

Webinar Q&A Report:

Understanding the Peripheral Nervous System

1. Do you have any tutorials on intro embryology showing the basic patterns you were talking about?

M. Nielsen: I do not have any tutorials, but I do have lots of lecture presentations. I am considering presenting HAPS-I course on embryology and the foundations of developmental patterns that clarify post-natal anatomy.

2. How many chapters do you cover in your anatomy class?

M. Nielsen: My anatomy course is probably quite unique because it is a combined systemic and regional approach. The first six weeks establish tissues and the various body systems, and then the last nine weeks takes a regional approach, which I believe is a much more impactful way to teach anatomy. During the regional portion we expand on the various systems and show how they are related within the regions of the body. Think about it, you do not go to healthcare professionals with a concern about your systems, you have a problem in your thorax or abdomen and you need to know how all the systems are interacting and related in the region to understand or diagnose the problem.

3. Do you have a stance or some thoughts regarding the idea that we should consider pelvic autonomics to be sympathetic rather than parasympathetic?

M. Nielsen: Yes, if you think about what I shared with you in this presentation, it is clear that the terms sympathetic and parasympathetic are terms of anatomy describing the evolution and development of two general pathways to smooth muscle in either the gut tube or cardiovascular tubes.

4. Aren't Schwann cells neural crest too?

M. Nielsen: Schwann cells are nonmigratory neural crest that wrap the axons of the preganglionic as they exit the neural tube and follow the axon to its termination, but the migratory crest cells that become the postganglionic neurons never associate with Schwann cells.

5. Why are preganglionic neurons myelinated and the postganglionic neurons not myelinated?

M. Nielsen: Schwann cells are nonmigratory neural crest that wrap the axons of the preganglionic as they exit the neural tube and follow the axon to its termination, but the migratory crest cells that become the postganglionic neurons never associate with Schwann cells.

6. Can the peripheral nerves heal themselves in the young? (Autonomic Dysfunction or Neuropathies)

M. Nielsen: Peripheral axonal repair and healing is much more common than central axonal repair. The tissues that wrap peripheral neurons play important roles in the healing process. Here is a link to a good article on this - <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2846285/>

7. The vagal nerves have branches to the heart, lungs, bladder and etc. Where are the postganglionic neurons in those organs?

M. Nielsen: In the lungs and bladder the postganglionic neurons are intramural (in the wall of the organs) as is the case with the digestive organs. Evidence points to parasympathetic postganglionics in the cardiac plexus of nerves around the heart.

8. Is it safe to assume that the number of somites match the number of cranial and spinal nerves? One for each level of the body to so speak?

M. Nielsen: Initially there are more somites and some of them regress in our anatomy with the reduction of the tail. So, the final number of somites that lead to the development of the vertebrae and the associated muscle segments of the body induce the growth of a spinal nerve from the spinal cord into the somite.

9. Anatomy is said to be dry area, how can you prove that wrong?

M. Nielsen: Anatomy is extremely boring if all you do is teach students to memorize a bunch of terms. I can think of nothing more boring. But anatomy comes to life and is exciting when you see how this complex machine with all its detailed parts is really quite simple and is modeled around a few basic patterns that emerge during development from a simple embryonic body plan. Then you correlate these structural patterns with functional logic that they support and anatomy becomes a fascinating problem-solving thought process and not a memorization game.

10. What make cardiovascular and GIT peculiar in the study of ANS?

M. Nielsen: The two distinct masses of developing muscle in the vertebrate embryo were in the wall of blood vessels or the wall of the gut tube. Both of which had different embryonic positional relationships that therefore established distinct and unique nerve pathways from the developing nervous system. The neuronal pathways to the gut tube were named parasympathetic and the neuronal pathways to the blood vessels were named sympathetic.

11. Can you recommend a good resource or two to help integrate embryology/developmental aspects to anatomical features?

M. Nielsen: I have never really seen this done quite like I do it, but there are good embryology books that help you understand development and can get you thinking about how to correlate it to the anatomy. The Developing Human by Moore and Persaud is a good book.

12. Have you given virtual exams for the anatomy courses you teach? If so, what types of questions do you use?

M. Nielsen: I always try to write questions that require students to synthesize information in a thoughtful way versus just regurgitate memorized information.

13. Why does the parasympathetic system innervate the heart if you say it only innervates the smooth muscle of the gut tube?

M. Nielsen: The evolution and development of the two systems are quite specific in what it is they innervate and the innervation is uniquely sympathetic or parasympathetic. However, over 500 million years of vertebrate evolution there are organs that have selected for dual innervation and this always seems to be associated with a more fine-tuned control. Where this occurs has to be in locations where both systems were naturally present. The heart is an example of dual innervation. Note however, that there is no dual innervation in the somatic body because the sympathetic system was the only system distributed somatically as it followed blood vessels. The parasympathetic was distributed to the gut tube and has no pathway to somatic organs. The one exception to this is the male penis, which has an extension of the gut tube in it, the urethra. The urethra develops from urogenital sinus at the terminal end of the gut tube.

14. Why is there no autonomic innervation from C1 to C8 and L2 to S1?

M. Nielsen: With the evolution of the large limbs in tetrapod vertebrates, the skeletal motor neurons of the ventral horn dominated those areas of the spinal cord and pushed the autonomies away from these regions.

15. I'm curious how much embryology you teach undergrad (lower division) anatomy students?

M. Nielsen: I do not teach embryology per se to my anatomy students, but I teach embryonic patterns that clarify anatomy. They learn basic concepts of the embryonic body plan and how morphogenesis of that basic embryonic body accounts for the anatomy that they are learning in their post-natal body. If you ask my students why some aspect of anatomy is the way it is, they will give my pat answer -"it is an embryo story" and then they will explain it clearly to you and all now makes sense!

16. Why don't ventral rami from T2-T1 form thoracic plexuses?

M. Nielsen: They are limited by rib development that helps maintain the segmental nature of that region of the body wall.

If you have additional questions for [ADInstruments](#) regarding content from their webinar or wish to receive additional information about their products and laboratory services, please contact them by phone or email:



ADInstruments, Inc.

77 Vogel Street, PO Box 587
Dunedin, New Zealand, 9016

<https://www.adinstruments.com>

Email: sales@adinstruments.com

