

OBJECTIVES, INFORMATION AND GUIDELINES

FOR THE

UNIVERSITY OF BRITISH COLUMBIA NEUROSURGICAL TRAINING PROGRAM

Revised June 2010

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**OBJECTIVES, INFORMATION AND GUIDELINES FOR THE
UNIVERSITY OF BRITISH COLUMBIA NEUROSURGICAL TRAINING PROGRAM**

A. Teaching faculty

Division Head:	Dr. Gary J. Redekop MD, MSc, FRCSC
Program Director:	Dr. Ryojo Akagami MD, BSc, MHSc, FRCSC
Administrative Assistant:	Ms, Sachiyo Kaneko 604-875-4142 Sachiyo.Kaneko@vch.ca
Primary Training Sites:	Vancouver General Hospital British Columbia Children's Hospital

Full Time Faculty:

Dr. Ryojo Akagami
Dr. Michael Boyd
Dr. Douglas Cochrane
Dr. Charles Dong
Dr. William Jia
Dr. Charles Haw
Dr. Christopher Honey
Dr. Scott Paquette
Dr. Gary Redekop
Dr. Ashutosh Singhal
Dr. Paul Steinbok
Dr. Brian Toyota
Dr. Thomas Zwimpfer

Associate Faculty:

Dr. G. Stuart Cameron	Victoria General Hospital
Dr. Sahid Gul	Lion's Gate Hospital (local director of resident education)
Dr. Stephen Hentschel	Victoria General Hospital (local director of resident education)
Dr. Andrew Lee	Royal Columbian Hospital
Dr. Julio Padilla	Lion's Gate Hospital
Dr. Richard Reid	Victoria General Hospital
Dr. Ramesh Sahjpaul	Lion's Gate Hospital
Dr. John Sun	Victoria General Hospital

In addition to Clinical Neurosurgery, residents rotate on/interact with other related neuroscience services including:

- (1) Neuropathology. The attending neuropathologists are:

At the Vancouver General Hospital

Dr. K. Dorovini-Zis
 Dr. John Maguire
 Dr. Ian McKenzieHead
 Dr. G. R. W. Moore.....Program director

At BC's Children's Hospital:

Dr. Glenda Hendson

- (2) Neurology, under the Division of Neurology, Department of Medicine

At the Vancouver General Hospital;

Dr. H. Feldman, Head	
Dr. Jeff Beckman, Program Director	
Dr. K. Chapman-Howard	Dr. G. Robinson
Dr. M. Javidan	Dr. P. Teal
Dr. M. Jones	Dr. B. Thiessen
Dr. M. Mezei	Dr. A. Woolfenden
Dr. C. Murphy	Dr. Barton
Dr. G. Gibson	Dr. C. Krieger
Dr. H. Briemberg	Dr. G Gibson
Dr. V. Devonshire	Dr. A. Curt
Dr. S Spacey	Dr. D Foti
Dr. T Hurwitz	Dr. D Li
Dr. J Oger	Dr. L Raymond
Dr. A J Stoessl	Dr. T Townsend
Dr. A Traboulsee	Dr. S Yip

At St. Paul's Hospital:

Dr. R. Keyes, Head	
Dr. S. Clarke	Dr. A. Prout
Dr. J. Hooge	Dr. C. Tai
Dr. D. Johnston	Dr. M. Wong
Dr. K. Chapman	Dr. G. R. Hsiung
Dr. A. Anzarut	

- (3) Neuroradiology

Dr. Douglas Graeb Head
 Dr. Manraj Heran
 Dr. Talia Vertinsky
 Dr. Jason Chew
 Dr. Jason Shewchuk

- (4) Neuro-ophtalmology

Dr. Anderson
 Dr. J Lindley
 Dr. J Barton
 Dr. K Wade

(5) Neuroethics

Dr. J. Illes

B. OVERVIEW

The UBC Neurosurgery Residency Training Program is fully accredited by The Royal College of Physicians and Surgeons of Canada. The training program is designed to use the above facilities and staff personnel to assist the residents in their learning of clinical Neurosurgery. Resident rotations are based upon the Objectives of Training and Specialty Training Requirements in Neurosurgery that can be found on the Royal college website.

C. OBJECTIVES OF THE NEUROSURGICAL TRAINING PROGRAM

- I). The objective of the training program and its institutions is to provide the resources, facilities, and opportunity for the trainee to become a fully trained neurosurgeon who:
 - a) is clinically competent, thus able to demonstrate:
 - i) a comprehensive and thorough knowledge of neuroscience, neuroanatomy, neurophysiology and neurosurgical disorders.
 - ii) expertise in neurological and systemic history-taking and physical examination.
 - iii) expertise in the diagnosis, investigation and management of neurosurgical disorders
 - iv) a broad knowledge base of related disciplines, including neurology, neuropathology, neuroradiology, neuro-oncology and neuropsychology.
 - v) technical excellence in all common aspects of operative neurosurgery.
 - vi) a comprehensive knowledge of operative preparation, operative strategy, complication avoidance and management, post-operative care and follow-up.
 - b) will pass the Royal College of Physicians and Surgeons of Canada **Principles of Surgery Examination**
 - c) will pass the Royal College of Physicians and Surgeons of Canada **Specialty Examinations in Neurosurgery.**
 - d) develops skills as an efficient communicator, collaborator, medical manager, health advocate, scholar and professional.

II) The development of competence in clinical neurosurgery requires the trainee:

- a) To master the principles of surgery.
- b) To become expert in the basic sciences of the nervous system and the diseases of the nervous system - to include all of;
 - i) neuroanatomy
 - ii) neurophysiology
 - iii) pathology and pathophysiologic mechanisms of neurologic disease.
- c) To be expert in clinical neurosurgery:
 - i) obtaining a detailed and accurate neurologic history and to carry out a thorough and accurate neurologic examination.
 - ii) localizing the neuroanatomic site of disorder and formulate a differential diagnosis based on a critical evaluation of the symptoms and signs.
 - iii) devising a methodical and efficient method of investigation
 - iv) constructing and enacting a management scheme - cognizant of the natural history of the disorder, all treatment options and their risk/benefit considerations
 - v) to develop the necessary technical skills to perform neurosurgical procedures. Including:
 - all the critical steps and nuances of: preparing a patient for a neurosurgical operation, avoiding operative and post-operative complications and managing them if they do occur, and managing the post-operative patient in the short and long term.
 - vi) to understand the fundamentals of neuro-anesthesia, neurology, neuro-radiology, neuro-ophthalmology, neuro-pathology, neuro-endocrinology.

- III) Following completion of training, the resident should have the knowledge and skills to comprehensively manage the following problems:
- a) craniocerebral and spinal trauma, and to provide basic primary care for multiple injuries.
 - b) cerebrovascular disease
 - c) cerebral and spinal cord neoplasms.
 - d) degenerative disc
 - e) pediatric neurosurgical disease.
 - f) peripheral nerve, brachial plexus and lumbosacral plexus disorders.
 - g) epilepsy.
 - h) pain syndromes and movement disorders.
- IV) Following completion of training, the resident should be competent at all aspects of a specialist physician as pertaining to neurosurgery (CanMEDS roles):

Communicator

Definition: To provide humane, high-quality care, Neurosurgeons establish effective relationships with patients, other physicians, and other health professionals. Communication skills are essential for the functioning of a neurosurgeon, and are necessary for obtaining information from, and conveying information to patients and their families. Furthermore, these abilities are critical in eliciting patients' beliefs, concerns, and expectations about their illnesses, and for assessing key factors impacting on patients' health.

Competencies: The specialist is able to:

1. *Establish a therapeutic relationship with patients.* This includes the ability to establish and maintain rapport and fostering an environment characterized by understanding, trust, empathy, and confidentiality.
2. *Elicit and synthesize relevant information from the patient, their family, and/or community about his/her problems.* This implies the ability to explore patient's beliefs, concerns, and expectations about the origin, nature, and management of his/her illness. Specialists need to be able to assess the impact of such factors as age, gender, ethno cultural background, social support, and emotional influences on a patient's illness.
3. *Discuss appropriate information with the patient, his/her family, and other health care providers that facilitates optimal health care of the patient.* This implies an ability to inform and counsel a patient in a sensitive and respectful manner while fostering understanding, discussion, and the patient's active participation in decisions about their care. This includes the ability to listen to the patient and to communicate effectively with other health providers, to ensure optimal and consistent care of the patient and his/her family. This also implies the ability to maintain clear, accurate, and appropriate records.

Specific Objectives: Upon completion of the specialty program the resident will be able to:

1. Recognize that being a good communicator is an essential function of a physician, and understand that effective patient-physician communication can foster patient satisfaction and compliance as well as influence the manifestations and outcome of a patient's illness.
2. Establish relationships with the patient that are characterized by understanding, trust, respect, empathy and confidentiality.
3. Gather information not only about the disease but also about the patient's beliefs, concerns and expectations about the illness, while considering the influence of factors such as the patient's age, gender, ethnic, cultural and socioeconomic background, and spiritual values on that illness.

4. Deliver information to the patient and family in a humane manner and in such a way that it is understandable, encourages discussion and promotes patient's participation in decision-making to the degree that they wish.
5. Understand and demonstrate the importance of cooperation and communication among health professionals involved in the care of individual patients such that the roles of these professionals are delineated and consistent messages are delivered to patients and their families.
6. Demonstrate skills in working with others who present significant communication challenges such as anger or confusion, or an ethno-cultural background different from the physician's own.
7. Effectively provide information to the general public and media about areas of local concern.

Taught:

1. Apprenticeship with the neurosurgical staff
2. Communication seminars conducted during the 512/513 course. Techniques and pitfalls of communication are discussed in seminars led by a Neuroscience social worker and the attending staff.
3. TIPS course- a seminar aimed at improving the communication abilities, through teaching and presentation, of physicians. Organized by the University of British Columbia Post-Graduate Faculty. Formal and informal instruction by the clinical staff regarding presentations at formal rounds and communications with patients, family and allied medical staff.
5. Participation in neuroscience nursing teaching sessions
6. Attendance and participation at daily multidisciplinary hand-over rounds.
7. Dictation of operative and consultations in a timely manner.

Evaluated:

1. Daily observation of patient and family interactions
2. Daily observation of allied medical staff interactions.
3. Daily observation of written and dictated reports.
4. Regular observation of clinical and didactic presentations at academic rounds and teaching sessions.
5. Review of dictations
5. Formal component of each written evaluation on neurosurgical rotations.
6. Formal component of each written evaluation on off-service rotations.

Feedback:

1. Informal conversations with surgical staff, allied medical staff, patients and family.
2. Formal written evaluation, after each rotation, by the neurosurgical staff.
3. Formal written evaluation after each rotation, by the staff of the off-service.
4. Formal written evaluation by allied medical services/staff.
5. Formal discussion with Program Director twice yearly.

Collaborator

Definition: Neurosurgeons work in partnership with others who are appropriately involved in the care of individuals or specific groups of patients. It is therefore essential for Neurosurgeons to be able to collaborate effectively with patients and a multidisciplinary team of expert health professionals for provision of optimal patient care, education, and research.

Competencies: The specialist is able to:

1. Effectively consult with other physicians and health care professionals. This implies the ability to develop investigations, treatment, and continuing care plans in partnership with the patient and other care providers. This collaborative approach includes the ability to: recognize the limits of personal expertise, understand the roles and expertise of the other individuals involved, inform and involve the patient and his/her family in decision-making, and explicitly integrate the opinions of the patient and care-givers into management plans.
2. Contribute effectively to other interdisciplinary team activities. This includes activities in hospitals, practice settings, and other institutions, such as committee work, research, teaching, and learning. It implies the ability to: recognize team members' areas of expertise, respect the opinions and roles of individual team members, contribute to healthy team development and conflict resolution, and contribute his/her own expertise to the team's task.

Specific Objectives: Upon completion of the specialty program, the resident will be able to...

1. Identify and describe the role, expertise and limitations of all members of an interdisciplinary team required to optimally achieve a goal related to patient care, a research problem, an educational task, or an administrative responsibility.
2. Develop a care plan for a patient they have assessed, including investigation, treatment, appropriate referrals and continuing care, in collaboration with the members of the interdisciplinary team.
3. Participate in an interdisciplinary team meeting, demonstrating the ability to accept, consider and respect the opinions of other team members, while contributing specialty-specific expertise him/herself.
4. Describe how health care governance influences patient care, research and educational activities at a local, provincial, regional, and national level.
5. Effectively communicate with the members of an interdisciplinary team in the resolution of conflicts, provision of feedback, and where appropriate, be able to assume a leadership role.

Taught:

1. Apprenticeship with neurosurgical staff
2. Attendance and participation of inter-disciplinary rounds
3. Instruction by surgical staff regarding the timing and indications for consultation from other services
4. Performance and discussion of consultations made by other services to neurosurgery.
5. Active participation in the longitudinal care of all neurosurgical patients, which requires input and support from several services.

Evaluated:

1. Daily observation of interaction with allied medical staff
2. Observation and consideration of consults made to other services
3. Observation of the performance of consultations done on behalf of the Division of Neurosurgery
4. Consideration of the longitudinal care received by patients.

Feedback:

1. Informal feedback by the surgical staff throughout the year.
2. Formal written evaluations, after each rotation, by the neurosurgical staff.
3. Formal written evaluations from allied medical services/staff.
4. Formal discussions with Program Director, twice annually.

Manager

Definition: Neurosurgeons function as managers when they make everyday practice decisions involving resources, co-workers, tasks, policies, and their personal lives. They do this in the settings of individual patient care, practice organizations, and in the broader context of the health care system. Thus, neurosurgeons require the abilities to prioritize and effectively execute tasks through teamwork with colleagues, and make systematic decisions when allocating finite health care resources. As managers, neurosurgeons take on positions of leadership within the context of professional organizations and the dynamic Canadian health care system.

Competencies: The neurosurgeon is able to...

1. *Utilize time and resources effectively in order to balance patient care, earning needs, outside activities, and personal life.* This implies the ability to employ effective time management and self-assessment skills to formulate realistic expectations and a balanced lifestyle.
2. *Allocate finite health care and health education resources effectively.* While acting in the best interest of the patient, this implies the ability to make sound judgments on resource allocation based on evidence of the benefit to individual patients and the population served.
3. *Work effectively and efficiently in a health care organization.* This involves the ability to understand: the roles and responsibilities of specialists in Canada, the organization and function of the Canadian Health Care system, and the forces of change. This includes the ability to: work effectively within teams of colleagues, manage a practice and function within broader organizational management systems (e.g. hospital committees).
4. *Effectively utilize information technology to optimize patient care, continued self-learning, and other activities.* This implies the ability to: use patient-related databases, access computer-based information, and understand the fundamentals of medical informatics.

Specific Objectives: Upon completion of the neurosurgical program, the resident will be able to...

1. Understand how to function effectively in health care organizations, ranging from an individual clinical practice to organizations at the local, regional and national level.
2. Understand the structure, financing, and operation of the Canadian health system and its facilities, function effectively within it and be capable of playing an active role in its change.
3. Have ability to access and apply a broad base of information to the care of patients in ambulatory care, hospitals and other health care settings.
4. Make clinical decisions and judgments based on sound evidence for the benefit of individual patients and the population served. This allows for an advocacy role primarily for the individual but in the context of societal needs when monitoring and allocating needed resources.
5. be open to working effectively as a member of a team or a partnership and to accomplish tasks whether one is a team leader or a team member.
6. Understand population-based approaches to health care services and their implication for medical practice.
7. Participate in planning, budgeting, evaluation and outcome of a patient care program.

Taught:

1. Apprenticeship with neurosurgical staff.
2. Supervision of clinical responsibilities of the ward; intensive care wards, operating room, and individual patients.
3. Discussion of resource allocation during formal teaching sessions and patient circulation.
4. In-services regarding the hospital's computerized information system.
5. Didactic teaching sessions on office management practice.
6. Discussion of national and international neurosurgical issues by the neurosurgical staff, many of whom are members on national and international neurosurgical committees.

Evaluated:

1. Daily observation of patient management.
2. Daily observation of management decisions involving resource utilization and interaction with affiliated services.
3. Observation during ward care and various rounds.
5. Observation of self-learning activities.
6. Formal component of each written evaluation on neurosurgical rotations.
7. Formal component of each written evaluation on off-service rotations.

Feedback:

1. Informal conversations with surgical staff, allied medical staff, patients and family.
2. Formal written evaluation, after each rotation, by the neurosurgical staff.
3. Formal written evaluation after each rotation, by the staff of the off-service.
4. Formal written evaluation by allied medical services/staff.
5. Formal discussion with Program Director twice yearly.

Health Advocate

Definition: Neurosurgeons recognize the importance of advocacy activities in responding to the challenges represented by those social, environmental, and biological factors that determine the health of patients and society. They recognize advocacy as an essential and fundamental component of health promotion that occurs at the level of the individual patient, the practice population, and the broader community. Health advocacy is appropriately expressed both by the individual and collective responses of specialist physicians in influencing public health and policy.

Competencies: The neurosurgeon is able to...

1. *Identify the determinants of health that affect a patient, so as to be able to effectively contribute to improving individual and societal health in Canada.* This includes the ability to recognize, assess, and respond to the psychosocial, economic, and biologic factors influencing the health of those served. The specialist incorporates information on the health determinants into his/her practice behaviours — both with individual patients and their community. At the doctor-patient level, this involves adapting patient management and education so as to promote health, enhance understanding, foster coping abilities, and enhance active participation in informed decision-making.
2. *Recognize and respond to those issues, settings, circumstances, or situations in which advocacy on behalf of patients, professions, or society is appropriate.* This involves the ability to: identify populations at risk, identify current policies that affect health, and recognize the fundamental role of epidemiological research in informing practice. At a broader level, this includes the ability to describe how public policy is developed and employ methods of influencing the development of health and social policy.

Specific Objectives: Upon completion of the neurosurgical program, the resident will be able to...

1. Demonstrate an understanding of the following:
 - a. Determinants of health by identifying the most important determinants of health (i.e., poverty, unemployment, early childhood education, social support systems), being familiar with the underlying research evidence, and applying this understanding to common problems and conditions in the resident's specialty.
 - b. Public policy for health by describing how public policy is developed; identifying current policies that affect health, either positively or negatively (i.e., communicable diseases, tobacco, substance abuse); and citing examples of how policy was changed as a result of actions by physicians.
2. Demonstrate an understanding of these concepts as applied to the following three levels:
 - a. In the management of *individual patients* by identifying the patient's status with respect to one or more of the determinants of health (i.e., unemployment); adapting the assessment and management accordingly (i.e., the medical history to the patient's social circumstances); and assessing the patient's ability to access various services in the health and social system.
 - b. In the analysis of a neurosurgeon's *practice population* work with specialty society and other associations in identifying current "at risk" groups within a given specialty practice and applying the available knowledge about prevention to "at risk" groups within the practice; and contributing "group data" for better understanding of health problems within the population.
 - c. In relation to the *general population* by describing, in broad terms, the key issues currently under debate regarding changes in the Canadian health care system, indicating how these changes might affect societal health outcomes and advocating to decrease the burden of illness (at a community or societal level) of a condition or problem relevant to his/her specialty through a relevant specialty society, community-based advocacy group, other public education bodies, or private organizations.

Taught:

1. Apprenticeship with the consultant staff
2. Formal and informal discussion with staff surgeons and allied health professionals regarding key determinants of health as applied to the individual patient, the neurosurgical practice population and general population.
3. Participation in the ambulatory care of the neurosurgical patient with attention made to pre-morbid risk factors, lifestyle modification, social coping skills, etc.
4. Participation in daily management and providing anticipated care of patient medical needs
5. Participation in the disposition and discharge of the neurosurgical patient with attention to continuing rehabilitation, convalescence, monitoring and follow-up care.
6. Observation of staff involvement in regional and national neurosurgical advocacy programs.

Evaluated:

1. Daily observation of patient and family interactions
2. Daily observation of patient care
3. Regular observation of clinical and didactic presentations at academic rounds and teaching sessions.
4. Formal component of each written evaluation on neurosurgical rotations.
5. Formal component of each written evaluation on off-service rotations.

Feedback:

1. Informal conversations with surgical staff, allied medical staff, patients and family.
2. Formal written evaluation, after each rotation, by the neurosurgical staff.
3. Formal discussion with Program Director twice yearly.

Scholar

Definition: Neurosurgeons engage in a lifelong pursuit of mastery of their domain of professional expertise. They recognize the need to be continually learning and model this for others. Through their scholarly activities, they contribute to the appraisal, collection, and understanding of health care knowledge, and facilitate the education of their students, patients, and others.

Competencies: The Neurosurgeon is able to...

1. *Develop, implement, and document a personal continuing education strategy.* This implies the acceptance of responsibility for determining personal learning needs. It includes: the ability to assess personal learning needs, select an appropriate learning method, and evaluate the outcome of learning for optimal practice.
2. *Apply the principles of critical appraisal to sources of medical information.* This involves incorporating a spirit of scientific enquiry and use of evidence into clinical decision making. As in the role of medical expert/clinical decision-maker, it includes the ability to: select an appropriate question, efficiently search for and assess the quality of evidence in literature and to keep up to date with the evidence-based standard of care for the conditions most commonly seen in his/her practice.
3. *Facilitate the learning of patients, students, residents, and other health professionals.* This includes the ability to: help others define learning needs and directions for development, provide constructive feedback, and apply the principles of adult learning in interactions with patients, students, residents, colleagues, and others.
4. *Contribute to the development of new knowledge.* While not all specialists will engage in active research, they should have the skills to participate in collaborative research projects, quality assurance, or guidelines development relevant to the practice of the specialist.

Specific Objectives: Upon completion of the neurosurgical program, the resident will be able in each of the following areas to...

1. Clinical:
 - a. pose a clinical question; recognize and identify gaps in knowledge and expertise around the clinical question;
 - b. formulate a plan to fill the gap:
 - i. conduct an appropriate literature search based on the clinical question;
 - ii. assimilate and appraise the literature;
 - iii. develop a system to store and retrieve relevant literature;
 - iv. consult others (physicians and other health professionals) in a collegial manner;
 - c. propose a solution to the clinical question;
 - d. implement the solution in practice. Evaluate the outcome and reassess the solution (re-enter the loop at c i) or c ii);
 - e. identify practice areas for research.
2. Research:
 - a. pose a research question (clinical, basic or population health);
 - b. develop a proposal to solve the research question:
 - i. conduct an appropriate literature search based on the research question;
 - ii. identify, consult and collaborate with appropriate content experts to conduct the research;
 - iii. propose a methodological approach to solve the question;
 - c. carry out the research outlined in the proposal;
 - d. defend and disseminate the results of the research;
 - e. identify areas for further research that flow from the results.
3. Education:
 - a. demonstrate an understanding of the principles of adult learning, with respect to oneself and others;
 - b. demonstrate an understanding of preferred learning methods in dealing with students, residents, and colleagues.

Taught:

1. Apprenticeship with the neurosurgical staff
2. UBC Clinical Epidemiology and Bio-statistics course (6 weeks) for all junior residents.
3. Journal Club - monthly
4. Participation in ambulatory care and discharge planning and the concomitant education provided to the patients.
5. Participation in weekly educational Neuroscience Grand Rounds, educational rounds and seminars of affiliated services.
6. Graduated responsibility which includes training/teaching aspects of junior residents.
7. Assigned role in the neurosurgical education of the UBC medical under-graduates.
8. Participation in the orientation and training of neuroscience ward and intensive care nurses.
9. Continuous supervised participation in clinical and basic science research projects within the Division of Neurosurgery, UBC.
10. Presentation of research at local, national and inter-national neurosurgical meetings.

Evaluated:

1. Daily observation of patient and family interactions
2. Daily observation of allied medical staff interactions.
3. Observation of teaching skills- to allied medical professionals, fellow residents, medical students and nurses.
4. Regular observation of clinical and didactic presentations at academic rounds and teaching sessions.
5. Journal Club
6. Review of published and/or presented research work.
7. Monitoring of studying strategies
8. Formal component of each written evaluation on neurosurgical rotations.
9. Formal component of each written evaluation on off-service rotations.

Professional

Definition: Neurosurgeons have a unique societal role as professionals with a distinct body of knowledge, skills, and attitudes dedicated to improving the health and well-being of others. Neurosurgeons are committed to the highest standards of excellence in clinical care and ethical conduct, and to continually perfecting mastery of their discipline.

Competencies: The specialist is able to...

1. *Deliver the highest quality care with integrity, honesty, and compassion.* This implies: an awareness of racial, cultural, and societal issues that impact on the delivery of care and an ability to maintain and enhance appropriate knowledge, skills and professional behaviours.
2. *Exhibit appropriate personal and interpersonal professional behaviours.* This implies: being accountable for personal actions, having a high degree of self-awareness, maintaining an appropriate balance between personal and professional roles, and addressing interpersonal differences in professional relations.
3. *Practice medicine in an ethically responsible manner that respects the medical, legal and professional obligations of belonging to a self-regulating body.* This implies: an understanding of and adherence to legal and ethical codes of practice, the recognition of ethical dilemmas and the need for help to resolve them when necessary and the ability to recognize and respond to unprofessional behaviours in clinical practice, taking into account local and provincial regulations.

Objectives:

1. Discipline-Based Objectives:
 - a. display attitudes commonly accepted as essential to professionalism;
 - b. use appropriate strategies to maintain and advance professional competence;
 - c. continually evaluate one's abilities, knowledge and skills and know one's limitations of professional competence.
2. Personal/Professional Boundary Objectives:
 - a. adopt specific strategies to heighten personal and professional awareness and explore and resolve interpersonal difficulties in professional relationships;
 - b. consciously strives to balance personal and professional roles and responsibilities and to demonstrate ways of attempting to resolve conflicts and role strain.
3. Objectives Related to Ethics and Professional Bodies:
 - a. know and understand the professional, legal and ethical codes to which physicians are bound;
 - b. recognize, analyze and attempt to resolve in clinical practice ethical issues such as truth-telling, consent, advanced directives, confidentiality, end-of-life care, conflict of interest, resource allocation, research ethics, etc.;
 - c. understand and be able to apply relevant legislation that relates to the health care system in order to guide one's clinical practice;
 - d. recognize, analyze and know how to deal with unprofessional behaviours in clinical practice, taking into account local and provincial regulations.

Taught:

1. Apprenticeship with the neurosurgical staff

Evaluated:

1. Daily observation of patient and family interactions
2. Daily observation of allied medical staff interactions.
3. Daily observation of written and dictated reports.
4. Regular observation of clinical and didactic presentations at academic rounds and teaching sessions.
5. Formal component of each written evaluation on neurosurgical rotations.
6. Formal component of each written evaluation on off-service rotations.

Feedback:

1. Informal conversations with surgical staff, allied medical staff, patients and family.
2. Formal written evaluation, after each rotation, by the neurosurgical staff.
3. Formal written evaluation after each rotation, by the staff of the off-service.
4. Formal written evaluation by allied medical services/staff.
5. Formal discussion with Program Director twice yearly.

D. PROGRAM INFORMATION

1) Trainee Positions. Through Department of Surgery training program, neurosurgery has been guaranteed funding for 1 to 2 trainees per year. This allotment includes the core basic principles of surgery training, and all the rotations to the affiliated departments, such as neurology; neuropathology, neuroradiology.

2) Course Description.

(For this document training sessions will be worded as 'months' as in the Royal College Documents but locally training intervals are organized into 4 week 'blocks' which are deemed equivalent by the Royal College, and will provide an extra 'block' of training per year which can be appropriately used during the the resident's training.)

- a) Twenty-four months of approved training in basic principles of surgery; this will include twelve months of Surgical Foundations (to include critical care, trauma surgery and/or emergency medicine) 6 months of adult neurosurgery, 3 months on the Combined Neurosurgical and Orthopaedic Spine Program, and 3 months of Neurology.
- b) 42 months of additional training in neurosurgery with progressively increasing responsibility for patient care, including six (6) months of pediatric neurosurgery and a minimum of 6 additional months on the Spine Program. This includes 12 months as Chief Resident.
- c) Training will include:
 - i) three months of residency in neurology
 - ii) three months of residency in neuropathology
 - iii) and an optional three months of residency in neuroradiology
- d) Further training may also include
 - further approved residency training in neurosurgery (including pediatric neurosurgery, spine or community neurosurgery)
 - clinical or basic research
 - other approved training or research relevant to the field of neurosurgery, desired by the resident and approved by the program.
- e) From PGY-2 year and on, it is expected that the resident complete one research project per year to present at Resident research day as well as national/North American meetings, with an intent to submit the project for publication.

To allow broad experience, several specific rotations will be arranged, such as:

- a) Community Adult Neurosurgery

North Vancouver – Lions' Gate Hospital
Victoria –Victoria General Hospital
- b) Spine Program: (minimum of 9 months, with the option of additional training as per the educational and career objectives of the individual resident.);
- c) Neuroradiology (1-3 months optional);
- d) One or more years of research in an approved neurosurgical or related laboratory.
- e) An elective period of training which shall be approved by the Program Director.
- f) Assistance for arranging advanced post-graduate training may be provided for a position such as a clinical fellow in neurosurgery, or in the Master of Science Program in Surgery.

EXAMPLE

Program Year	Content and Sequence of Rotations												
	Number of Months/Blocks												
	1	2	3	4	5	6	7	8	9	10	11	12	13
First	NS	NS	NS	PS	PS	ER	N	N	N	IM CCU	IM Endo	GS Trauma	GS Trauma
Second	NS	NS	NS	Spine	Spine	Spine	OTL	OTL	OTL	Vasc	Vasc	ICU	ICU
Third	NS	NS	NS	NS	NSC	NSC	NSC	NSC	NSC	NSC	NR	NR	NR
Fourth	NS	NS	NS	NP	NP	NP	Spine	Spine	Spine	Spine	Spine	Spine	Spine
Fifth	E	E	E	E	E	E	PNS	PNS	PNS	PNS	PNS	PNS	PNS
Sixth	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

NS = Neurosurgery

NSC= Community Neurosurgery

PS = Plastic Surgery

ER = Emergency Medicine

N = Neurology

E = Elective / Research

ICU = Intensive care unit

OTL = otolaryngology

IM Endo = Internal Medicine (Endocrinology)

IM CCU = Internal Medicine (Cardiac Care Unit)

GS Trauma = General Surgery / Trauma Service

NR = Neuroradiology

NP = Neuropathology

PNS = Pediatric Neurosurgery

Recommended Content of Training

Description	Duration	Sites in which this training may be taken
Adult General Neurosurgery/Community	30 Months*	Vancouver General Hospital/LGH/Victoria
Spinal Neurosurgery	9 months*	Vancouver General Hospital
Pediatric Neurosurgery	6 months	BC's Children's Hospital
Neurology	3 months	Vancouver General Hospital
Neuropathology	3 months	Vancouver General Hospital
Neuroradiology (optional)	3 months	Vancouver General Hospital
Critical Care Medicine – ICU	2 months	Vancouver General Hospital
Internal Medicine	2 months	Vancouver General Hospital
Otolaryngology	2 months	Vancouver General Hospital
Vascular Surgery	2 months	St. Paul's Hospital
General Surgery – Trauma	2 months	Vancouver General Hospital
Plastic Surgery	2 months	Vancouver General Hospital
Emergency Medicine	1 month	Vancouver General Hospital

- The relative lengths of adult neurosurgery and spine rotations is flexible and can be adjusted based on the educational and career interests of each resident. The Royal College "Objectives of Training and Specialty Training Requirements in Neurosurgery" mandates at least 42 months of Clinical Neurosurgery (including pediatric, spine, and community neurosurgery). The cumulative 45 months of adult general, spinal, and pediatric neurosurgery is recommended.

Elective Content of Training

Description	Duration	Sites in which this training may be taken
Elective Neurosurgery	3-6 months	North Vancouver – Lions' Gate Hospital Victoria –Victoria General Hospital Kelowna/Kamloops or other North American Neurosurgical center approved by the Program Director.
Clinical or Basic Science Research	3 months or longer	Any university approved by the RPC and RCPSC
Other Clinical Rotations · Neuro-ophthalmology · Neuro-oncology · Additional Neuroradiology · Additional Spine · Additional Adult Neurosurgery	1 – 3 months	Vancouver General Hospital

As a resident progresses through the PGY 3 to 6 years, there is a gradual increase in responsibility as determined by the program objectives and the resident's capability. This responsibility is across all areas: Ward, Operating room, Emergency, Teaching and Administrative duties. The sequence of rotations is somewhat flexible and will be tailored to the residents needs, in particular as this relates to timing of electives, research, and community neurosurgery rotations. The Chief Resident is in charge of the day to day management of the neurosurgery patients, under the supervision of the attending staff. He/she also makes up the call schedule for each month, approves holidays for house staff, and designates the cases to be presented at weekly Neurosurgery Correlative Rounds. Assignment of house staff to cases in the operating room are done by the Chief resident at the beginning of each week to allow junior residents to prepare for cases.

Log of Procedures

Residents are expected to keep a log of patients/procedures that they have been involved in. Recording date/diagnosis/procedure/operation and the level of surgical interaction (ie. 1st/2nd assist, primary operator). This can be recorded by a number of means.

E. EDUCATIONAL PROGRAM

(1) The Resident

The major responsibility for the learning aspects of the training program rests with the resident. The objective is to become an independent, competent neurosurgeon. His/her responsibilities are to develop and practice the skills of self-learning which will lead to independence from their teachers.

The accumulation of knowledge in both basic and clinical sciences is the responsibility of the trainee. The resident should plan his study in a disciplined fashion, outlining for himself topics and appropriate material to review, spread comprehensively over the period of his training. This should include a study of basic textbooks, a review of the classical literature, review of articles on major topics, and current journal reviews.

The cognitive skills of analysis and problem-solving, clinical judgment and decision-making are learned through the development of a careful system of analysis. It is suggested that each resident develop of himself a system which takes into consideration:

- the anatomical diagnosis;
- a clinical diagnosis;
- the indications and alternatives for confirmatory investigation, the expected results, and interpretation of same;
- a careful analysis of the differential diagnosis;
- a provisional diagnosis;
- a statement of the natural history of the condition;
- a critical analysis of the treatment alternatives;
- a plan for action.

Technical skills are learned under supervision and practiced repetitively to perfection. The aspects of operating skills include:

- a) Cognitive Aspects: The resident comes to the operating room prepared with an operative plan. He knows his surgical anatomy and on the basis of his reading or previous experience condenses the operation into DEFINABLE STEPS. He anticipates areas of difficulty and has defined the acceptable end results. Problems are recognized and possible solutions analyzed and he becomes proficient at dealing with technical difficulties and mechanical problems.
- b) Psychomotor Aspects: A superior resident is dexterous and uses sharp dissection precisely. He follows each step in sequences and proceeds confidently. He selects and uses the instruments correctly. He develops a good three dimensional perception in and out of the wound and under magnification has learned to use visual feedback. His actions are time and motion efficient.
- c) Affective Aspects: He is confident and secure and maintains his performance in the face of frustration, technical difficulties, and disagreement. He incorporates suggestions into his actions. He involves assistants in the case and is polite and professional with the operating room staff.

Patient-relational skills are learned from day to day interaction. It is suggested that in discussing patients' illnesses with them, that the resident develop a specific pattern which would include:

- a clear statement of the diagnosis.
- a natural history of the disease and prognosis;
- the recommended treatment and influence on natural history;
- the expected results;
- the risks involved in the treatment;
- consideration of the patient as a person in crisis seeking help; the physician must respect his anxiety, questions, dignity, and hopes.

The resident's knowledge-base, cognitive, technical and patient-relational skills are continuously monitored, evaluated, critiqued and upgraded in both formal and informal means throughout the residency. This is accomplished by the structure of the residency program (rounds, didactic sessions, journal club, etc.) and the guidance of the attending staff.

(2) The Staff Neurosurgeon

The responsibilities of the attending neurosurgical staff in the program are to assist the resident to achieve a competent state of independence in the practice of neurosurgery. This can be done by giving guidance in reading and studying, by supervising and demanding excellence in data gathering skills, by supervising the resident's development of a system of analysis and decision making, and in supervising and teaching technical skills. The staff should provide regular positive and constructive feedback of the resident's performance and activities. The staff can assist the resident by coordinating and participating in seminars, by giving guidance in topics of priority, and from time-to-time providing references and pertinent articles for review so as to stimulate resident reading. The residency system of training can best be described as a mentor/apprentice relationship between student and teacher. It has been clearly shown that the relationship and interaction between student and teacher is the most important single element in the training process.

There are several aspects in the development of this relationship.

- a) Repeated and frequent exposure and interaction between staff and residents;
 - b) A relationship which is characterized by trust and respect;
 - c) Expectations and demand for excellence on both parties;
 - d) An attitude and activity of constructive input into each others' performance;
 - e) An understanding that both staff and residents are integral to the program and share the same objectives and aims.
- (3) A. Opportunities exist within the Department of Surgery for a Master of Science degree, granted by the University of British Columbia. The present requirements for this are:
- a) Enrolment as a graduate student for one year.
 - b) Satisfactory completion of 15 units of study which include three units for the correlative neuroscience-neuroanatomy course, one unit for completion of the basic surgery course 502, one unit for the Department of Surgery course in advanced neurosurgery 512/513, one unit for a formal academic and written presentation at course 512 or 513, and nine units for a successfully completed research project and a written thesis presentation.
- B. Under special arrangements, a Ph.D. in Neuroscience can be done.
- (4) The Program Director and participating staff will ensure that the service to education ratio is kept in balance and that there will be time protected for the resident to engage in adequate study, clinical research and publication and personal interest.

APPENDIX I

RESIDENT SELF-ASSESSMENT OF HIS CAPABILITIES

- a) Each resident will keep a record of all operative procedures.
- b) At the completion of each block of training in clinical neurosurgery, the trainee is encouraged to discuss with the Program Director, his surgical experiences and his progress in technical neurosurgery.
- c) Attached is a general guide to the technical expectations of the program.

PROCEDURAL EXPECTATIONS FOR NEUROSURGERY RESIDENCY**3 MONTH EXPECTATIONS**

1. Application of Mayfield Pins
2. Carpal tunnel release
3. Positioning - cranial and spinal
4. Insertion external ventricular drain and Camino monitor
5. Burr holes
6. Set up and balance microscopes

6 MONTH EXPECTATIONS Previous 3 month expectations plus:

1. Craniotomy planning
2. Dural closure
3. Craniotomy closure
4. Spinal wound closure
5. Ulnar nerve decompression, transposition
6. Lumbar spine - exposure to lamina

9 MONTH EXPECTATIONS Previous 6 month expectations plus

1. Craniotomy opening - supratentorial
2. Stereotactic frame application
3. Lumbar disc - exposure to the level of the disc
4. Evacuate acute subdural and epidural hematomas

12 MONTH EXPECTATIONS Previous 9 month expectations plus:

1. Cervical disc exposure to the level of the disc
2. Craniotomy opening
 - suboccipital
 - parasagittal
3. Nerve and muscle biopsies
4. Lumbar discectomy
5. Lumbar laminectomy

15 MONTH EXPECTATIONS Previous 12 month expectations plus:

1. Evacuate intra-cerebral hematoma
2. Subpial resection
3. Resect intra-axial neoplasm - partial
4. Elevate skull fracture
5. Cervical discectomy
6. Insertion of ventriculo-peritoneal shunt

18 MONTH EXPECTATIONS Previous 15 month expectations plus:

1. Resection of intra-axial neoplasm - complete
2. Expose carotid-optic cistern
3. Expose carotid artery
4. Cervical laminectomy
5. Cervical laminoplasty
6. Expose brachial plexus and sciatic nerve
7. Resection of peripheral nerve tumor
8. Primary peripheral nerve anastomosis
9. Percutaneous trigeminal rhizolysis
10. neuroendoscopy

21 MONTH EXPECTATIONS Previous 18 month expectations plus:

1. Split Sylvian fissure
2. Expose/dissect intra-cranial cranial nerves
3. Remove convexity meningioma
4. Decompression of Chiari malformation
5. Trans-sphenoidal tumor removal
6. Cervical plate application (anterior)

24 MONTH EXPECTATIONS Previous 21 month expectations plus:

1. Suture repair of carotid artery
2. Microvascular decompression of V and VII nerves
3. Temporal lobectomy - for trauma or neoplasia
4. Decompress syrinx

27 MONTH EXPECTATIONS Previous 24 month expectations plus:

1. Remove carotid plaque
2. Dissect intra-cranial aneurysm
3. Expose and partially resect skull base tumor
4. Resection of intra-dural, extra-medullary tumor
5. Release tethered cord
7. Lateral mass plate - application

30 MONTH EXPECTATIONS Previous 27 month expectations plus:

1. Corpus Callostomy
2. Resection of intra-dural, intra-medullary tumor
3. Clip intra-cerebral aneurysm
5. Resection of "low-grade" AVM
6. Deep brain stimulation and lesioning

36 MONTH EXPECTATIONS Previous 30 month expectations plus:

1. AV dural-fistula, spinal and cranial, exposure and resection
2. Resection of skull base tumor - complete
3. Posterior circulation aneurysm clipping
4. Temporal lobectomy - for seizure control
7. Insertion of pedicle screws

8. Drill/resect anterior clinoid
9. Resection vestibular schwannoma
10. Awake craniotomy and cortical mapping
11. Treat Pediatric conditions such as craniosynostosis, spinal dysraphic conditions

42 month expectations

1. Proficient in all previous expectations and manage intraoperative complications sometimes encountered during these procedures

**OPERATIONAL OBJECTIVES FOR ROTATION TO THE SPINE PROGRAM
FOR NEUROSURGICAL RESIDENTS**

At the end of the rotation to the Spine Program, the resident will be able to:

1. Describe the anatomy and embryology of the spine - including the vertebral segments, discs, joints and ligaments
2. Describe the anatomy and physiology of the spinal cord- including vasculature, major tracts, zones, segments, and nerve roots.
3. Describe the biomechanics of the spine - in normal and pathologic states.
4. Spinal Cord Injury:
 - i. Outline the major mechanisms of injury and the pathogenesis of spinal cord injury.
 - ii. Classify and describe the types of bony, ligamentous and neurologic injury at each level of the spine and spinal cord.
 - iii. List the general and associated effects of the spinal cord injury to the cardiovascular, respiratory, urological and other systems.
 - iv. Describe all aspects of the surgical and non-surgical management of each level of spinal and spinal cord injuries, including general, urologic and respiratory care; indications for neurological decompression and indications for external and internal spinal stabilization
 - v. Discuss the principles of spinal stabilization - external and internal fixation; including indications, risks and benefits, and approaches
 - vi. The delayed and chronic effects of injury to the spinal cord including pain and delayed neurological deterioration.
 - vii. The psychological and social and family effects of spinal cord injury.
5. Degenerative disc disease:
 - i. Describe the neurological syndromes of degenerative disc disease and indications for surgical management
 - ii. Describe degenerative spinal instability and the indications for internal stabilization.
6. Acute spinal cord compression:
 - i. Describe all aspects of spinal infection, general care, antibiotic management, surgical decompression and indications for stabilization.
 - ii. Describe all aspects of acute metastatic compression and indications for surgical decompression, stabilization and adjuvant therapy.
7. Spinal cord neoplasms:
 - i. Describe and manage all juxtamedullary and intramedullary neoplasms of the spinal cord.
8. Vascular and other affections of the spinal cord.

In addition to the above knowledge objectives, the following technical objectives should be learned.

1. External immobilization - including skull tongs, traction, halo fixation and all external orthoses.
2. All manners of decompression of the spinal cord.
3. All procedures for neurological complication of degenerative disc disease
4. All procedures for neoplasms, vascular and other conditions of the spinal cord.
5. Internal Stabilization including anterior and posterior cervical fixation, placement of thoracic and lumbar pedicle screws, use of various fixative rods and basic fusion techniques.

**OPERATIONAL OBJECTIVES FOR NEUROLOGY ROTATION
FOR NEUROSURGICAL RESIDENTS**

The neurology rotation is a three to six month rotation which may include neuro-ophthalmology. The objectives for this rotation are as follows:

1. Review functional and clinical neurophysiology and neuro-anatomy, and to correlate patient presentations and clinical pictures into functional anatomical concepts.
2. Demonstrate proficiency in neurologic history-taking and physical examination.
3. Discuss headache patterns, differential diagnosis and management.
4. Demonstrate a complete understanding of the pathophysiology, signs, symptoms, pathology, and clinical syndromes of coma.
7. Discuss all aspects of speech and language disorders.
8. Describe all aspects of seizure disorders, including pathophysiology, and the various clinical syndromes, anti-epileptic medications and the principles and interpretation of EEG.
9. Demonstrate knowledge of all aspects of cerebral vascular occlusive disease, including pathogenesis, the clinical syndromes and management.
10. Demonstrate knowledge of all aspects of CNS infection, including viral, fungal, parasitic and bacterial disease.
11. Discuss eye movements and their disorders; the visual pathway and its disorders; and basic abnormalities of the optic discs and retina.
13. Discuss in brief the major demyelinating diseases and cerebral degenerative diseases.

**OPERATIONAL OBJECTIVES FOR ROTATION TO PEDIATRIC NEUROSURGERY
FOR NEUROSURGICAL RESIDENTS**

Residents are allocated, at the senior resident level, to the pediatric service for a period of 6 months. The following are the learning objectives for that rotation:

1. Discuss the embryologic principles and developments which relate specifically to congenital malformations of the nervous system.
2. Demonstrate a knowledge and understanding of the anatomical and physiologic specifics in the neonate, infant and child, which have application to neurosurgery.
3. Discuss the management parameters of the following specific pediatric conditions:
 - congenital and developmental abnormalities of the skull, meninges, brain, spine, spinal cord, and peripheral nerves.
 - neoplasms
 - craniocerebral trauma
 - vascular malformations and anomalies
 - midline developmental abnormalities
 - hydrocephalus and increased intracranial pressure
 - epilepsy
4. demonstrate a knowledge of the principles of cranial reconstructive surgery and the management of craniosynostosis and related conditions.

OPERATIONAL OBJECTIVES FOR ROTATION TO NEUROPATHOLOGY FOR NEUROSURGICAL RESIDENTS

At present, residents are allocated to neuropathology for three to six months. The primary purpose is an opportunity to review basic sciences, and to learn pathology applicable to the practice of neurosurgery.

The basic objectives are as follows:

1. Demonstrate a thorough knowledge of neuroanatomy.
2. Discuss the general pathophysiological processes of the major neurological diseases: including neoplasia, cerebrovascular disease, traumatic nervous injury and infections.
3. Discuss the gross anatomical pathology of neurological disease, and in particular those with surgical implications (neoplasia, vascular disease and trauma)
4. Discuss the microscopic pathology of neurologic conditions specifically related to neurosurgical practice.
5. Demonstrate a knowledge of diagnostic criteria and interpretation of smear cytology.
6. Discuss the major cellular, genetic and molecular biologic processes important for the understanding of neurosurgical diseases. (e.g. apoptosis, chromosomal anomalies in neoplasia, tumor markers, pathophysiology of ischemic disease, etc.)

The following technical skills will be learned.

1. Autopsy removal of brain and spinal cord.
2. Techniques of frozen section and smears.
3. Brain cutting.

**OPERATIONAL OBJECTIVES FOR THE NEURORADIOLOGY COMPONENT OF THE
NEUROSURGICAL TRAINING PROGRAM**

During his years of training and on a specific rotation to neuroradiology, the resident should meet the following objectives.

1. A basic knowledge of the physics and principles of x-rays, ultrasound, MRI, PET, radionuclide imaging and CNS related applications/techniques.
2. Demonstrate a working knowledge and correlation between sagittal, coronal, and horizontal brain anatomy and radiologic imaging, CT scan and MRI.
3. Discuss the evolution of extra-vascular blood as seen on MRI.
4. Thoroughly interpret skull and spine x-rays, CT scans, CT angiograms, formal angiograms, MRI and MR angiograms, myelograms and ultrasound.
5. Discuss the indications, techniques and complications of interventional neuro-radiologic procedures.
6. Discuss the concepts of functional imaging, SPECT scans, intra-cranial Doppler and MEG.

**OPERATIONAL OBJECTIVES FOR THE INTERNAL MEDICINE COMPONENT
OF THE NEUROSURGICAL TRAINING PROGRAM**

Upon completion of the internal medicine rotation, the neurosurgery resident shall be able to:

1. Discuss a working classification of respiratory failure, and list common causes for each classification (e.g. hypoxia, hypercapnea).
2. Interpret arterial blood gases, including calculation of the A-a gradient and identification of acid-base abnormalities (e.g. uncompensated acute metabolic acidosis).
3. Diagnose and treat common fluid balance disorders, including hypovolemia and hypervolemia.
4. Diagnose and treat common electrolyte disturbances, including: hypo/hyponatremia, hypo/hyperkalemia, hypo/hypermagnesemia, hypo/hypercalcemia and hypo/hyperglycemia.
5. Interpret an electrocardiogram, including identification of common dysrhythmias (.e.g. atrial fibrillation, ventricular tachycardia).
6. Identify and initiate treatment for common, acute cardiac events (e.g. myocardial infarction, atrial fibrillation, supraventricular tachycardia, defibrillation for pulseless ventricular tachycardia).
7. Outline the common causes and initial empiric treatment of the patient with: pneumonia, urinary tract infection, endocarditis, meningitis, and other common infections.
8. Classify antibiotics, describe their mechanisms of action and the primary indications for use.
9. Diagnose and manage common endocrinological disorders including diabetes and hypo/hyper-pituitarism.
10. Manage anticoagulation and its reversal.

**OPERATIONAL OBJECTIVES FOR THE GENERAL SURGERY COMPONENT
OF THE NEUROSURGICAL TRAINING PROGRAM**

Upon completion of the general surgery rotation, the neurosurgery resident shall be able to:

1. Demonstrate a working diagnostic approach to a patient with an acute abdomen, including: history, physical examination, ordering and interpretation of laboratory and radiological investigations.
2. List the differential diagnosis for a patient with an acute abdomen.
3. Outline the symptoms and signs of a patient with a small/large bowel obstruction, and initiate management of these patients.
4. Discuss the diagnosis and initial treatment of common fluid balance disorders, including hypovolemia and hypervolemia.
5. Discuss the diagnosis and treatment of common electrolyte balance disturbances, including: hypo/hyponatremia, hypo/hyperkalemia, hypo/hypermagnesemia, hypo/hypercalcemia, and hypo/hyperglycemia.
6. Describe the approach to and primary management of the multiply injured person.
7. Outline the mechanism of normal hemostasis and describe the mechanisms of common abnormalities.
8. Outline the pre-operative management of a patient with a warfarin-induced coagulopathy.
9. Outline the diagnostic criteria and management of DIC.
10. Describe the indications for blood transfusions.
11. Outline the symptoms and signs, and initiate management of minor/major transfusion reactions, including: anaphylaxis, hemolytic transfusion reactions, and non-hemolytic transfusion reactions.
12. Perform the following skills:
 - a) Insert a nasogastric tube
 - b) Insert a Foley catheter
 - c) Sharp and blunt dissection
 - d) Basic suturing techniques
 - e) Open and close a small laparotomy incision

**OPERATIONAL OBJECTIVES FOR THE TRAUMA COMPONENT
OF THE NEUROSURGICAL TRAINING PROGRAM**

Upon completion of the Trauma rotation, the neurosurgery resident shall be able to:

1. Discuss the principles of ATLS, including primary survey, resuscitation, secondary survey and adjuncts/investigations.
2. Identify the clinical setting in which airway obstruction is likely to occur, and recognize the symptoms and signs of airway obstruction when it does occur.
3. Outline the various techniques to maintain an airway in a trauma patient, including endotracheal intubation and cricothyroidotomy, and have a working knowledge of when these techniques should be applied.
4. Define shock and have a working classification of shock.
5. Discuss the symptoms and signs in patients presenting with various etiologies of shock, including: hypovolemic, septic, cardiogenic and neurogenic.
6. Outline the treatment of hemorrhagic shock, and list the clinical indicators of response to therapy.
7. Outline the symptoms and signs, and initiate treatment for the following injuries: airway obstruction, pulmonary contusion, simple/tension/open pneumothorax, flail chest, simple/massive hemothorax, and cardiac tamponade.
8. Recognize the signs suggestive of intraperitoneal, retroperitoneal and pelvic injury, including: guarding, rebound, flank hematoma, perineal hematoma, etc.
9. Discuss the indications for and be able to interpret the results of DPL, ultrasound and trauma CT scans.
10. Outline the principles of initial management of musculoskeletal trauma, including: immobilization, assess neurovascular integrity, etc.
11. Outline the recommendations for tetanus prophylaxis in the trauma patient.
12. Perform the following skills:
 - a) Insert an oropharyngeal/nasopharyngeal airway.
 - b) Perform a cricothyroidotomy, tracheal puncture and tracheostomy.
 - c) Obtain vascular access, including peripheral venous access, central venous access (femoral, subclavian, internal jugular), venous cutdown, and arterial lines.
 - d) Thoracostomy

**OPERATIONAL OBJECTIVES FOR THE VASCULAR SURGERY COMPONENT
OF THE NEUROSURGICAL TRAINING PROGRAM**

Upon completion of the Vascular Surgery rotation, the neurosurgery resident shall be able to:

1. Outline the risk factors for atherosclerosis.
2. Describe the pathogenesis of atherosclerosis.
3. Discuss the patient with cerebrovascular ischemia, including: history, physical examination, investigations and treatment (anterior/posterior circulation)
4. Discuss the results of clinical trials evaluating efficacy of carotid endarterectomy (e.g. NASCET, ACAS) as well as surgical indications for symptomatic and asymptomatic carotid stenosis.
5. Describe the pathophysiology of intermittent claudication, and differentiate it from neurogenic claudication.
6. List the risk factors for developing deep vein thrombosis, and methods to help prevent deep vein thrombosis.
7. Outline the diagnosis and treatment of deep venous thrombosis, including indications for Greenfield filters.
8. Describe the surgical steps involved in performing a carotid endarterectomy.
9. Outline brachiocephalic ischemic syndromes.
10. Describe vascular compartment syndromes, their investigation, natural history and management.

**OPERATIONAL OBJECTIVES FOR THE PLASTIC SURGERY COMPONENT
OF THE NEUROSURGICAL TRAINING PROGRAM**

Upon completion of the plastic surgery rotation, the neurosurgery resident shall be able to:

1. Outline the mechanism of normal wound healing.
2. Outline the factors that impair normal wound healing.
3. Outline the different types of soft tissue wounds and their management, including lacerations, abrasions, contusions, avulsions, clean and contaminated wounds.
4. Discuss the various types of skin infections and their management, including: cellulitis, erysipelas and necrotizing fasciitis.
5. Outline the initial assessment, diagnosis, and classification of facial fractures.
6. Perform the following skills:
 - a) Repair all types of skin/scalp lacerations.
 - b) Recognize the most appropriate closure for a given skin defect, including: primary closure, skin graft, flap, etc.

**OPERATIONAL OBJECTIVES FOR THE ICU COMPONENT
OF THE NEUROSURGICAL TRAINING PROGRAM**

Upon completion of the ICU rotation, the neurosurgery resident shall be able to:

1. Describe the physiology of pulmonary gas exchange, and describe the clinical consequences of dead space ventilation and pulmonary shunting.
2. Discuss working classification of respiratory failure, and list common causes for each classification (e.g. hypoxic-hypercapnic)
3. Interpret arterial blood gases, including calculation of A-a gradient and identification of acid-base abnormalities (e.g. uncompensated acute metabolic acidosis).
4. Outline the pathogenesis of acute respiratory distress syndrome, and list its common causes. Describe the Pathology.
5. List the indications/criteria for intubation/extubation.
6. Discuss the various types of mechanical ventilation and their indications.
7. Describe positive pressure ventilation and its interaction with the management of patients with severe closed head injuries (e.g. impaired cerebral venous drainage, permissive hypercapnea causing vasodilation).
8. Interpret an electrocardiogram, including identification of common dysrhythmias (e.g. atrial fibrillation, ventricular tachycardia).
9. Identify and initiate treatment for common, acute cardiac events (e.g. myocardial infarction, defibrillation for pulseless ventricular tachycardia).
10. Describe a working classification for shock, outline the pathophysiology and hemodynamic abnormality for each type (e.g. hypovolemic, septic shock:), and initiate treatment for each type.
11. Outline the commonly used inotropes, their indications for use, and their pharmacological effects.
12. Outline the commonly used antihypertensive agents, their indications for use, and their pharmacological effects.
13. Discuss the indications, benefits and risks of invasive hemodynamic monitoring.
14. Describe a working approach to acute renal failure, including classification, history, physical examination, investigations (e.g. urinalysis, urinary electrolytes), and initial treatment.
15. Outline the etiology, pathophysiology, and clinical features of systemic inflammatory response syndrome and multiple organ failure.
16. Outline the indications for total parenteral nutrition, and become familiar with the nutritional requirements for patients with severe closed head injury.

17. Manage all aspects and Critical care of increased ICP
- a) Describe the concepts of normal and increased ICP, CPP, CBT and factors which affect change or homeostasis.
 - b) Describe the metabolic monitoring of increased ICP and the parameters and therapies used to manage it.
 - c) Describe excitatory neurotoxicity, pathophysiology and the cellular and molecular changes which occur.
 - d) Describe the therapies and mechanisms and manipulations of CBF, hypertension and ventilation to restore normal brain metabolism.
 - e) Describe the mechanism, pathophysiology and pharmacology of the following adjuvants to manage increased ICP.
 - hypothermia
 - hypertension
 - barbiturates
 - free radical scavengers
18. Perform the following skills:
- a) Insert an oropharyngeal/nasopharyngeal airway
 - b) Perform endotracheal intubation
 - c) Obtain vascular access, including peripheral venous access, central venous access (femoral, subclavian, internal jugular), and venous cutdown
 - d) Insert a jugular bulb
 - e) Obtain an arterial line (radial, femoral)
 - f) Thoracostomy

**OPERATIONAL OBJECTIVES FOR THE OTOLARYNGOLOGY COMPONENT
OF THE NEUROSURGICAL TRAINING PROGRAM**

Upon completion of the Otolaryngology rotation, the neurosurgery resident shall be able to:

1. Discuss hearing loss, dizziness, and tinnitus, including: history, physical examination, and initial investigations.
2. Interpret audiometry tests, specifically the patterns seen with vestibular schwannoma, including: pure-tone thresholds, speech discrimination, caloric testing, and auditory brain stem responses.
3. Describe the diagnosis and management of the patient with a vestibular schwannoma, including: history, physical examination, investigations, surgery, and radiation.
4. Outline the options for facial reanimation following transection of the facial nerve, including: end-to-end anastomosis, and hypoglossal-facial nerve anastomosis, cross face transfers etc.
5. Possess applied knowledge of sinonasal anatomy.
6. Discuss embryology, clinical pictures and practical management of nasoencephalocoeles.
7. Describe sinonasal skull base surgical entities, e.g. nasopharyngeal carcinomas, angiofibromas, sinonasal carcinomas, mucoceles, etc.

**Appendix II:
Division of Neurosurgery Graduates
1969-2010**

Dr. Felix A. Durity	1969	Professor Emeritus, UBC
Dr. David J. Fairholm	1973	Clinical Professor, UBC, Assistant Dean, Faculty Development and Educational Support
Dr. G. Barrie Purves	1974	Neurosurgeon, Dakota Dunes, SD, USA
Dr. Paul Steinbok	1977	Professor, UBC, Head, Division of Pediatric Neurosurgery
Dr. W. Barrie Woodhurst	1980	Clinical Professor, Director, Undergraduate Education, Department of Surgery, UBC
Dr. Cornelius Matwijecky	1982	Neurosurgeon, Dallas, TX, USA
Dr. Richard Chan	1984	Neurosurgeon, Royal Columbian Hospital, New Westminster, BC
Dr. Michael C. Boyd	1986	Clinical Associate Professor, UBC Vancouver General Hospital
Dr. Michael McDermott	1988	Professor of Neurological Surgery, University of California, San Francisco
Dr. Mark Matishak	1992	Neurosurgeon, Royal Columbian Hospital, New Westminster, BC
Dr. Christopher Honey	1995	Associate Professor, Division of Neurosurgery, UBC
Dr. Husam Bader	1996	Neurosurgeon, Jerusalem, West Bank
Dr. Andrew Lee	1997	Clinical Instructor, UBC, Royal Columbian Hospital, New Westminster, BC
Dr. James Guest	1998	Assistant Professor, Department of Neurological Surgery, University of Miami Spine Institute, Miami, FL
Dr. Abdurrazag Mutat	1998	Neurosurgeon, Lions' Gate Hospital, North Vancouver, BC
Dr. Ryojo Akagami	2000	Assistant Professor, Division of Neurosurgery, UBC
Dr. Walter Hader	2000	Assistant Professor, Department of Clinical Neurosciences University of Calgary, Calgary, AB
Dr. Charles Haw	2001	Assistant Professor, Division of Neurosurgery, UBC
Dr. John Sun	2001	Clinical Instructor, UBC; Neurosurgeon, Victoria General Hospital, Victoria, BC
Dr. Stephen Hentschel	2002	Assistant Professor, Division of Neurosurgery, Victoria General Hospital, BC
Dr. Richard Perrin	2003	Neurosurgeon, Walnut Creek, CA, USA
Dr. Navraj Heran	2004	Neurosurgeon, Royal Columbian Hospital
Dr. Shahid Gul	2005	Neurosurgeon, Lions' Gate Hospital, North Vancouver, BC

Dr. Salvatore DiMaio	2010
Dr. Daniel Warren	2010
Dr. Raymund Yong	2010