.
3. Gray, Henry. 2000. Anatomy of the Human Body 20th edition. Revised and re edited Lewis, WH (Editor). New York. WH Bartley. 1396 p.
4. Kish G. 2007. Computer Human Anatomy, Myotomia Video. Debrecen, Hungary. URL: <http://garykish.tripod.com> [accessed June 2009]
5. Last RJ. 1963. Anatomy Regional and Applied. 3rd Edition. London. J&A Churchill, Ltd. 849 p.
6. Netter FH. 1987. Musculoskeletal System Volume 8 Section II Embryology. Summit, NJ. Ciba-Geigy Corporation. 260p.
7. Netter FH. 2006 Atlas of Human Anatomy. 4th Edition. Philadelphia. Saunders/Elsevier. 545 p.
8. Physical Therapy.web-log.nl. Lumbosacral plexus 2006. The Netherlands. URL: <http://physicaltherapy.web-log.nl/physicaltherapy> [accessed May 19 2009].
9. Romm, DS, Chu DA. 2005. Learn the Brachial Plexus in Five Minutes or Less. Physical Medicine and Rehabilitation Department of Veteran Affairs, Biloxi, Miss. URL: http://www.ama-assn.org/ama1/pub/upload/mm/15/brachial_plex_how_to.pdf [accessed May 19 2009]
10. Sadler, TW. 2006. Langman's Medical Embryology. 10th Edition. Baltimore, MD. Lippincott Williams & Wilkins. 371 p.

References

1. Agur Anne MR, Dalley AF. 2005. Grant's Atlas of Anatomy. 11th Ed. Philadelphia, Baltimore MD. Lippincott Williams & Wilkins. 848 p.
2. Federative Committee on Anatomical Terms. 2000. Terminologia Anatomica: International Anatomical Terminology. Stuttgart, Germany: Thieme 292 p.
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9. Romm, DS, Chu DA. 2005. Learn the Brachial Plexus in Five Minutes or Less. Physical Medicine and Rehabilitation Department of Veteran Affairs, Biloxi, Miss. URL: http://www.ama-assn.org/ama1/pub/upload/mm/15/brachial_plex_how_to.pdf [accessed May 19 2009]
10. Sadler, TW. 2006. Langman's Medical Embryology. 10th Edition. Baltimore, MD. Lippincott Williams & Wilkins. 371 p.