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Topic Review: Combo Meal for Neuroanatomy Newbies

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Dr. Zoidberg: Now open your mouth and lets have a look at that brain. No no no no no no not that mouth!

[For those who don't watch the show *Futurama*, Dr. Zoidberg is a alien doctor on a human spaceship. He thinks that the human male genitalia (or 'gonads') are located in the neck region]

I have a confession to make: when it comes to neuroanatomy, I am probably not too much better than Dr. Zoidberg. It is very likely that I would say something stupid like "Let's cut open that you-know-what gyrus and let's take a look at that olfactory bulb!" After careful self-introspection, I realized that my ignorance is multidimensional:

1. Although I am supposed to know something about the functions and physiological properties of quite a few brain structures, there are lots and lots of brain areas that are unfamiliar to me. Name any nuclei in the midbrain. This is a good chance that I have no idea what or where it is.

2. Come to think of it, I don't even know too much about the physiology and functions of most of the brain.

3. I don't know how brain areas are connected. To me, the brain is modeled like the Internet, you just send a package of information to any address. Of course, I know this is not true at all, but my knowledge of connection is so limited that it doesn't matter: I still cannot make any educational inferences based on anatomical considerations.

4. I don't know how brain structures are packed spatially. I don't know if you take a slice from the brain, which structures will appear in the same slice. Or where to aim an electrode at if I want to reach the LGN.

Now, I can hide behind my role as a computational modeler and declare I don't care too much about anatomy. But it is really embarrassing sometimes. I decided to do something about it.

The goal is to improve my knowledge in 1-4 by self study. I actually tried to do it a few times in the traditional way, which involves picking up a brain atlas and trying to memorize the brain structures on each page. It never worked because I always got lost in the spider-webs of latin names and got bored. This method is too inefficient for me. It's like trying to memorize the whole family tree of the Baggins family without knowing any stories about Bilbo and Frodo. Although neuroanatomy books usually include a big chapter on functional systems, the description is usually too brief and dry to be useful to a beginner. I need more context and functional information to make the brain structures meaningful, but not a 2000-page reference book that I have no hope of reading from back-to-back. I recently found a combination of books that seems to be very satisfying. I would like to share this finding with you.

The combo meal for neuroanatomy newbies includes:

1. *Neuroscience Secrets*

edited by Margaret T. T. Wong-Riley.
Hanley & Belfus Inc.

2. *The Human Brain: in Photographs and Diagrams*
by J. Nolte and J. Angevine
Mosby, Inc

3. *The Human Central Nervous System: A Synopsis and Atlas*
by van Huijzen and Nieuwenhuys.
Springer Verlag, Inc.

Neuroscience Secrets is the functional part of the combo. As you can tell from the title, it is not a scholarly work. It is more like a cheat sheet you bring to a graduate-level exam, reviewing all the major topics in neuroscience in only 400 pages. Unlike other books in this genre, however, *Neuroscience Secrets* is written in prose, rather than in diagrams and bullet points. It is a enjoyable read even if you know very little about some of the topics. Each topic is presented in a question and answer format.

For example, questions found in the auditory system section include: what do the cochlear nuclei do? Where do the outputs of the cochlear nuclei go? How do the medial and lateral nuclei of the superior olove function in sound localization? What is the lateral lemniscus?

The questions usually start with an overview of the brain structures involved in a certain system, the connections between the structures, and the physiology of each structure. The answers are brief but not overly simplistic. I learned a few new things even in the systems that I am most familiar with.

The downside of *Neuroscience Secrets*, is that the illustrations are small and poorly drawn. The anatomical information is also not always detailed enough. To overcome this problem, I added *The Human Brain* to the menu. Out of several brain atlases, Nolte and Angevine seems to be most friendly to beginners. The labels of brain structures and the connections are simplified such that beginners won't feel too overwhelmed by the complexity of the brain. The quality of the color photos is also top notch.

I added *van Huijzen and Nieuwenhuys* to accomplish mission 4: learn the spatial relationship of brain structures. Brain atlases are usually organized by slices of different cutting planes and the readers are left to reconstruct the three dimensional picture on their own. This is quite a difficult task for beginners. Nolte and Angevine tries to help by including some rendered 3D computer models. While this approach does help to solve the inverse problem of 3D reconstruction, the models in the book only include major structures, such as the thalamus and the basal ganglia, but not individual nuclei. van Huijzen and Nieuwenhuys is a very good supplement to *The Human Brain*. The diagrams in *The Human Central Nervous System* are hand-drawn creatively, such that spatial relations of associated structures are highlighted, but irrelevant information is reduced. This approach dramatically reduces the confusion of reading slices. It also complement the simplicity of Nolte and Angevine with much more details.

So here you have it, the combo meal for neuroanatomy newbies. My knowledge of neuroamatomy is now probably better than Dr. Zoidberg, and I hope in half a year I will be able to perform a lobotomy without having a book in hand. I hope you will enjoy this combo meal too!

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