BIOGRAPHICAL SKETCH

Provide the following information for the key personnel in the order listed for Form Page 2.
Follow the sample format for each person. **DO NOT EXCEED FOUR PAGES.**

NAME	POSITION TITLE
Stephen Charles Strother	**Senior Scientist, Professor of Medical Biophysics**

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)*

INSTITUTION AND LOCATION	DEGREE (if applicable)	YEAR(s)	FIELD OF STUDY
Auckland University, Auckland, New Zealand	B.Sc.	1973 - 1976	Physics & Mathematics
Auckland University, Auckland, New Zealand	M.Sc.(Hons)	1977 - 1979	Physics
McGill University, Montreal, Canada	Ph.D.	1981 - 1985	Electrical Engineering
Memorial Sloan-Kettering Cancer Center, New York	Post. Doc.	1985 – 1989	PET Neuroimaging

A. Personal Statement

I am internationally recognized in the neuroimaging field for developing multivariate statistical and machine-learning-based analysis techniques [1,2,4-7,9,10,13-15], neuroinformatics standards, and related databases and optimization tools. Of direct relevance for validation of the Virtual Brain in the NRG I was a co-author on the first papers to describe multivariate predictive modeling in neuroimaging (Lautrup et al., Proc. Supercomputing in Brain Research, 1994; Morch N, et al. Lec. Notes Comp. Sci 1230, 1997), and I published one of the first papers on reproducibility metrics in neuroimaging (Strother et al., Hum Brain Mapp, 5:312, 1997). In 2002 my collaborators and I proposed a data-driven framework (dubbed NPAIRS) using reproducibility and prediction metrics for comparing and optimising neuroimage processing and analysis pipelines [1,5,6,15], and this has recently been extended to use state-of-the-art, mutual information approaches [13]. These pipeline optimization, predictive modeling and activation-pattern reproducibility themes are now appearing with increasing frequency in the neuroimaging and bioinformatics literature.

In addition to my analytic and machine learning research, my second strength supporting this proposal is my broad experience with optimizing clinical neuroimaging research using multivariate functional connectivity measurements. This was recognized as a member of the Biological Psychiatry Task Force that produced "good practice" guidelines for functional MRI in clinical research [11]. My clinical research focus within the NRG has been in collaboration with Rich Zemel, Tanya Schmah (Computer Science) and Grigori Yourganov (Ph.D. student) in Toronto, together with Steven Small (Neurology, Chicago) to study data dimensionality, and prediction in longitudinal data on stroke recovery [2,4,5]. By measuring the complexity of brain networks comparing methods for accurately measuring covariance dimensionality to analyze changes in functional connectivity over longitudinal stroke recovery [2,5], it appears that two measures of complexity of brain networks are significantly negatively correlated with behavioral measures of recovery [5]. This work is potentially important for both the NRG's virtual brain developments and validation, and translation to a focus on brain recovery in stroke and epilepsy patient data sets.

My third strength supporting the NRG proposal is my appointment in 2009 as the Associate Director of the Baycrest Site of the Centre for Stroke Recovery, a virtual centre linking three institutions funded by the Heart and Stroke Foundation of Ontario. This position recognizes my continuing leadership in spearheading the development of the Stroke Patient Recovery Research Database platform within the Centre. Recently within the NRG this work has been developed, in collaboration with Steven Small (Chicago) and Cathy Price (London), as a proposal for a multi-national set of linked databases and high-performance computer analysis platforms for predicting recovery from stroke [3].

B. Positions and Honors.
Positions and Employment

1976 – 1979, 1980 – 1981   Medical Physicist, Auckland Hospital, New Zealand

1979 – 1980   Postgraduate Student, Montreal Neurological Institute (MNI), McGill University, Canada.
1981 – 1985   Research Fellow, MNI, Montreal, Canada
1985 – 1989   Research Associate, Neurology, Memorial Sloan Kettering Cancer Center, New York
1989 – 1995   Assistant Professor, Radiology, University of Minnesota
1989 – 2001   Senior PET Physicist, PET Imaging Service, VA Medical Center, Minneapolis
1995 – 2002   Associate Professor, Radiology, University of Minnesota
1999 – 2001   Assoc. (99-01) & Full (01-04) Member of Graduate Faculty, Biomed Eng., U. of Minnesota
2002 – 2004   Professor, Radiology, University of Minnesota
2004 – present Senior Scientist, Rotman Institute-Baycrest Centre
2004 – present Professor Medical Biophysics, University of Toronto.
2007 – present Member, Institute of Medical Science, University of Toronto
2008 – present Core Member, Centre for Stroke Recovery, Heart & Stroke Foundation of Ontario
2009 – present Assistant Site Director, Centre for Stroke Recovery, Rotman Institute-Baycrest Centre

Selected Other Experience and Professional Memberships

1991 – 1997   National Test Consultant for PET scanners, VA National Acquisition Center, Hines, Illinois
1996 – present Member, Organization for Human Brain Mapping.
1997 – present Member, American Association for the Advancement of Science.
2001 – present Co-Founder (with M. Wernick, Ph.D), Neuroimaging Consulting Co., Predictek, Inc., Chicago.
2002   Chair, Special Review Committee, Neuroinformatics Technology Initiative (NIfTI), NIMH
2002 – 2007   Chair, Data Format Working Group for fMRI in NIfTI, sponsors NIMH, NINDS & NIBIB at NIH
2003 – present Associate Editor: Human Brain Mapping
2006 – 2009   External Advisory Board, functional Biomedical Informatics Research Network (fBIRN),
                NCRR/NIH
2007   Ad Hoc member of Behavioural Sciences - C grants review committee, CIHR, Canada
2008 – present Member, ISMRM
2009 – present Standing member, Neurotechnology Study Section , CSR, NIH

Honors

1979 – 1980   Rotary International Postgraduate Fellowship, Montreal Neurological Institute (MNI), Canada.
1984   50th Anniversary Fellows Research Essay Award, MNI, Canada (Joint with Dr. J. Tyler)
2004   Rotman Research Institute awarded CIHR Institutional Establishment Grant for startup
               funds to recruit Dr. Strother back to Canada as an outstanding Canadian Scientist.

C. Selected peer-reviewed publications (Selected from 95 peer-reviewed publications).

Most relevant to the current application

1. **Strother SC**, Anderson J, Hansen LK, Kjems U, Kustra R, Siditis J, Frutiger S, Muley S, LaConte S, Rottenberg D. The quantitative evaluation of functional neuroimaging experiments: The NPAIRS data analysis framework. *Neuroimage* 15:747-771, 2002.

2. Schmah T, Yourganov G, Zemel RS, Hinton GE, Small SL, **Strother SC**, "Comparing classification methods for longitudinal fMRI studies.," *Neural Computation,* (in press).

3. Gee T, Kenny S, Price CJ, Seghier ML, Small SL, Leff AP, Pacurar A, **Strother SC.** Data Warehousing Methods and Processing Infrastructure for Brain Recovery Research. *Archives Italiennes de Biologie* (in press).

4. Yourganov G, Schmah T, Small SL, Rasmussen PM, **Strother SC.** Functional connectivity metrics during stroke recovery. *Archives Italiennes de Biologie* (in press).

5. Yourganov G, Chen X, Lukic A, Grady C, Small SL, Wernick M, **Strother SC**. Dimensionality Estimation for Optimal Detection of Functional Networks in BOLD fMRI Data. *Neuroimage* (in press)

Additional recent publications of importance to the field (in chronological order)

6. **Strother SC**, La Conte S, Hansen LK, Anderson J, Zhang J, Pulapura S, Rottenberg D, "Optimizing the fMRI data-processing pipeline using prediction and reproducibility performance metrics: I. A preliminary group analysis," *Neuroimage*, vol. 23 Suppl 1, pp. S196-207, 2004.

7. LaConte S, **Strother SC**, Cherkassky V, Anderson J, Hu X. Support Vector Machines for Temporal Classification of fMRI Data. *Neuroimage*, 26:317-329, 2005.

8. **Strother SC**, "Evaluating fMRI preprocessing pipelines," Invited Review Paper: *IEEE Eng Med Biol Mag*, vol. 25, pp. 27-41, Mar-Apr 2006.

9. Lukic AS, Wernick MN, Tzikas DG, Chen X, Likas A, Galatsanos NP, Yang Y, Zhao F, **Strother SC.** Kernel Methods for Analysis of Functional Neuroimages. *IEEE Trans Med Img.* 26(12):1613-24, 2007.

10. Schmah T, Hinton G, Zemel RS, Small SL, **Strother SC**. Generative versus discriminative training of RBMs for classification of fMRI images. *Proc. Neural Information Processing Systems*, 1409-1416, 2008

11. Carter CS, Heckers S, Nichols T, Pine DS, **Strother SC**. Optimizing the Design and Analysis of Clinical FMRI Research Studies. *Biol Psychiatry* 64(10):842-9, 2008.

12. Grady C, Protzner A, Kovacevic N, **Strother SC**, AfshinPour B, Wojtowicz M, Anderson J, Churchill N, McIntosh AR. A Multivariate Analysis of Age-Related Differences in Default Mode and Task-Positive Networks across Multiple Cognitive Domains," *Cereb Cortex*, Sep 29 2009.

13. AfshinPour B, Hamid S-Z, Gholam-Ali H-Z, Grady, C, **Strother SC**. Mutual Information Based Metrics for Evaluation of fMRI Data Processing Approaches. *Human Brain Mapp* Advance online publication. doi:10.1002/hbm.21057, 2010.

14. Wernick MN, Yang Y, Brankov JG, Yourganov G, **Strother SC**. Machine Learning In Medical Imaging. Invited Review Paper: *IEEE Sig Proc Mag* 27:25-38, 2010

15. **Strother SC**, Oder A, Spring R, Grady C. The NPAIRS Computational Statistics Framework for Data Analysis in Neuroimaging. *Proc. 19th Int. Conf. on Computational Statistics: Refereed Keynote, Invited and Contributed Papers*, Lechevallier, Yves; Saporta, Gilbert (Eds.), pp. 111-120, Physica-Verlag, Berlin, 2010

D. Research Support.

Ongoing Research Support
GFN 341638 NSERC   04/1/2010-03/31/2016
Discovery Grant (P.I., S. Strother, Canada)
Optimizing signal detection in functional neuroimaging using resampled performance metrics
This projects goal is to use simulations to develop state-of-the-art statistical resampling techniques that optimize multivariate network detection algorithms in functional neuroimaging.

CBrain Networking (P.I. A. Evans, Canada)
CANARIE, Inc. (Canada's Advanced Network Organization)   10/1/2008 – 09/30/2010
Canadian Brain Imaging Research Network (CBrain)
This project's goal is to develop a platform for distributed processing and exchange
of 3D/4D brain imaging data.
Role: P.I. of Subcontract to Rotman Research Institute, Baycrest

MOP 84483, CIHR (P.I., S. Strother, Canada)   1/7/2007 ─ 30/6/2011
Canada Institutes for Health Research: Aging Institute
Towards Clinical fMRI: Characterizing a Rapid, Multi-Task, fMRI Battery as a Function of Age
A study designed to develop and test the repeat scan reliability of a multi-task, clinical testing battery using neuropsychological tasks that require movement and speech in the fMRI scanner.
Role: Principal Investigator

Bridging Brain, Mind, and Behavior (P.I. R. McIntosh, Canada)   7/01/2005 – 6/30/2010
James S. McDonnell Foundation, USA
Network mechanisms underlying cognition and recovery of function in the human brain
An international group of researchers (Brain Network Recovery Group) representing the union of computational, cognitive and clinical neuroscience dedicated to the application of neural network theory to understanding the damaged brain.
Role: Co-Investigator, Computational Neuroscience Project

Centre for Integrated Molecular Brain Imaging   01/01/2006 – 12/31/2010
Lundbeck Foundation, Denmark (P.I. GM. Knudsen, Denmark)
An international group of researchers studying the serotonergic system in six project groups: (1) Molecular brain imaging of the Serotonergic system; (2) Genetic and biochemical determinants of the serotonergic

transmitter system; (3) Relation between personality, biochemistry and brain structure; (4) Functional brain imaging under serotonergic challenges; (5) Development of a PET agonist tracer to probe endogenous serotonin release; (6) A meta-analytic approach to knowledge discovery
Role: Co-Investigator, Project 6 (P.I., L. K. Hansen, Denmark). Supports one visiting Danish PhD student for one year at the Rotman Research Institute.

2 R44MH073204-02 (P.I. A. Lukic, Predictek, Inc., Chicago, USA) 12/01/2007—11/30/2010
NIH/NIMH, Phase 2 SBIR
Detection of Drug Effect in Small Groups using PET
The goal is to improve detection of drug-no drug effects in FDG PET images in small
samples using state-of-the-art machine learning techniques to measure network biomarkers.
Role: Co-investigator

<u>**Completed Research Support**</u>
1 R43 MH07320-01 (P.I. A. Lukic, Predictek, Inc., Chicago, USA) 3/04/2006—2/28/2008
NIH/NIMH, Phase 1 SBIR
Detection of Drug Effect in Small Groups using PET
The goal is to improve detection of drug-no drug effects in FDG PET images in
small samples using state-of-the-art machine learning techniques to measure network biomarkers.
Role: Co-investigator

1 P20 MH072580-01 (P.I. M. Gazzaniga, USA) 5/01/2005 – 3/31/2007
NIH/NIMH
Hypothesis-Driven fMRI Research via Database Mining, Management, and Visualization
This program project uses the large-scale database of complete fMRI studies from the peer-reviewed literature stored at the fMRI Data Center (fMRIDC) at Dartmouth College to obtain new knowledge about human brain function with novel, hypothesis-driven fMRI experiments into the neurophysiological correlates of cognitive function.
Role: P.I. Project 3, Optimizing fMRI Processing Pipelines
The goal of this project is to use the performance metrics for evaluation of fMRI processing tools developed in (P20 EB02013; P.I.:Rottenberg), to optimize processing for a cross-section of data sets from the public repository of fMRI data at the fMRIDC. The software for generating performance metrics will also be made widely available to users of the fMRIDC's computing facilities and data base.

1 R43 EY15604 (Pl. A. Lukic, Predictek, Inc., Chicago, USA) 6/01/2004 – 5/31/2006
NIH/NEI, Phase 1 SBIR
Multispectral diagnostic imaging of the iris
Development of an imaging system for diagnosis of diseases of the iris that can lead to glaucoma.
Role: Co-investigator

P20 EB02013 (P.I. D.A. Rottenberg, USA) 10/01/2001 - 09/30/2006
NIH/NIBIB
Spatial and Temporal Patterns in Functional Neuroimaging
The goal of this program project is to model and visualize spatial and temporal patterns of functional activation obtained from O-15 water PET and 1.5T and 4T fMRI neurocognitive studies.
Role: P.I. Project 2, Concensus patterns in functional neuroimaging.
The goal of this project is to develop further quantitative measures of functional neuroimage quality and to apply them to a range of fMRI data sets to assess the importance of a range of preprocessing and consensus data analysis techniques.