PEDIATRIC NEURO-ONCOLOGY FELLOWSHIP
PROGRAM DESCRIPTION DEPARTMENT OF PEDIATRICS
MEMORIAL SLOAN-KETTERING CANCER CENTER, NEW YORK, NY

A. PROGRAM DEMOGRAPHICS

1. **Name of Host Institution:** Memorial Sloan-Kettering Cancer Center
2. **Program Subspecialty:** Pediatric Neuro-Oncology
3. **Program Address (mailing):** Memorial Sloan-Kettering Cancer Center, 1275 York Ave, Box 565, New York, NY 10065
4. **Program Address (physical location):** Memorial Sloan-Kettering Cancer Center, 1275 York Ave, New York, NY 10065
5. **Program Director: Matthias Karajannis, MD**
6. **Program Coordinator: Evelyn Clarke**

B. INTRODUCTION

1. **History:** The program began in 2004. Ten fellows have successfully completed the training program since its inception.

2. **Duration:** 1 year (12 months)

3. **Prerequisite training/Selection Criteria:** Applicants must have successfully completed their residency training in pediatrics and fellowship training in pediatric hematology/oncology or child neurology prior to starting. Foreign applicants with equivalent qualifications are also eligible to apply.

4. **Goals and Objectives for Training:** The aim of the Pediatric Neuro-Oncology Fellowship is to train the fellow to effectively evaluate and manage children and young adults with benign and malignant tumors of the central nervous system (CNS). Given the inherent multidisciplinary nature of the subspecialty, the training will include key areas related to neuro-oncology, including neurosurgery, neuropathology, neuroradiology, nuclear medicine, radiation oncology and neuropsychology. Fellows will also become experienced with the diagnosis and management of complications of treatment of CNS tumors. Child neurology trained fellows will also receive training in the neurologic complications of cancer. Fellows will have exposure to clinical research, including clinical trials for pediatric brain tumor patients, and are expected to complete a clinical research project during the course of the training program under the mentorship of program faculty.

5. **Program Certifications:** Fellows who have previous training in pediatric neurology may be eligible to become board certified in Neuro- oncology through the United Council for Neurologic Subspecialties (UCNS).

C. RESOURCES

Teaching Staff:

Matthias Karajannis, MD: Chief Attending, Pediatric Neuro-Oncology Service, Department of Pediatrics
Ira Dunkel, MD: Attending, Pediatric Neuro-Oncology Service, Department of Pediatrics
Sameer Farouk Sait, MD: Assistant Attending, Pediatric Neuro-Oncology Service, Department of Pediatrics
Yasmin Khakoo, MD: Attending, Pediatric Neurology Service, Department of Pediatrics
Mary Petriccione, NP: Pediatric Neurology Service, Department of Pediatrics
Catherine Scorrano, NP: Pediatric Neurology Service, Department of Pediatrics
Dorothea Dashiell, NP: Pediatric Neurology Service, Department of Pediatrics

Facility: Memorial Sloan-Kettering Cancer Center, 1275 York Ave, New York, NY 10065

D. EDUCATIONAL PROGRAM – BASIC CURRICULUM

1. **Clinical components:** The Pediatric Neuro-Oncology Program at Memorial Sloan-Kettering Cancer Center is one of the largest in the country, with approximately 150 new patients per year. The fellow will participate in the pediatric neuro-oncology clinic, seeing patients for follow-up as well as evaluating new patients with the Attendings. The fellow will also participate in the evaluation and management of hospitalized patients on the Pediatric Neuro-Oncology Service and related inpatient consults. Fellows will also be asked to take part in mail-based reviews that have been sent to the department faculty. In addition, the fellow participates in teaching residents and medical students who are rotating on the Pediatric Neuro-Oncology Service. The treatment of children and young adults with CNS tumors at Memorial Sloan-Kettering Cancer Center utilizes a multidisciplinary team approach.

2. **Participants supervisory and patient care responsibilities:** The Pediatric Neuro-Oncology team consists of pediatric neuro-oncologists, pediatric neurologists, nurse practitioners, neurosurgeons, radiation oncologists, neuro-radiologists and neuro-pathologists. The fellows are exposed to each of these disciplines with each patient, which leads to a more complete understanding of the individual types of CNS tumors. Fellows are expected to gain a thorough understanding of the clinical presentation and evaluation of pediatric CNS tumors, as well as treatment options, complications of treatment and long-term survivor follow-up.

3. **Procedural requirements:** Depending on their prior training, fellows will perform lumbar punctures, Ommaya reservoir taps, bone marrow aspirates and bone marrow biopsies on outpatients under attending supervision.

4. Didactic components:

Name	Frequency	Trainee Attendance Required		# People Attending		Educational Objectives
		Yes	No	Trainees	Faculty	
Pediatric Grand Rounds	Weekly	X		15	20	Subject-specific education through weekly guest lecturers
Pediatric Neuro-Oncology team meeting	Weekly	X		1	10	Multidisciplinary meeting to review and plan patient care
Pediatric Neuro-Oncology Tumor Board	Weekly	X		10	10	Multidisciplinary discussion of newly diagnosed and other select patients
New York City Pediatric Neuro-Oncology Tumor Board	Quarterly	X		20	25	Multidisciplinary discussion of select patients with colleagues from other centers
MSKCC Adult Neuro-oncology Lecture series	Weekly			10	5	Weekly lecture series and monthly journal club to review basics on Neuro-oncology in the beginning of the year and then higher level topics (trial design, experimental therapeutics etc.)
MSKCC Brain Tumor Center Retreat	Yearly	X		25	50	Multidisciplinary educational conference reviewing current diagnosis, treatment, understanding and management of Neuro-oncology in clinical and basic science arenas
MSKCC Brain Tumor Center Lecture Series	Weekly from Sept-June	X		25	40	Multidisciplinary review of clinical and basic science Neuro-oncology in both Pediatrics and Adult Oncology
Comskil: communication skills building laboratory	2 full days per year	X		15	10	Learning effective communication in oncology through role playing. Topics covered include breaking bad news; the angry patient; and transitioning to palliative care
MSKCC Neuropathology Conference	Monthly from Sept-June	X		15	20	Review neuropathology cases seen at MSKCC; Recognize the importance of whole genome arrays, specifically as they relate to the treatment and prognosis of medulloblastoma

5. Progression by PGY level: not applicable

E. EVALUATION

At the beginning of the academic year, the new fellow will meet with the Director and Associate Director of the Pediatric Neuro-Oncology Fellowship to review the overall objectives of the program as well as individual expectations of the fellow. The fellow will review the evaluation form with the Attendings to indicate what specific areas they will actually be evaluated on. The fellow will be evaluated by the teaching faculty and meet with the Director and Associate Director at four months, eight months and at the completion of the fellowship by the Attendings. Records of each evaluation and the PD meeting are maintained on file in the Pediatric Education Office (see attached copy of a standard evaluation). Any performance issues which arise during the fellowship, will be addressed by the program director(s). Fellows complete the standard Memorial Hospital forms to anonymously evaluate the teaching faculty as well as the program.

The feedback received is discussed by the service and is used to strengthen the education program.

This fellowship program is evaluated internally by the Graduate Medical Education Committee every year. (GMEC has oversight of all training programs for physicians.)

ATTACHMENT

Educational objectives

Clinical and theoretical knowledge: the fellow is expected to learn the following (adapted from The American Board of Pediatrics subspecialty curriculum):

a. Epidemiology/predisposing factors/genetics

- Know the cytogenetic and molecular genetic abnormalities associated with brain tumors
- Recognize the association between brain tumors and heritable syndromes (eg, neurofibromatosis, tuberous sclerosis)
- Know the association between pine blastoma and retinoblastoma

b. Pathology

- Recognize the World Health Organization 2016pathologic subtypes of brain tumors relative to prognosis, primary tumor site and pattern of spread
- Recognize the relationship between histologic grade of gliomas and prognosis
- Recognize the role of molecular profiling and categorizing tumors

c. Clinical presentation

- Recognize the clinical presentation of brain tumors by anatomic site
- Perform a competent neurologic assessment and be able to localize the lesion
- Understand the clinical and pathologic characteristics of pediatric brain tumors
- Know the clinical and laboratory features of medulloblastoma, cerebellar astrocytoma, brain stem glioma, pineal tumors, ependymoma, primitive neuroectodermal tumors and optic pathway gliomas
- Recognize the relationship between age and anatomic site in the clinical presentation of brain tumors

d. Diagnosis and staging

- Utilize appropriate imaging modalities to determine the extent and metastatic spread of brain tumors
- Know which central nervous system tumors are associated with spinal cord metastases
- Know the cerebrospinal fluid findings associated with medulloblastoma
- Know how to utilize imaging modalities to characterize medulloblastoma, astrocytoma, brain stem glioma, pineal cell tumors, ependymoma and primitive neuroectodermal tumors
- Know the patterns of metastasis and spread characteristic of medulloblastoma, low grade astrocytoma, ependymoma and primitive neuroectodermal tumors
- Know which central nervous system tumor is most likely to metastasize outside the central nervous system

- Know how to utilize imaging modalities to characterize optic pathway gliomas
  Know the patterns of metastasis and spread characteristic of glioblastoma

e. Treatment

- Know the role of surgery in the treatment of brain tumors
- Recognize that surgery alone is curative for cerebellar astrocytoma
- Know the role of irradiation in the treatment of brain tumors
- Know the role of chemotherapy in the treatment of brain tumors
- Know the role of targeted agents in the treatment of brain tumors
- Monitor the response to treatment of brain tumors using clinical modalities, imaging modalities, biochemical markers and histologic markers
- Know the principles of management for patients with medulloblastoma, low grade astrocytoma, brain stem glioma, pineal tumors, ependymoma, primitive neuroectodermal tumors, high grade gliomas (anaplastic astrocytoma and glioblastoma) and central nervous system germ cell tumors

f. Prognosis

- Know the prognostic features of brain tumors
- Know the prognosis of brain tumors according to stage and histology
- Know the natural history of medulloblastoma, low grade astrocytoma, brain stem glioma, pineal cell tumors, ependymoma, high grade gliomas and primitive neuroectodermal tumors
- Identify the prognostic factors in patients with medulloblastoma, astrocytoma, brain stem glioma, pineal cell tumors, ependymoma and primitive neuroectodermal tumors
- Identify the prognostic factors in patients with central nervous system germ cell tumors

g. Complications/late effects

- Know the acute complications of treatment of CNS tumors including deep venous thromboembolism; neutropenia, thrombocytopenia, and anemia; and CNS and systemic infections
- Know the use of blood products and growth factor support
- Know the late effects of brain tumors and their treatment in patients of various ages
- Know the secondary malignancies associated with treatment of brain tumors
- Know the potential neurologic, endocrine, intellectual sequelae of brain tumors and their treatment
- Know the complications and late effects of surgery, irradiation and chemotherapy performed in the treatment of brain tumors
- Know how to implement pain management strategies for headache, increased intracranial pressure and treatment related peripheral neuropathy
- Know how to transition patients to palliative and end-of-life care

h. Additional competencies for fellows may include:

- Know the treatment of metastatic cancer to the nervous system including brain and spinal cord metastases; base of skull metastases; leptomeningeal metastases; epidural metastases and spinal cord compression; and plexus and peripheral nerve metastases
- Know the evaluation, diagnosis and management of systemic cancer-related neurologic disorders including:

1. Adverse events and reactions to surgical, medical, and radiation treatment of neuro-oncology patients
2. Toxic, nutritional and metabolic encephalopathy
3. Cerebrovascular disease
4. Seizures
5. Neuro-oncologic complications of bone marrow transplantation
6. Paraneoplastic syndromes