Integrating Neuroanatomy and Behavioural Neuroscience to Enhance Medical Students' Appreciation of Visual Processing

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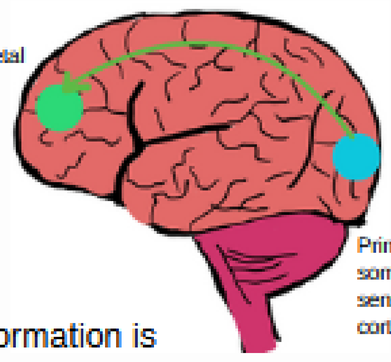
At the University of British Columbia, neuroanatomy is a central feature of undergraduate medical education. In recognition of the fact that structure and function are inextricably linked, medical students are taught about neuroanatomical structures that are involved in human behaviour in tandem with relevant clinical presentations. Here, we use visual processing to outline how neuroanatomy and behavioural neuroscience can be integrated to enhance medical education.

Neuroanatomy (Structure) of Visual Processing

Visual information from eyes

Primary visual cortex



This visual information is relayed to the parietal lobe through the **dorsal stream** (van Polanen & Davare, 2015)

Parietal lobe ==> Involved in reception and processing of somatosensory information

Functional Roles of Neuroanatomical Structures

DORSAL STREAM

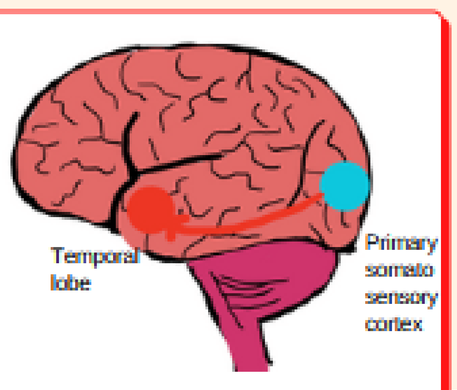
- Involved in **spatial processing** and **navigation**
  - This is completed by integrating visual information from the **primary visual cortex** with somatosensory information in the **parietal lobe** (van Polanen & Davare, 2015)

LESION!

- **THEREFORE,** a lesion along the dorsal stream would cause deficits in **visuospatial processing** (Cooper & O'Sullivan, 2016)
- **E.g., BALINT'S SYNDROME,** which is characterized by **(1)** difficulty with voluntary eye movements, **(2)** inability to spontaneously move hand towards an object, and **(3)** difficulty with perception of more than one object (Cooper & O'Sullivan, 2016)

Visual information from eyes

Primary visual cortex



This visual information is relayed to the parietal lobe through the **ventral stream** (van Polanen & Davare, 2015)

Temporal lobe ==>Various functions including face and object recognition

VENTRAL STREAM

- Involved in **object discrimination** and **recognition**
  - This is completed by integrating visual information from the **primary visual cortex** with face and object recognition information in the **temporal lobe** (van Polanen & Davare, 2015)

LESION!

- **THEREFORE,** a lesion along the ventral stream would cause deficits in **object discrimination and recognition** (Álvarez & Masjuan, 2016).
- **E.g., VISUAL AGNOSIA,** which is characterized by the inability to recognize familiar objects at sight (Álvarez & Masjuan, 2016)

ONLINE vs. IN-PERSON LEARNING EXPERIENCES

Due to the COVID-19 pandemic, the current cohort of medical students have experienced both online and in-person neuroanatomy instruction. We have noticed that:

- Online learning has enabled us to use various different tools to learn (e.g., 3D models, simulations, videos)
- In-person learning has enabled us to gain a better physical appreciation for the structures we are studying; by touching neuroanatomical structures during dissections, we were able to better understand physical relationships between structures.

KEY POINTS

The authors of this poster are either current medical students or instructors who have been involved in this integrated education approach. Our experience in this approach has elucidated that:

- When neuroanatomy is taught in conjunction with the functional roles of relevant neuroanatomical structures, students are provided with the opportunity to more fully appreciate the relationship between structure and function.
- Using clinical implications of lesions in neuronatomical structures (e.g., Balint's syndrome and visual agnosia) highlights the functional significance of these structures in a way that is clinically relevant and appropriate during medical education.
- An understanding of deficits related to lesions helps students conceptualize the physiological function of structures and the brain and their role in behaviour. Likewise, by understanding the neuroanatomy of the brain, students are better able to appreciate clinical presentations.

References
van Polanen, V., & Davare, M. (2015). Interactions between dorsal and ventral streams for controlling skilled grasp. *Neuropsychologia*, *79*(Pt B), 186–191. https://doi.org/10.1016/j.neuropsychologia.2015.07.010
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