CURRICULUM VITAE

ICHIRO NAKANO, M.D., Ph.D.

Professor

Director, Office of Laboratory Research

Departments of Neurosurgery, Neurology, Cell Developmental and

Integrative Biology, Biochemistry and Molecular Genetics

Co-Leader, Neuro-Oncology Program, Comprehensive Cancer Center

University of Alabama at Birmingham

2017

CURRICULUM VITAE

NAME Ichiro Nakano, MD, PhD

CITIZENSHIP United States of America

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RANK/TITLE Professor

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Integrative Biology, Biochemistry and Molecular Genetics

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LANGUAGES English, Japanese

#### HOSPITAL University of Alabama Hospital, Birmingham, AL. 2015-Present

#### EDUCATION

1987-1993 Medical School, Kyoto University Graduate School of Medicine

1997-2001 Graduate School, Kyoto University Graduate School of Medicine

MILITARY None

LICENSURE

1993 Medical Licensure certified by the Japan Medical Association

2006 Restricted Medical License by the Medical Board of California (under the program of 2113 for foreign medical doctors, effective in the UCLA Medical Center)

2006 USMLE Step 1 and 2

2008 USMLE Step 3

2009 Training Medical License by the State Medical Board of Ohio

2012 Medical Licensure certified by the Ohio Medical Board (No. 099066)

2015-present Limited Licensure certified by the Alabama Medical Board (No. L.4206DP)

BOARD CERTIFICATION

2001 Japanese Board of Neurological Surgery (# 5492)

CLINICAL TRAINING AND RESEARCH TRAINING

1993 Neurosurgery residency, Department of Neurosurgery, Kyoto University

 School of Medicine

1993-1996 Neurosurgery residency, Department of Neurosurgery, Kitano Hospital (affiliated to Kyoto University School of Medicine)

1996-1997 Neurosurgery residency, Department of Neurosurgery, Hyogo Prefectural Tukaguchi Hospital (affiliated to Kyoto University School of Medicine) – Completion of clinical training in residency (Department of Neurosurgery, Kyoto University School of Medicine, Chair: Dr. Haruhiko Kikuchi)

1997-2001 Staff neurosurgeon, affiliated hospitals to Kyoto University School of Medicine

2001 Staff neurosurgeon, Department of Neurosurgery, Kishiwada City Hospital (affiliated to Kyoto University School of Medicine)

2002-2005 Postdoctoral fellow, Department of Pharmacology, UCLA

2006-2009 Clinical Instructor, Division of Neurosurgery, Departments of Surgery and Pediatrics, UCLA (Supervisor: Dr. Neil Martin)

2009-2012 Clinical Neurosurgery Fellowship (neuro-oncology surgery, Supervisor: Dr. Antonio E. Chiocca), the Ohio State University

ACADEMIC AND ADMINISTRATIVE APPOINTMENTS

2016-present co-Leader, Neuro-Oncology Program, Comprehensive Cancer Center, UAB

2015-present Member, UAB Comprehensive Cancer Center’s Clinical Trial Protocol

 Review Committee

2015-present Co-Director, Brain Tumor SPORE, UAB

 Director, Office of Laboratory Research, UAB

2015-present Professor, Departments of Neurosurgery, Cell Developmental and

 Integrative Biology, Biochemistry and Molecular Genetics, UAB

2009-2015 Associate Professor, Department of Neurological Surgery, OSU

2009-2015 Director, Neural Cancer Stem Cell Program, OSU

ADJUNCT ASSOCIATE PROFESSOR POSITION

2015-present Department of Neurosurgery, Osaka City College, Japan

VISITING PROFESSOR/FACULTY POSITIONS

2010-present Department of Neurosurgery, Xi’an Jeongton University, China

2013-present Department of Neurosurgery, Osaka Medical College, Japan

2014-present Department of Neurosurgery, Kansai Medical College, Japan

2016-present Department of Neurosurgery, Ehime University, Japan

CLINICAL INTERESTS

Brain tumors

Functional Mapping

Intraoperative MRI

Fluorescence-guided brain surgery

Minimally-invasive surgery

Microvascular decompression

RESEARCH INTERESTS

Molecular characterization of brain tumor stem cells

Therapy development for brain tumors

Phase I/II Clinical Trial for malignant brain tumors

Molecular mechanism of therapy resistance of brain tumors

Genetic mechanism for ce0ll fate decisions in neural stem cells

PERSONAL STATEMENT

By training, I am an academic neurosurgeon conducting both brain tumor translational research and clinical brain tumor surgery. As a physician, I surgically treat patients with brain tumors. As a scientist, I focus on the molecular characterization of brain cancer heterogeneity and plasticity and translate that knowledge to cancer therapeutics. My research is highlighted with the discovery of brain cancer stem cells, published in PNAS in 2003, and the discovery of glioblastoma subtype-specific cancer stem cells, published in PNAS, Cancer Cell in 2013, Cancer Cell in 2016, and JCI in 2017. As of July 2017, I have published more than 105 peer-reviewed research and review articles. I currently hold 7 NIH grants as a PI or co-I (6 R01s and 1 R21). All of these projects aim to study various molecular mechanisms that drive brain cancer aggressiveness, heterogeneity, therapy resistance and development.

In October 2015, I was recruited to the UAB Department of Neurosurgery. Since I joined UAB, I have thoroughly integrated myself into the UAB brain tumor program and have taken on major leadership roles. For example, I serve as a co-Leader in the Neuro-Oncology Program in UAB Comprehensive Cancer Center. Under this mechanism, I aim to be among the national and international leaders in therapeutic development for brain cancers. My research projects are extensively supported by many collaborations and I have assembled neuro-oncology scientists and physicians covering various and broad expertise into my team. We share the mission to identify novel and effective therapies for malignant brain tumors as a result of our collaborative work.

My long-term goal is to make visible impact on prognosis of cancer patients by developing innovative and effective therapies. I continue to devote myself towards improving the outcomes of patients by developing effective therapies for this devastating disease in collaboration with my collaborators including basic scientists, oncologists, pathologists, and neurosurgeons.

REPORT OF CLINICAL ACTIVITIES DURING 2009-2012

*MAJOR AREAS OF CLINICAL PRACTICE* are in brain tumor surgery and involve patients with benign and malignant tumors of the central nervous system. The office practice is in Doan Hall within the Ohio State University Medical Center/Arthur G. James Cancer Hospital (OSUMC/James) under the supervision of the Chair of Department of Neurosurgery, Dr. Antonio E Chiocca. Patients are seen within this office setting, in the emergency room of the hospital, and in in-patient consultation. Neurosurgical consultation is also provided to requesting physicians at outside hospitals. Neurosurgical operative procedures are performed at OSUMC.

*PATIENT LOAD:* During the neurosurgery brain tumor fellowship, patients are seen every Tuesday, Wednesday, or Thursday; on average, approximately 5-10 new and some follow-up patients are seen each week. Operative procedures are performed on Tuesdays, and Fridays and number approximately 4 per week (average). Approximately 3 to 4 patients per day are assigned. The total number of operative cases performed during the fellowship was approximately 250.

REPORT OF CLINICAL ACTIVITIES DURING 2015-2016

Following the clinical training in the Department of Neurosurgery at OSU, I completed one year of credentialing confirmation under Dr. James M. Markert, Chair of the Department of Neurosurgery at UAB. During this period, I performed 76 operative procedures, all of which were brain tumor cases.

REPORT OF CLINICAL ACTIVITIES SINCE 2016

*MAJOR AREAS OF CLINICAL PRACTICE* are in brain tumor surgery and involve patients with benign and malignant tumors of the central nervous system. I see outpatients in The Kirklin Clinic at the UAB Main Hospital, assigned for one day per week. I perform neurosurgical operative procedures in the Operation Room in the UAB Main Hospital with the block time of one day per week.

ACTIVITIES OF THERAPY DEVELOPMENT/TRANSLATIONAL RESEARCH

**Phase 0 Clinical Trial for Recurrent Glioblastoma with BGB324**

One of the translational research projects in my lab is to investigate the roles of the Receptor Tyrosine Kinase AXL in glioblastoma and glioma stem cells (Cheng et al., *Stem Cell Reports* 2015). In this project, my lab made a contract with the biotechnology company *BerGenBio* in Norway, supporting us by providing the small molecule AXL inhibitor BGB324 for the purpose of pre-clinical evaluation and to run the Phase 0 Trial for Glioblastoma. This project was selected as Project 1 in the SPORE, submitted in September 2016. In parallel, I presented this project to design a Phase 0 Trial in the American Brain Tumor Consortium annual meeting at Baltimore, MD in December 2016. The Letter of Intent is scheduled to be sent to the Cancer Therapy Evaluation Program (CTEP) in NCI by the end of 2016. I plan to lead this Trial with Dr. Burt Nabors, the Chief of the Neuro-Oncology Program in the Comprehensive Cancer Center at UAB, as co-PI.

**Other agents in the pipeline**

From our recent publications, we identified several novel molecular targets and potential lead targeting compounds for glioblastoma and glioma stem cells. One of them is the HDAC inhibitor AR42. This small molecule compound was provided by the biotechnology company *Arno* in Columbus, OH. *Arno* supports my lab to perform both pre-clinical evaluation using some brain tumor models and to develop an early phase clinical trial for glioblastoma. Currently, AR42 is under Phase 0 for Acoustic Schwannoma and Meningioma (Harvard) and Phase 1 for AML, CLL, Multiple Myeloma (Cincinnati Children’s Hospital and some others). The current status of our study for glioblastoma therapy development is at the pre-clinical evaluation stage. This project will be considered for submission as a potential Development project in the SPORE as well.

The other molecular targets that we are studying as the ongoing research projects include MELK (serine/threonine kinase), EZH2 (Histone Methyltransferase), Aldehyde Dehydrogenase (ALDH), MLK4 (serine/threonine kinase) and NEK2 (serine/threonine kinase). My lab has the lead small molecule compound for each of these target molecules. The main disease for therapy development is glioblastoma (collaboration with Dr. Nabors) and the second disease target is breast cancer brain metastasis (collaboration with Dr. Andres Forero-Torres, medical oncologist / Director of Breast Cancer Program at UAB).

HONORS AND AWARDS

2003 The Jules Spivak Memorial Scholarship Award

2004 Fine Science Tools Postdoctoral Award from Brain Research Institute at

 UCLA

2006 Journal of Neuro-Oncology Award (in the Annual Meeting of the AANS,

 San Francisco)

2007 Clinical Symposium Chair. “Brain tumors and Stem Cells”. UCLA Neurosurgery / Institute for Stem Cell Biology and Medicine

2008 American Brain Tumor Association Young Investigator Award (in the Annual Meeting of the AANS, Chicago)

2009 National Brain Tumor Translational Research Investigator Award (in the Annual Meeting of the CNS, New Orleans)

2012 American Brain Tumor Association Translation Research Award

CONFERENCE ACTIVITIES

2007 Distinguished Speaker Award. Hamamatsu University School of Medicine

2016 co-Chair, Cancer Stem Cell Session, 21st International Conference on Brain Tumor Research and Therapy, Okinawa, Japan

2016 Invited International Speaker, Annual meeting for the Japan Neurosurgery Society, Fukuoka, Japan

2016 Session co-Chair, Early Morning Lecture, Annual Meeting for the Society for Neuro-Oncology, San Antonio, Arizona

2017 Panelist for Breakfast Seminar, The Spectrum of Adjuvant Therapy for Brain Tumors, Annual Scientific Meeting, American Association of Neurological Surgeons, Los Angeles

PROFESSIONAL SOCIETY MEMBERSHIPS

International Member, Congress of Neurological Surgeons (the USA)

International Member, American Association of Neurological Surgeons

Member, American Association of Neurological Surgeons

Member, Society for Neuro-Oncology

Member, Congress of Neurological Surgeons (Japan)

Member, Society for Neuroscience

Member, Japan Neurosurgical Society

Advisor Faculty Member, Medical Scientist (MD/PhD) Program, OSU

Mentoring Faculty, Molecular, Cellular, and Developmental Biology Program, OSU

Advisor Faculty Member, Neuroscience Graduate Studies Program, OSU

Advisor Faculty, Integrated Biomedical Science Graduate Program, OSU

Program Planning Committee Members, World Federation of Neuro-Oncology/SNO

 Annual Meeting, 2013, OSU

Faculty member, Solid Tumor Biology Program, James Comprehensive Cancer Center,

 OSU, 2015

#### EDITORIAL POSITIONS, BOARDS, AND PEER-REVIEW SERVICE

*Editorial Board Member:*

PLoS One

Advances in Neuroscience

American Journal of Stem Cells (Senior Editor)

Behavioral Neurology

Journal of Stem Cell Research and Transplantation

Journal of Stem Cells Research, Development and Therapy (Eminent Editor)

Imaging Journal of Clinical and Medical Sciences

Aperito Journal of Surgery and Anesthesia

Free Radical Research

Cancer Science

Stem Cell and Translational Investigation

*Review for Journal Publications:*

Journal of Neuroscience Research

Medical Science Monitor

Neurobiology of Disease

Pediatric Research

Expert Review of Anti-Cancer Therapy

Journal of Neuro-Oncology

Future Neurology

Cancer Science

Journal of Biochemistry

Neuron

Experimental Neurology

Surgical Neurology

Cancer Cells

Journal of Neurosurgery

Oncogene

Journal of Neuroscience

PLoS ONE

Journal of Carcinogenesis and Mutagenesis

Stem Cells

Clinical Cancer Research

Stem Cell Research

American Journal of Pathology

Journal of Molecular Diagnostics

Stem Cells Translational Research

Neurosurgery

Journal of Molecular Medicine

Cancer Letters

Cell Proliferation

Medical Principles and Practice

Neuro-Oncology

PNAS

Science Translational Medicine

Cancer Research

Oncotarget

REVIEW FOR GRANTS (NATIONAL):

National Institute for Health, Study Section of Basic Mechanism of Cancer Therapeutics (*ad hoc* member) July, 2014

 National Institute for Health, NCI Exploratory/Developmental Research Grants (NCI Omnibus R21) and NCI Small Grants Program (NCI Omnibus R03), Nov, 2014

 National Institute for Health, Cancer Molecular Pathobiology Study Section (CAMP), SEP R01 Review, Nov 2014

 National Institute for Health, National Cancer Institute Initial Review Group; Subcommittee I—Transition to Independence. K01, K08, K25, February 2015

 National Institute for Health, 2015/05 ZCA1 SRB-V (M1) S, OMNIBUS SEP 3 R03 & R21 ZCA1 SRB-V (M1), March 2015

 National Institute for Health, National Cancer Institute, Special Emphasis Panel/Scientific Review Group 2015/05 ZRG1 OBT-Z (55) R, April 2015

 American Cancer Society, Review Committee, Differentiation and Development in Cancer, June 2015

 Review Panel, Discovery Grant, American Brain Tumor Association, 2016

 NIH/P01 Study Section, Special Emphasis Panel, Bethesda, MD, June 2016

 NIH/R01 Study Section, Clinical Neuroimmunology and Brain Tumors, Bethesda, MD, Nov 2016

 NIH/R01 Study Section, Cancer Health Disparities, Bethesda, MD, Nov 2016

 NCI R03 & Clinical and Translational R21: SEP-8 Review Committee, Bethesda, MD, 2017

 NINDS Special Emphasis Panel: ZNS1-SRB (J16) “NINDS R35 Review” 2017

REVIEW FOR GRANTS (INTERNATIONAL):

 Medical Research Council, UK, 2013-present

 World Cancer Research Fund International, UK, 2014-present

REVIEW FOR ABSTRACTS:

Annual Meeting, The Society of Neuro-Oncology, 2012

Annual Meeting, The Society of Neuro-Oncology, 2013

Annual Meeting, 21st International Conference on Brain Tumor Research and Therapy,

Okinawa, Japan, 2016

Annual Meeting, The Society of Neuro-Oncology, 2016

Annual Meeting, The Society of Neuro-Oncology, 2017

#### PATENT / INVENTION REPORT

1. Cancer Stem Cells. Serial #: 60/671,696 (Kornblum HI, Geschwind DH, Nakano I)

2. Submitted provision patent (Tech ID #10158): A Novel Anti-Brain Tumor Agent, Compound 1

3. Submitted provision patent (Tech ID #10160): Platform to Discover Novel Kinase Targeting Cancer Stem Cells in Brain Tumors with Structure-Based Computational Drug Design

4. Combined treatment of cancer with benzo[e]pyridoindoles and DNA-damaging agents (10% co-ownership) (Primary Institute: Institute Curie, France), June 2010

5. LLP-3 as a novel inhibitor for Survivin/Ran complex in cancer stem cells. (50% co-ownership) (Primary Institute: OSU), September 2012 (ongoing process)

6. Klarquist Ref. No. 8123-90793-01, For       ALDH1A3 AS A BIOMARKER AND THERAPEUTIC TARGET FOR HIGH-GRADE GLIOMA, Application No. 61/819,361, filed May 3, 2013, Country: United States of America

MEDICAL CONSULTING ACTIVITIES

*Celgene*, Inc., 2009-2013

*StemCycle*, Inc. 2014-present

SPONSORED RESEARCH

*ArrienPharma,* Inc., 2013

THERAPY DEVELOPMENT

Novel HDAC inhibitor AR42 for Phase I trial for advanced cancers including glioblastoma.

Role: co-Investigator, 2013

RESEARCH SUPERVISION

Current

Assistant Professors

2016-present Chang-Hyuk Kwon, PhD

 Project: Single cell analysis to determine GBM heterogeneity

2016-present Tatsuya Ozawa, MD, PhD

 Project: Therapy-induced plasticity of glioma stem cells

Postdoctoral Fellows

2013-present Mutsuko Minata, MD, PhD

 Project: Radioresistance in glioma stem cells and therapy development

2017-present Kyung-don Kang, PhD

Research Associates

2015-present Jun Wang, PhD

2015-present Svetlana Komarova, PhD

2016-present Shinobu Yamaguchi, PhD

Visiting Scientists

2016-present Heba Alsheikh, MBchB, MSc

 Project: breast cancer brain metastasis

2016-present Anutosh Ganguly

2016-present Hai Yu, PhD.

 Project: Therapy development for glioblastoma

2017-present Suojun Zhang, PhD

Graduate Student

2016-present Sonyia Bastola – UAB

 Project: inter-cellular communication in glioblastoma

Previous

Postdoctoral Fellows

2006-2008 Kuniyasu Saigusa, MD, PhD (current: Professor in Neurosurgery, Tokyo Medical and Dental University)

2008 Xiangdong Deng, PhD

2008-2009 Akihito Inagaki, PhD

2008-2010 Yuko Nakamura-Okemoto, PhD

2009-2011 Takeshi Miyazaki, MD, PhD. (current: Assistant Professor in Dept. of Neurosurgery, Shimane University)

2009-2010 Mayumi Jijiwa, MD, PhD

2010-2012 Chunyu Gu, MD. (current: Clinical staff, Neurosurgery, China)

 International Medical Graduates

2010-2011 Ryosuke Yamada, MD

2010-2011 Habibe Demir, MD, (current: Clinical Resident in Dept. of

 Pathology, OSU)

2011 Deepti Purohit, MD, (current: Clinical Resident, Newark Beth

 Israel Medical Center in Pediatrics)

2011-2012 Hacer Guvenc, MD, research fellow (current: Clinical Resident, Internal Medicine)

2012 Yeshavanth Kumar Banasavadi-Siddegowda, PhD, postdoctoral fellow

2011-2013 Ping Mao, MD (post-training: Clinical fellow, Neurosurgery, Xi’an Jeontong Medical University)

2012-2013 Samah Abou-Sharieha, PhD

2013-2014 Claudia LL Valentim, PhD

 Project: Characterization of Compensatory Proliferation in Glioblastoma

2013-2016 Sunghak Kim, PhD (current: Assistant Professor, Chonnam National University

Project: Characterization of MLK4 serin/threonine kinase in glioma stem cells

2013-2016 Peng Cheng, MD (current: staff neurosurgeon, China National Medical School)

 Project: RNAi screen for kinases essential for glioma stem cells

2014-2015 Natsuko Kondo, MD, PhD (current: Assistant Professor, Kyoto Univerisity)

Project: Inter-cellular communication of proneural and mesenchymal glioma cells

2014-2016 Jia Wang, MD (current: staff neurosurgeon, Xi’an Jeongton Medical School)

Project: Essential kinases in glioblastoma and development of therapy resistance

2014-2017 Marat Pavliukov, PhD

 Project: Splicing factors in glioblastoma and glioma stem cells

2016-2017 Mayuko Nishi, PhD

Project: Determinant of cell fate in glioblastoma

Visiting Scientists

2009-2014 Kaushal Joshi

Project: Characterization of the molecular determinants for Proneural-to-Mesenchymal Transition of glioma stem cells

2015-2016 Sunghak Kim, PhD

2016-2017 Minxue Lian

2016-2017 Hirokazu Sadahiro, MD, PhD

 Project: Therapy development for glioblastoma

2016 Zhou Xhang

2016 Vito Coviello

Neurosurgery Residents

2013-2015 Ahmed Mohyeldin, MD, PhD

 Project: Tumor metabolism for cellular hierarchy in Glioblastoma

Medical Students

2011 Aalap Narichania, medical student, OSU

2012 Luke Smith, medical student, OSU

2012 Christopher Hong, medical student, OSU

2013-14 Ranjit Ganguly, medical student, OSU

Undergraduate Research Courses

 Neuroscience 4998 May Session, OSU – 19528

 Neuroscience 4998 7Wk Session, OSU – 14119

MENTORING ACHIEVEMENTS

1. Landacre Honor Society: Aalap Narichania (medical student, OSU), Advisor: Ichiro Nakano, 2010

2. The Fourth Annual Neuroscience Signature Program Poster Day Award: Kaushal Joshi, Advisor: Ichiro Nakano. “MELK-dependent phosphorylation of FOXM1 is essential for mitotic progression of glioma-initiating cells” 2011

3. Dardinger Neuro-Oncology award for outstanding progress in research: Kaushal Joshi, Advisor: Ichiro Nakano, 2012

4. American Academy of Neurology Medical Student Summer Research Scholarship: Ranjit Ganguly, Advisor: Ichiro Nakano, 2013

5. China Council Scholarship supported by Education Ministry of China: Ping Mao, Supervisor: Ichiro Nakano, 2012-2013

6. China Council Scholarship supported by Education Ministry of China: Peng Cheng, Supervisor: Ichiro Nakano, 2012-2013

7. Dardinger Neuro-Oncology award for outstanding progress in research: Ping Mao, Advisor: Ichiro Nakano, 2013

8. NIH/R25: Ahmed Mohyeldin, Supervisor: Ichiro Nakano, 2014-2015

9. Neurosurgery Research & Education Foundation. Medical Student Summer Research Fellowship: Ranjit Ganguly, Supervisor: Ichiro Nakano, 2014

10. Mentoring Program, UAB Comprehensive Cancer Center, 2016

INVITED NATIONAL AND INTERNATIONAL SEMINARS AND LECTURES *(selected)*

1. Maternal Embryonic Leucine-zipper Kinase, MELK, regulates proliferation in neural stem and tumor cells. Keystone Symposia, Colorado, 2004
2. Neural Stem Cells and Brain Tumor Stem Cells. The Second Annual Hot Topics in Stem Cell Biology, Annual Meeting of Society for Neuroscience, Washington DC, 2005
3. Neural stem cells and brain tumor stem cells. Pediatric Ground Rounds, UCLA, Los Angeles 2006
4. Stem cells in Pediatric brain tumors. Clinical Neurosurgical Symposia, UCLA, Los Angeles 2006
5. Heterogeneity of brain tumors- discovery of brain tumor stem cells. Special seminar series in the Department of Neurosurgery, Hiroshima University, Hiroshima, Japan 2007
6. Brain tumor stem cells. The 13th annual meeting of the Japan Society of Gene Therapy, Nagoya, Japan 2007
7. Heterogeneity of brain tumors- discovery of brain tumor stem cells. Special seminar series in the Department of Neurosurgery, Hamamatsu University School of Medicine, Hamamatsu, Japan 2007
8. Neural stem cells and brain tumor stem cells. Encino-Tarzana Regional Medical Center, Los Angeles, 2007
9. Brain tumor stem cells. The Department of Neurosurgery, University of Tokyo, Tokyo, Japan 2007
10. Signaling mechanisms regulating brain tumor stem cell growth. the Annual meeting of the Cell Transplantation Society. Minneapolis, 2007
11. Clinical Implication of Neural Stem Cells and Brain Tumor Stem Cells. Educational Lecture for staff in PICU at UCLA, Los Angeles 2007
12. Luncheon Seminar; Brain Tumor Biology. The 12th Asian Australasian Congress of Neurosurgical Surgeons / World Federation of Neurosurgical Societies, 13th Interim Meeting, Nagoya, Japan 2007
13. Brain tumor stem cells. Invited Lecture in the Department of Neurosurgery, Nara University School of Medicine, Nara, Japan 2007
14. Brain tumor stem cells. Invited Lecture in the Department of Neurosurgery, Osaka City University School of Medicine, Osaka, Japan 2007
15. Brain tumor stem cells. Invited Lecture in the Department of Neurosurgery, Mie University School of Medicine, Mie, Japan 2008
16. Cancer stem cells in brain tumors. Invited Lecture. The 12th World Congress on In Vitro Biology, Tucson, 2008
17. Neural Stem Cells and Brain Tumor Stem Cells. Invited Presentation. Department of Neurological Surgery, The Ohio State University. Columbus, 2008
18. Neural Stem Cells and Brain Tumor Stem Cells. Invited Presentation. The Stem Cell Institute, The James Graham Brown Cancer Center, University of Louisville. Louisville, 2008
19. Neural Stem Cells and Brain Tumor Stem Cells. Invited Presentation. Ground Rounds, Department of Neurosurgery, Emory University. Atlanta, 2008
20. Therapeutic Development for malignant glioma. Keio University, Japan, 2010
21. Therapeutic Development for malignant glioma. Japan Foundation for Cancer Research, Tokyo, Japan, 2010
22. Therapeutic Development for malignant glioma. National Institute of Advanced Industrial Science and Technology, Tokyo, Japan, 2010
23. Therapeutic Development for malignant glioma. 9th International Meeting, Brain Tumor Symposium, Tuscany, Italy, 2010
24. Therapeutic Development for malignant glioma. Clinical Trial Phase I/II Meeting, the Ohio State University, Columbus 2010
25. Therapeutic development targeting brain tumor stem cells. The Third Annual World Congress of Regenerative Medicine and Stem Cells, Shanghai, China 2010
26. Therapeutic development program for Malignant Glioma. Department of Neurosurgery, Nagoya University, Nagoya, Japan 2011
27. Therapeutic development program for Malignant Glioma. Department of Neurosurgery, Osaka Medical University, Osaka, Japan 2011
28. Therapeutic development program for Malignant Glioma. Department of Neurosurgery, Osaka City University, Osaka, Japan 2011
29. Glioma Stem Cells: Moving Target and Therapy Development for Malignant Glioma. Cornell University, New York 2012
30. Glioma Stem Cells: Moving Target and Therapy Development for Malignant Glioma. University of Pittsburgh, Pittsburgh 2012
31. Glioma Stem Cells: Moving Target and Therapy Development for Malignant Glioma. Virginia Commonwealth University, Richmond 2012
32. Glioma Stem Cells: Moving Target and Therapy Development for Malignant Glioma. Neural Stem Cell Research Center, UCLA, Los Angeles 2012
33. Translational Research with Glioma Stem Cells, Retreat, Center for Regenerative Medicine and Cell-Based Therapy, OSU, Columbus 2012
34. Invited seminar, Glioma Stem Cells: Moving Target and Therapy Development for Malignant Glioma. Sanford-Burnham Medical Research Institute, San Diego, 2012
35. Invited seminar, Glioma Stem Cells: Moving Target and Therapy Development for Malignant Glioma. Department of Neurosurgery, UCSD, San Diego 2012
36. Invited seminar, Glioma Stem Cells: Moving Target and Therapy Development for Malignant Glioma. Department of Neurosurgery, University of Arizona, Tucson, 2012
37. Invited talk at Ground Rounds, Glioma Stem Cells: Moving Target and Therapy Development for Malignant Glioma. Barrow Neurosurgical Institute, Phoenix, 2012
38. Glioma Stem Cells: Moving Target and Therapy Development for Malignant Glioma. Department of Stem Cell Research and Regenerative Medicine, Cleveland Clinic, Cleveland 2012
39. Glioma Stem Cells: Moving Target and Therapy Development for Malignant Glioma. Stem Cell Program Meeting, Sanford-Burnham Medical Research Institute, San Diego 2012
40. Glioma Stem Cells: Moving Target and Therapy Development for Malignant Glioma. The 5th International China Neurosurgical Meeting, Xi’an, China 2012
41. Moderator, The Annual Meeting for the Society for Neuro-Oncology, Washington DC, Oct 2012
42. Identification of the first-in-class Ran/Survivin inhibitor LLP-3 for Glioblastoma Therapy Development. Inventor Presentation at Technology Review Board, Columbus, 2013
43. Cancer stem cell evolution. Center for Tissue Regeneration and Engineering at Dayton, University of Dayton, Dayton 2013
44. Stem Cell Signature in Normal Brains and Oncogenesis. Drug Discovery Asia 2013, Singapore 2013
45. Brain Tumor Stem Cells – Evolution of Cancers. 5th Asia Stem Cells and Regenerative Medicine Congress, Singapore 2013
46. Evolution of Cancer Stem Cells – Lesson from Brain Tumors. Cancer Science Institute, National University of Singapore, Singapore 2013
47. Developmental Therapeutics for Malignant Brain Tumors. XV WFNS World Congress of Neurosurgery, Seoul, Korea 2013
48. Developmental Therapeutics for Malignant Brain Tumors. Korea University, Seoul, Korea 2013
49. Evolution of Cancer Stem Cells – Lesson from Brain Tumors. Departmental Biomedical Seminar Series, Department of Biology, University of Dayton, Dayton 2013
50. Proneural-Mesenchymal Transformation of Glioma Stem Cells. the 4th Quadrennial Meeting of the World Federation of Neuro-Oncology held in conjunction with the 18th Annual Meeting of the Society for Neuro-Oncology, San Francisco, California, 2013,
51. Proneural-Mesenchymal Transformation of Glioma Stem Cells. California Pacific Medical Center Research Institute, San Francisco,, California 2013
52. Proneural-Mesenchymal Transformation of Glioma Stem Cells. The 31st Annual Meeting of Japan Society of Neuro-Oncology, Miyazaki, Japan 2013
53. Proneural-Mesenchymal Transformation of Glioma Stem Cells. Ground Rounds, Department of Biological Sciences, University of Toledo, Toledo, 2014
54. Proneural-Mesenchymal Transformation of Glioma Stem Cells. The 32st Annual Meeting of Japan Society of Neuro-Oncology, Chiba, Japan 2014
55. Evolution of glioma stem cells. Invited seminar, Cornell University. New York 2014
56. Evolution of glioma stem cells. Invited seminar, Virginia Commonwealth University. Richmond 2014
57. Proneural-Mesenchymal Transformation of Glioma Stem Cells. Cancer Stem Cell Model meets Cellular Evolution Model. Translational Therapeutics Seminar Series, James Comprehensive Cancer Center, The Ohio State University, Columbus, Ohio 2014
58. Proneural-Mesenchymal Transformation of Glioma Stem Cells. Cancer Stem Cell Model meets Cellular Evolution Model. Ground Rounds, Department of Neurosurgery, UCSD, San Diego, 2014
59. Proneural-Mesenchymal Transformation of Glioma Stem Cells. Cancer Stem Cell Model meets Cellular Evolution Model. Joint Conference by Comprehensive Cancer Center and Stem Cell Center, UC Irvine, Irvine, 2014
60. Evolution of Glioma Stem Cells - Cancer Stem Cell Model meets Cellular Evolution Model. Invited Seminar, Cancer Center, Virginia Commonwealth University, Richmond, 2014
61. Evolution of Glioma Stem Cells - Cancer Stem Cell Model meets Cellular Evolution Model. Ground Rounds, Department of Neurosurgery, Mayo Clinic, Rochester, 2014
62. Evolution of Glioma Stem Cells - Cancer Stem Cell Model meets Cellular Evolution Model. 26th Kansai Neuro-Oncology Seminar Series, Department of Neurosurgery, Osaka Medical College, Japan, 2014
63. Therapeutic Development for Glioblastoma. Special Seminar, Department of Neurosurgery, Hiroshima University, Japan, 2014
64. Cancer Stem Cell Dynamics. Invited seminar, International session, Annual meeting for the Japan Cancer Society, Yokohama, Japan, 2014
65. Cancer Stem Cell in Brain Tumor. Invited seminar, Stem Cell and Cancer Conference, Montreal, Canada, 2014
66. Cancer Stem Cell Dynamics. Invited seminar, Annual meeting for Society of Brain Mapping and Therapeutics, Los Angeles, 2015
67. Evolution of Glioma Stem Cells - Cancer Stem Cell Model meets Cellular Evolution Model. Korean Cancer Center, Seoul, Korea, 2015
68. Evolution of Glioma Stem Cells - Cancer Stem Cell Model meets Cellular Evolution Model. Korea University, Seoul, Korea, 2015
69. Evolution of Glioma Stem Cells - Cancer Stem Cell Model meets Cellular Evolution Model. Japan Cancer Center, Tokyo, Japan, 2015
70. Evolution of Glioma Stem Cells - Cancer Stem Cell Model meets Cellular Evolution Model. Department of Neurosurgery, Kansai Medical College, Hirakata, Japan, 2015
71. Evolution of Glioma Stem Cells - Cancer Stem Cell Model meets Cellular Evolution Model. Department of Neurosurgery, Osaka City College, Osaka, Japan, 2015
72. Evolution of Glioma Stem Cells - Cancer Stem Cell Model meets Cellular Evolution Model. Department of Neurosurgery, Kansai Medical College, Hirakata, Japan, 2015
73. Evolution of Glioma Stem Cells - Cancer Stem Cell Model meets Cellular Evolution Model. Research Institute for Microbial Diseases, Osaka University, Osaka, Japan, 2015
74. Therapeutic Development for Glioblastoma. Special Seminar, Department of Neurosurgery, University of Alabama at Birmingham, Birmingham, 2015
75. Epithelial-Mesenchymal Transition in Glioblastoma. Chair of Cancer Stem Cell Session. 21st International Conference on Brain Tumor Research and Therapy, Okinawa, Japan, 2016
76. Selected Speaker, Therapy development for Glioblastoma. Christopher Davidson Forum, St. Louis, Missouri, September 2016
77. International Invited Speaker, Development of Phase 0/I clinical trial for brain cancers in the United States. Annual Meeting for Japan Neurosurgery Society, Fukuoka, Japan September 2016
78. International Invitation, Education for Physician Scientists in the United States. Annual meeting for the Japan Cancer Society, Yokohama, Japan, Oct 2016
79. Seminar, Signaling mechanism to control stemness in cancers. Korea National Cancer Center, Seoul, Oct 2016
80. Early morning lecture, Tumor heterogeneity in a single tumor of glioblastoma. Annual Meeting for the Society of Neuro-Oncology, Phoenix, Arizona, Nov 2016
81. ABTC Trial Concept Update: [drug name confidential] as a therapeutic agent for Glioblastoma, Adult Brain Tumor Consortium – Baltimore, MD. Dec 2016
82. Population Dynamics in Intra-tumoral Heterogeneous Cells and Therapy Development for Glioblastoma, Invited speaker, University of San Francisco, CA, Jan 2017
83. Career Development for the Physician Scientist Studying Cancer Therapies in the US, International invited speaker, Ehime University, Japan, Jan 2017
84. Neurosurgical research and treatment strategies, International invited speaker, 2017 Chang’an International Neurosurgery Summit Forum, Xi’an, China, Mar 2017
85. Moving targets in heterogeneous cells in single tumor and their population dynamics, International invited speaker, University of Toronto, Canada, Feb 2017
86. ABTC Trial Concept Update: [drug name confidential] as a therapeutic agent for Glioblastoma, Adult Brain Tumor Consortium – Baltimore, MD. Apr 2017
87. Comprehensive Team Approach for Brain Tumors, Guest Speaker, Fort Walton Beach Medical Center, Florida. April 2017
88. Fluorescence Technologies in Tumor Neurosurgery: Present and Future Directions. American Association of Neurological Surgeons Annual Meeting. Los Angeles, CA. Apr 24, 2017
89. The Spectrum of Adjuvant Therapy for Brain Tumors. Panelist. American Association of Neurological Surgeons Annual Meeting. Los Angeles, CA. Apr 26, 2017
90. Collaboration with Japanese Neuro-Oncology Groups. Kansai Medical University, Osaka City University, and RIKEN. July 01-02, 2017
91. Discussion for 5-ACA Surgery using Surgical Loupe and Translational Research Project to Collect Fluorescent Tumors. Osaka Medical University. July 05-06, 2017
92. Cancer heterogeneity – Lesson from glioma biology to capture a moving target. Winthrop P. Rockefeller Cancer Institute Grand Rounds, University of Arkansas for Medical Sciences. September 13, 2017.

GRANTS

Active Grants

R01NS083629 (PI: Lathia) 7/15/2013 – 6/30/2018 0.12 calendar

Subaward from Cleveland Clinic $14,000

Novel adhesion mechanisms in glioblastoma stem cells

The goal of this project is to uncover the critical role of CSC interaction with the niche via JAM-A and evaluate potential therapies to GBM which disrupt niche related communication.

*Role – Subaward PI*

R01NS083767 (PI: Nakano, Lee) 05/19/2016-04/30/2018 1.20 calendar

NINDS $210,820

Targeting MELK-mediated EZH2 signaling in glioma stem cells

The goal of this project is to find a new paradigm for glioma stem cell (GSC) biology and a novel therapeutic approach to target key regulators of GSC.

*Role – Contact PI*

R01NS087913 (PI: Rich, Nakano) 4/15/2014 - 2/28/2019 1.20 calendar

NINDS: Distribution from Cleveland $115,000

Metabolism informs intertumoral & intratumoral heterogeneity

**The goal of this project is** to translate our findings to develop therapeutics targeting the dysregulated metabolic signaling in GBM.

*Role – Principal Investigator (multi PI)*

R01CA183991 (PI: Nakano) 2/15/2015 - 1/31/2020 1.20 calendar

NCI $207,215

**Novel role of compensatory proliferation in human brain tumor**

The goal is to determine whether inter-cellular signaling between therapy-induced dying tumor cells and surviving cells leads to creation of recurrent tumors with even more therapy resistant phenotype.

*Role – Principal Investigator*

R01CA201402 (PI: Cerione, Nakano) 12/4/2015 - 11/30/2020 1.80 calendar

NCI: Distribution from Cornell $135,000

**The roles of a unique GTP-binding protein/crosslinking enzyme in disease**

The goal is to understand the biological roles of TGase-2 in disease, as well as identify novel therapeutic targets for EGFR/EGFRvIII-driven cancers such as GBM.

*Role – Principal Investigator (Multi PI)*

R01NS093843 (PI: Cheng) 9/1/2015 - 5/31/2020 0.12 calendar

Subaward from Northwestern $13,500

**Glioblastoma Phenotype Modulation Through miRNA Control of Wnt Signaling**

The goal is to understand how aberrant miR expression and Wnt signaling activity contribute to glioma malignancy.

*Role – Subaward PI*

R21CA198648 (PI: Iyer) 5/19/2016-4/30/2018 0.3 calendar

Subaward UT Austin $5,962

Novel role of the Polycomb repressive complex PRC2/EZH2 in glioblastoma

The goal is to establish, characterize and use patient-derived glioma neurosphere cultures and their mouse xenograft brain tumors to investigate the physiological role of EZH2 association with short NRAs in glioma stem cells

*Role – Subaward PI*

R25NS079188 (PI: Standaert) 7/01/2016-06/30/2022 N/A

NINDS $77,000

UAB Research and Education Program in Neuroscience

The goal is to support residents in neurology, neurosurgery, and neuropathology who are pursuing careers combining clinical practice and research, and foster their development as physician-scientists

*Role – Associate Director*

Pending Grants

R01 TBD (PI: Bhat) 7/1/2017 - 6/30/2022 0.12 calendar

Subaward from MD Anderson $50,000

Characterization and Targeting of the Cell Surface Protein CD109 in Glioblastoma

The major goal is to establish and identify cell surface markers for radio-resistance and clinical biomarkers associated with high grade gliomas

*Role- Subaward PI*

R01 TBD (PI: Chinnaiyan) 7/1/2017 - 6/30/2022 0.12 calendar

Subaward from Beaumont Research Institute $53,000

Defining the Biologic Consequence and Therapeutic Implications of Fatty Acid Oxidation (FAO) in Glioblastoma

The overall goal is to determine the *in vivo* efficacy of two compounds that target fatty acid oxidation in glioma stem cells in GBM.

*Role – Subaward PI*

P50 CA217670 (PI: Markert) 7/1/2017 - 06/30/2022 1.8 calendar

NCI $2,500,000

Contemporary Therapeutics for Anaplastic Gliomas

The goal of this project is to facilitate translational Brain Cancer research. There are two distinct interventional research Projects that will initiate two novel Phase I clinical trials, a reverse translation Project that will conduct correlative biology studies of specimens from an ongoing Phase 2/3 trial, and a population science Project that will evaluate DNA polymorphisms in mitochondrial DNA for risk factors related to development or progression of, or response to therapy in, malignant gliomas

*Role - Biospecimen and Glioma Models Core Leader, Clinical Co-Leader (project 2), DRP Leader*

U01 TBD (PI: Lee) 7/1/2017 - 06/30/2022 1.20 calendar

Subaward from OSU $150,000

Nanochannel Electroporation and Lipoplex Nanoparticle Biochips to Characterize Glioma Stem Cells

The goal of this proposal is to use novel nanotechnologies to enable the identification, isolation, and further biointerrogation of rare populations of aggressive glioma stem cells and their extracellular vesicles and facilitate the development of novel therapies to treat GBM relapse.

*Role – Subaward PI*

R21CA215872 (PI: Suswam) 4/1/2017-3/31/2019 0.24 calendar

NCI

PAD4-Mediated deamination of plectin 1 as a key regulator of glioma invasion

The goal of this proposal is to investigate a novel mechanism of glioma cell migration and invasion via PAD4-mediated deamination of plectin 1 and evaluation of a PAD inhibitor.

*Role: Co-Investigator*

R01 TBD (PI: Kango-Singh) 7/1/2017-6/30/2020 0.12 calendar

Subaward University of Dayton $74,250

Molecular networks and cellular mechanisms involved in tumorigenesis

The goal of this proposal is to combine Drosophila studies with human studies to yield insights about the molecular signaling interactions in glioma which will help to design better therapeutic strategies.

*Role: Sub-Award PI*

R01NS083767 renewal (PI: Nakano) 9/1/2017-8/31/2020 1.20 calendar

NINDS $1,493,475

Targeting the Dual EZH2 signaling in plastic glioma stem cells

The goal of this proposal is to determine the molecular mechanisms of the newly identified FOXM1-driven MELK/NEK2-to-EZH2 signaling axis in GBM cells and examine whether targeting this pathway would be a safe and efficient therapeutic strategy for GBM.

*Role – Principal Investigator*

Completed Grants

R21CA175875, PI: Nakano (Contact); Penalva $43,795

Role: PI 1/1/2014-12/31/2016

*Determination of Musashi1/CD44v6 signaling in mesenchymal glioma stem cells.*

5 R01 MH065756-05, PI: Kornblum, HI xwa$180,000.00

National Institutes of Health 07/01/2004 - 04/30/2008

Role: Assistant Researcher

*Identity and Function of CNS Progenitor Cell Genes*

It is hypothesized that genes expressed in multiple stem cell populations will play important roles in NSC self-renewal. The first two aims of this research will focus upon three genes that share the characteristics of restricted expression in CNS germinal zones and expression in multiple stem cell containing cultures: MELK, PSP, and TOPK.

Jonsson Cancer Center Foundation, PI: Kornblum, HI $150,000.00

Role: Co-Investigator 06/01/2005 - 05/31/2006

*Brain Tumor Stem Cells*

This research examines the relationship between brain tumor progenitors and neural stem cells and is designed to test the hypotheses that brain tumors contain cancer stem cells and that therapies directed towards blocking cancer stem cell self renewal will be effective treatments in animal models.

R01 NS052563-01(PI: Kornblum, HI) $198,822.00

National Institutes of Health 04/01/2006 - 03/31/2009

Role: Co-Investigator

*Neural Progenitor Genes and Brain Tumors*

This grant will test the specific role of MELK in glioma and medulloblastoma proliferation, will seek to develop novel therapeutics based on regulation of MELK expression, and will determine the role of other neural stem cell genes in brain tumor propagation.

The Childhood Brain Tumor Foundation (P.I.: Nakano, I) $50,000.00

 8/1/2006-7/31/2008

*A role of a transcription factor, FoXM1, in cancer stem cells in pediatric brain tumors.* The goal is to study the role of FoXM1 in normal neural stem cells and brain tumor stem cells to identify novel mechanisms of tumorigenesis and improve our understanding of the molecular pathways regulating the proliferation of normal and brain tumor stem cells.

The UCLA Neurosurgery Seed Grant (P.I.: Nakano, I) $15,000.00

*Characterization of a transcription factor, FoXM1, in brain tumor stem cells and identification of its small molecule inhibitors.*

The Institute for Stem Cell Biology and Medicine (P.I.: Nakano, I) $190,000.00

 11/1/2006-10/31/2008

This is a training fellowship to support young clinical investigators to enhance their career as a stem cell researcher, who seek to perform clinically-relevant research.

Vincent J. Sgro/The American Brain Tumor Association (P.I.: Nakano, I) $50,000.00

 7/1/2008-6/30/2009

*Targeting the key signaling pathways in brain tumor stem cells.*

Katie’s Kids for the Cure (P.I.: Nakano, I) $50,000.00

 7/1/2008-6/30/2010

*Targeting Maternal Embryonic Leucine-zipper Kinase in cancer stem cells in pediatric brain tumors.*

NIH 1R21CA135013-01A1 (P.I.: Nakano, I) $203,280.00

Impact Score: 139, Percentile: 12.6 9/1/2009-8/31/2011

*Characterization of CD44 in brain tumor stem cells*

In this proposal, we will undertake innovative strategies targeting molecular aberrations in brain tumor stem cells. The successful achievement of this proposal will enable us to launch novel therapeutic approaches for patients with brain tumors.

National Brain Tumor Foundation (P.I.: Nakano, I) $50,000.00

 1/1/10-12/31/11

*Targeting brain tumor stem cells via MELK inhibition (translational research award)*

American Brain Tumor Association (P.I.: Nakano, I) Direct cost: $75,000.00

 7/1/12-6/30/13, no cost extension until 12/31/2013

CD44v as a target in therapy-resistant mesenchymal glioblastoma

American Cancer Society (MRSG-08-108-01) (P.I.: Nakano, I) Direct cost: $729,000

 11/1/2008-10/30/2013, no cost extension until 6/30/2014

*Targeted inhibition of the key signaling pathways in pediatric brain tumors.*

OSU CCC/Pelotonia IRP Award, PI: Nakano, I; Cole S $50,000

 7/1/2015-6/30/2016

*Examining oscillatory Hes1 expression as a novel mechanism to support glioma stem cell proliferation and heterogeneity.*

R21CA192042, PI: Verbridge) $139,658

Role: Co-Investigator in Year 1 2/12/2015-1/31/2017

*Targeted electric field therapy for malignant infiltrative glioma*

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BOOK CHAPTERS

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OUTREACH PROGRAM

Chinese Medical Research Collaboration Meetings. Description: Travel to China to give seminars in the Beijing International Neurological Forum and at Chongqing Medical University regarding collaboration on medical research 2009 September

Partnership development, Neurosurgical Departments in Chinese Universities (Wuhan University and Xi’an University) 2010 July

Partnership development between Korea University and Ohio State University 2013

## ABSTRACTS *(selected)*

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