

Anatomical Foundations of Neuroscience (Anatomy & Cell Biology 9535b)

This is a half-course, offered in the Spring term, to help graduate students appreciate the relevance of anatomical knowledge to research in Neuroscience.

Since 2010 the former lecture component of the course has been replaced by a web site, making use of WebCT-OWL. The instructor (J. A. Kiernan) will, however, be available for consultation and discussion throughout the term, and review sessions will be conducted before tests and at other times if requested. **Laboratory classes** (about 12 hours) will be arranged at times convenient for students. Students taking 9535b are also invited to attend six morning classes in **Clinical Neuroanatomy** for 4th-year medical students. These will be on Thursday mornings, 8:30-11:30 in the Social Sciences Building, Room 2036, from 17th March to 21st April. Attendance is optional. Graduate students involved in research with human subjects have found these sessions helpful in previous years.

Evaluation.

1. Mid-course test, second week in February, worth 20%. (This is a take-home exam with 5 questions requiring written answers.)
2. Practical exam based on the laboratory work, worth 30%. (This is a timed video with 100 multiple choice questions.)
3. Final written exam, worth 35%. (This is a take-home exam covering all the course content, with multiple choice questions and questions written requiring short and long written answers.)
4. Oral exam, worth up to 15%. The outcome of the oral exam cannot reduce a student's final mark, but may increase it.

Topics covered. Times are flexible.

Jan to mid-Feb.

Overview of the anatomy of nervous systems of invertebrate animals (up to and including non-vertebrate chordates).

Early development of the vertebrate nervous system. (Formation of neural tube and neural crest. Major divisions of brain; neuromeres. Alar and basal laminae. Abnormal neural tube development.)

Later development of the vertebrate (mammalian) nervous system. (CNS: Secondary divisions of brain; flexures; production and migration of neurons; caudal cell mass; formation of the cerebellum; gliogenesis. PNS: Migration and differentiation of neural crest cells.)

Development of special sense organs (Olfactory & vomeronasal epithelia; eye; ear; taste buds; other derivatives of placodes.)

Major parts of the adult CNS in various groups of vertebrate animals.

Organization of the PNS: (Types of ganglia. Somatic and visceral innervation. Separation of function in nerve roots in different groups of vertebrates.)

Gross anatomy of the spinal cord and brain stem (various animals).

The cranial nerves and their functions (1).

The cranial nerves and their functions (2).

FIRST MID-COURSE TEST (20%) [Written]

Mid-Feb to mid-Mar. Laboratory work (12 hours), with human and rat material and/or pictures.

Sectional anatomy of the spinal cord.

Sectional anatomy of the medulla and pons.

Sectional anatomy of the midbrain.

Anatomy of the cerebellum (Lecture and lab).

Sectional anatomy of the diencephalon.

Descriptive anatomy of the human cerebral cortex; equivalent areas in the rat.

Internal structure of the telencephalon.

Mid-Mar. SECOND MID-COURSE TEST (30%) [video-practical]

Mid-Mar to late Apr.

Somatic sensory pathways.

Chemical senses. (Olfactory system and taste; receptors and pathways.)

Descending pathways controlling skeletal musculature: Vestibulospinal, tectospinal, reticulospinal, rubrospinal and corticospinal projections.

Vestibular and auditory pathways

Eye movements. Visual system.

Anatomy, connections and functions of the cerebellum and basal ganglia.

The hypothalamus and neuroendocrinology.

Cerebral cortex and its functions, including linguistic functions.

Neuroanatomy of consciousness, coma and sleep.

Hippocampal formation and related “limbic” parts of the forebrain.

Neuroanatomy of memory.

Mid Mar to mid-Apr. (Optional) Clinical Neuroanatomy with fourth-year medical students on Thursday mornings.

Late Apr. FINAL EXAM (a) Written (35%)

End of Apr. FINAL EXAM (b) Oral (15%)

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Web site: <http://webct.uwo.ca> This includes course notes, downloadable documents and slide shows, and 12 sets of self-test questions.

Recommended reading.

The course notes on WebCT-OWL do not replace a **neuroanatomy textbook**. One of the following is recommended.

Blumenthal H (2002) Neuroanatomy through Clinical Cases. Sunderland, MA: Sinauer.
ISBN 9780978930609

Brodal P (2010) The Central Nervous System. Structure and Function. 4th ed. New York: Oxford University Press. ISBN 9780195381153

Kiernan JA (2009) Barr's The Human Nervous System. 9th ed. Philadelphia: Lippincott, Williams & Wilkins. ISBN 9780718782562

Martin JH (2003) Neuroanatomy: Text and Atlas. 3rd ed. New York: McGraw-Hill.
ISBN 9780071381833 (Note: A fourth edition of Martin's book is due in October 2011: ISBN 9780071603966)

For the lab classes:

A guide for use in the lab classes (by Michael Wu, 2009) is available in the Department of Anatomy & Cell Biology as a CD-ROM. For students wanting more, the following are recommended.

Bruni JE & Montemurro DG (2009) Human Neuroanatomy. A Text, Brain Atlas and Laboratory Dissection Guide. 3rd ed. ISBN 9780195371420. This is the best book available for thorough exploration of the topography of the human CNS by dissection and comparison with CT and NMR images.

Heimer, L (2008) The Human Brain and Spinal Cord. 3rd ed. New York: Springer-Verlag. ISBN 9780387942278. This provides up-to-date information about connectivity alongside traditional instructions for dissecting the human brain.

For students wanting to know more about the neuroanatomy of **invertebrates and submammalian vertebrates** the following, though old, are very readable. All are in UWO's Sciences Library

Bullock TH & Horridge GA (1965) Structure and Function in the Nervous Systems of Invertebrates. San Francisco: Freeman.

Bullock TH, Orkand R & Grinnell A (1977) Introduction to Nervous Systems. San Francisco: Freeman. ISBN 071670577X

Sarnat HB & Netsky MG (1981) Evolution of the Nervous System. 2nd ed. New York: Oxford University Press. ISBN 0195027752 or 0195027760 (paperback)

Elementary information can also be found in undergraduate-level textbooks of zoology; it is often easier to find information in older than in more recent editions. Two more recent and more advanced books on **comparative anatomy of vertebrate central nervous systems** are:

Butler AB, Hodos W. (2005) Comparative Vertebrate Neuroanatomy. 2nd ed. Hoboken, NJ: Wiley-Liss. ISBN 0471210056

Striedter GF. (2005) Principles of Brain Evolution. Sunderland, MA: Sinauer. ISBN 0878938206

Paxinos G. (2004) The Rat Nervous system. 3rd ed. San Diego, CA: Elsevier. ISBN 0125476388

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