

Topics in Neurotrauma – from Basic Research to Bedside to Community
RHSC 506
January – April 2021

COURSE LEADER: Dr. Wolfram Tetzlaff

INSTRUCTIONAL TEAM: Drs. Wellington, Ramer, Kramer, Kwon, Panenka, Sekhon, Mortenson,
Lam, Krassioukov, West, Kavanagh, Elliott,
Borisoff, Berger

OFFICE HOURS: By appointment. Direct questions/concerns about a specific module
to the instructor(s) of that module (see Topical Outline)

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INTRO

Trauma to the Brain and Spinal Cord (collectively called Central Nervous System) affects thousands of Canadians every year and often results in various degrees of disabilities. The personal loss of quality of life and opportunities, and the costs to the individuals as well as society are immense.

This course aims to provide an overview of the concepts and current research topics in these areas spanning from basic animal research, the translational challenges from bench to bedside, clinical research and rehabilitation research, and clinical problems facing people living with spinal cord injury (SCI) and traumatic brain injury (TBI) as well as the challenges when they return to community.

UBC has an outstanding group of internationally recognized investigators working in these areas and therefore this course will be taught by specialists presenting the concepts of their areas accompanied with ongoing discussions.

PREREQUISITES: We will accept graduate students and senior undergraduates from all medical disciplines, Biology and Sciences, Engineering and Kinesiology. Admission of undergraduate students and students from other areas (e.g. Computer Sciences, Pharmaceutical Sciences and Education and Population Health) will require special permission after discussion with Dr. Tetzlaff.

FORMAT: Lectures, student presentations, laboratory demonstrations (dependent on class size)

The instructors will make an effort that the course will be understandable to students with year a first year biology education – but a high level knowledge is recommended.

EVALUATION: Marks are given on the basis of class participation 10%, in class quizzes 20%, in-class research paper presentation (20%) and a term paper in the form of a grant application

(50%) – depending on class size and on COVID-related course format restrictions. If this class is given entirely online this exam scheme might be modified.

For the research grant proposal a topic in an area that may be close to the student's background (without overlapping) would be acceptable, as long as it is of relevance for neurotrauma. Students are encouraged to show how their background could make a contribution this field. Some time will be dedicated to how to write a research grant.

CONTENT:

The student will gain an understanding of the Pathobiology of Neurotrauma (TBI and SCI), the challenges (failures) of therapeutic approaches for neuroprotection, regeneration and rehabilitation. The student will learn

I. SCI -

- the basics of spinal cord anatomy with motor, sensory and autonomic pathways /neurons.
- an overview over the different severities of SCI in humans and the challenges in the clinical treatment of SCI including the current (limited) therapy options and future research needs.
- the way SCI is modelled in the animal laboratories, small and larger animals (pigs).
- the basic cellular pathology of spinal cord injury (SCI) including the concepts of primary and secondary and the molecular (and drug based) strategies for neuroprotection
- the reasons why nerve fibers do not regenerate in the central nervous system (CNS) but do so in peripheral nerves – neural regeneration research.

II. TBI

- the preclinical search for neural repair including stem cell-based approaches for SCI
- the clinical concepts and challenges of TBI – from mild concussions to severe injuries
- the animal models used in TBI research and the conceptual frameworks of brain tissue damages in mild, moderate and severe injuries

III. Chronic SCI

The Students will get an understanding of the multiple organs affected by and complications in the **chronic phase of spinal cord injury** and how research is currently addressing them both in the animal laboratories and clinically; Included are

- sensory dysfunction after SCI as the basis for neuropathic pain
- cardiovascular dysfunction after SCI and the cause of autonomic dysreflexia
- sexual dysfunction after SCI – male infertility and motherhood
- bladder dysfunction after SCI – neuro-urology
- rehabilitation training and neural stimulation (epidural stim and transcutaneous stim)
- surgical nerve transplantation to regain hand function
- the challenges and barriers to community integration ; accessibility and assistive devices