BIOGRAPHICAL SKETCH

NAME: Martin Styner

eRA COMMONS USER NAME (credential, e.g., agency login): MARTIN_STYNER

POSITION TITLE: Associate Professor

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Completion Date MM/YYYY	FIELD OF STUDY
Federal Institute of Technology, Zurich, Switzerland	MSc	06/1997	Computer Science
University of North Carolina at Chapel Hill	PhD	07/2001	Computer Science

A. Personal Statement

Dr Styner is one of the leading experts in medical image computing with specific expertise in anatomical structure and tissue segmentation, structural brain morphometry, deformable registration, atlas building and diffusion MRI analysis. He applies his research mainly to medical imaging studies of the human, non-human primate, and rodent brain. Dr. Styner has co-authored over 350 papers in peer reviewed journals and conferences. He is on the editorial board of “Medical Image Analysis”, the premier journal in the field of medical image computing. As the director of the UNC Neuro Image Research and Analysis Laboratory and associate director of the Developmental Neuroimaging Core in the Carolina Institute for Developmental Disabilities at UNC, he oversees many medical image analysis research projects in a variety of applications. In this project, Dr Styner will guide and supervise aspects of image analysis, and tool development performed at UNC.

1) Girault JB, Munsell BC, Puechmaille D, Goldman BD, Prieto JC, **Styner M,** Gilmore JH. White matter connectomes at birth accurately predict cognitive abilities at age 2. NeuroImage. 2019 27;192:145–55. PMCID: PMC6453706

2) Hazlett HC, Gu H, Munsell BC, Kim SH, **Styner M,** Wolff JJ, Elison JT, Swanson MR, ZHU H, Botteron KN, et al. Early brain development in infants at high risk for autism spectrum disorder. Nature. 2017;542(7641):348–351, PMCID: PMC5336143.

3) S. H. Kim, I. Lyu, V. S. Fonov, C. Vachet, H. C. Hazlett, R. G. Smith, J. Piven, S. R. Dager, R. C. McKinstry, J. R. Pruett, A. C. Evans, D. L. Collins, K. N. Botteron, R. T. Schultz, G. Gerig, **M. Styner**, (2016) Development of cortical shape in the human brain from 6 to 24months of age via a novel measure of shape complexity.,NeuroImage, 135, pp. 163–176. PMCID PMC4915970.

4) Verde AR, Budin F, Berger J-B, Gupta A, Farzinfar M, Kaiser A, et al., **Styner M** (2014). UNC-Utah NAMIC framework for DTI fiber tract analysis. Front Neuroinform, 7, 51. PMCID: PMC3885811

B. Positions and Honors

Positions and Employment

1995-1997 Developer, MRI imaging software, Spectrospin AG, Faellanden, Switzerland
1997-1998 Research Assistant at Image processing laboratory, ETH Zurich, Switzerland
1998-2001 Research Assistant at Neuro Image Analysis Laboratory, UNC Chapel Hill, USA
2001-2002 Project leader at the Duke Image Analysis Laboratory, Duke University, Durham
2002-2004 Director Medical Image Analysis, M.E.Müller Institute, University of Bern, Switzerland
2002-2004 Deputy project leader of Swiss ORTHOMIS project, COME, Switzerland
2004-2008 Research Assistant Professor, Department of Psychiatry, UNC Chapel Hill
2004-2012 Research Assistant Professor, Department of Computer Science, UNC Chapel Hill
2008-2012 Assistant Professor, Departments of Psychiatry, UNC Chapel Hill
2004-present Director Neuro Image Research and Analysis Laboratory, Psychiatry, UNC
2004-present Associate Director Developmental Neuroimaging Core, CIDD, UNC Chapel Hill
2012-present Research Associate Professor, Departments of Computer Science, UNC Chapel Hill
2012-present Associate Professor, Departments of Psychiatry, UNC Chapel Hill

Other Experience and Professional Memberships

Since 1998 Member IEEE (The Institute of Electrical and Electronics Engineers)

Since 2005 Member MICCAI (The Medical Image Computing and Computer Assisted Intervention Society)

Since 2007 Editorial Board Medical Image Analysis (Elsevier)

Conference organization: Conference Chair Image Processing at SPIE Medical Imaging 2013, 2014, 2015, 2016, Conference Chair Information Processing in Medical Imaging IPMI 2017, Workshop chair at MICCAI conference 2005, 2014, Program Committee MICCAI conference 2005 – 2013.

C. Contributions to Science (Google Scholar h-index = 57 and >12,500 citations, >350 indexed papers)

Full list of publications is available here on my NCBI:
http://www.ncbi.nlm.nih.gov/sites/myncbi/martin.styner.1/bibliography/40334614/public

C.1. Structural shape analysis: Shape analysis is of high interest to the biomedical sciences due to its potential to precisely locate morphological changes in pathological structures. My research has been both instrumental in establishing shape analysis in neuroimaging, as well as creating a publicly available analysis framework called SPHARM PDM for the general user. This popular open-source software tool has been used by the biomedical research community to analyze the morphology of anatomical structures in large variety of applications

a) Tu L, Styner M, Vicory J, Elhabian S, Wang R, Hong J, Paniagua B, Prieto JC, Yang D, Whitaker R, Pizer SM. Skeletal Shape Correspondence Through Entropy. IEEE Trans Med Imaging. 2018 Jan;37(1):1–11. PMCID: PMC5943061
b) Cevidanes LHS, Walker D, Schilling J, Sugai J, Giannobile W, Paniagua B, et al, **Styner M** (2014). 3D osteoarthritic changes in TMJ condylar morphology correlates with specific systemic and local biomarkers of disease. Osteoarthr. Cartil., 22(10), 1657–67. PMCID: PMC4185299
c) McClure RK, **Styner M**, Maltbie E, Lieberman JA, Gouttard S, Gerig G, et al. (2013) Localized differences in caudate and hippocampal shape are associated with schizophrenia but not antipsychotic type. Psychiatry research. 211(1):1–10. PMCID: PMC3557605
d) Styner M, Lieberman JA, McClure RK, Weinberger DR, Jones DW, Gerig G. (2005). Morphometric analysis of lateral ventricles in schizophrenia and healthy controls regarding genetic and disease-specific factors. Proc. Natl. Acad. Sci. U.S.A., 102(13), 4872–7. PMCID: PMC555727

C.2. Diffusion MRI analysis and artifact correction: Diffusion tensor imaging (DTI) has become an important modality in the field of neuroimaging to capture changes in micro-organization and to assess white matter integrity or development. Our research has yielded both an openly available analysis framework for the analysis of DTI data along white matter fiber tracts, as well as significant methodological advancements to the image analysis field, particularly to the automatized quality assessment and artifact correction such as motion.

a) Prieto JC, Ngattai PD, Belhomme G, Ferrall J, Patterson B, **Styner M**. TRAFIC: fiber tract classification using deep learning. SPIE Medical Imaging; 2018. p. 37–10. PMCID: PMC5956534
b) Oguz I, Farzinfar M, Matsui J, Budin F, Liu Z, Gerig G, Johnson HJ, **Styner M**. (2014) DTIPrep: quality control of diffusion-weighted images. Front Neuroinform, vol. 8, p. 4, 2014, PMCID: PMC3906573
c) Verde AR, Budin F, Berger J-B, Gupta A, Farzinfar M, Kaiser A, et al., **Styner M** (2014). UNC-Utah NAMIC framework for DTI fiber tract analysis. Front Neuroinform, 7, 51. PMCID: PMC3885811
c) Farzinfar M, Oguz I, Smith RG, Verde AR, Dietrich C, Gupta A, et al., **Styner M** (2013). Diffusion imaging quality control via entropy of principal direction distribution. NeuroImage, 82, 1–12. PMCID: PMC3798052

C.3. Medical Image Computing for the developing brain: Neuroimaging of the early postnatal brain development is particularly difficult due the low signal-to-noise settings, presence of motion and changing structural MR image contrast in the first two years of life. Our research group has contributed important methods and tools to the field to properly analyze such data.

a) Mostapha M, **Styner M**. Role of deep learning in infant brain MRI analysis. Magn Reson Imaging. 2019 epub, in press, PMID: 31229667.

b) Lyu I, Kim SH, Girault JB, Gilmore JH, **Styner M**. A cortical shape-adaptive approach to local gyrification index. Med Image Anal. 2018 Jun 28;48:244–58. PMCID: PMC6167255
c) Kim SH, Lyu I, Fonov VS, Vachet C, Hazlett HC, Smith RG, Piven J, Dager SR, McKinstry RC, Pruett JR, et al **Styner M**. Development of cortical shape in the human brain from 6 to 24months of age via a novel measure of shape complexity. NeuroImage. 2016;135:163–176, PMCID: PMC4915970
d) Wang J, Vachet C, Rumple A, Gouttard S, Ouziel C, Perrot E, et al., **Styner M**. (2014). Multi-atlas segmentation of subcortical brain structures via the AutoSeg software pipeline. Front Neuroinform, 8, 7. PMCID: PMC3915103

C.4. MRI studies of early postnatal brain development: Neuroimaging of the early postnatal development has the potential to provide pre-diagnostic MRI based markers of developmental disorders. With that goal in mind, we have applied our methods and tools (C.1-3) for the analysis of diffusion MRI and structural MRI in that field of application resulting in numerous significant publications.

a) Girault JB, Cornea E, Goldman BD, Knickmeyer RC, **Styner M,** Gilmore JH. White matter microstructural development and cognitive ability in the first 2 years of life. Hum Brain Mapp. 2019 March ;111(20):7456.
b) Hazlett HC, Gu H, Munsell BC, Kim SH, **Styner M,** Wolff JJ, Elison JT, Swanson MR, ZHU H, Botteron KN,et al. Early brain development in infants at high risk for autism spectrum disorder. Nature. 2017;542(7641):348–351, PMCID: PMC5336143.
c) Lee SJ, Steiner RJ, Yu Y, Short SJ, Neale MC, **Styner M**, ZHU H, Gilmore JH. Common and heritable components of white matter microstructure predict cognitive function at 1 and 2 y. Proceedings of the National Academy of Sciences. 2017;114(1):148–153, PMCID: PMC5224366
d) Knickmeyer RC, Wang J, ZHU H, Geng X, Woolson S, Hamer RM, Konneker T, **Styner M**, Gilmore J. (2013). Impact of Sex and Gonadal Steroids on Neonatal Brain Structure. Cerebral cortex. PMCID: PMC4153808

C.5. Quantification from MRI and CT: In recent years, our lab has adapted sophisticated image analysis methods for the quantitative analysis of water and fat content in MRI and CT, allowing for the enhanced assessment of such data in applications to brain development, Duchenne's muscular dystrophy, exercise exposure and craniofacial surgery.

a) Styner M, Pagnotti GM, McGrath C, Wu X, Sen B, Uzer G, Xie Z, Zong X, **Styner M,** Rubin C, Rubin (2017). Exercise Decreases Marrow Adipose Tissue Through ß-Oxidation in Obese Running Mice. J Bone Miner Res, 32(8), 1692–702. PMCID: PMC5550355
b) Lee K, Cherel M, Budin F, Gilmore J, Consing KZ, Rasmussen J, et al. **Styner M** (2015) Early Postnatal Myelin Content Estimate of White Matter via T1w/T2w Ratio. Proc SPIE Int Soc Opt Eng.;9417. PMCID: PMC4657562
c) Fan Z, Wang J, Ahn M, Shiloh-Malawsky Y, Chahin N, Elmore S, Bagnell Jr. CR, Wilber K, An H, Lin W, Zhu H, **Styner M**, Kornegay J. (2013). Characteristics of magnetic resonance imaging biomarkers in a natural history study of golden retriever muscular dystrophy. Neuromuscul Disord, 24(2), 178–91. PMCID: PMC4065593
d) de Paula LK, Ruellas ACO, Paniagua B, **Styner M**, Turvey T, Zhu H, et al. (2013). One-year assessment of surgical outcomes in Class III patients using cone beam computed tomography. Int J Oral Maxillofac Surg, 42(6), 780–9. PMCID: PMC3970766

D. Additional Information: Research Support and/or Scholastic Performance

R21 AG059065, Styner (PI) 1/7/18-6/30/20, **Longitudinal Analysis of the dynamic network disruptions in Alzheimer's disease,** This project develop the first longitudinal brain network analysis tool and it to structural connectivity data computed from ADNI database to investigate how Alzheimer's disease disrupts aging brain connectivity in AD progression. Role: Co-Principal Investigator

R01 EB021391, Paniagua (Styner, UNC-PI) 12/21/16-06/30/20, **Shape Analysis Toolbox for Medical Image Computing Projects.** Shape analysis allows biomedical scientists to precisely locate shape changes in their imaging studies. This software maintenance grant develops and maintains a crucial resource for the imaging field that will enable many and important new findings in biomedical imaging studies. Role: Subcontract PI

R01 HD089390, Verma (Styner, UNC-PI), 02/01/17-01/31/22, **Temporal connectomics for infant brain: neuro-development modulated by pathology**, We aim at comprehensive analysis of diffusion structural connectivity in high- and low-risk populations, to elucidate the earliest manifestation of Autism. Role: Site PI

R01 MH105538, Wadhwa (Styner, UNC-PI), 02/01/16-05/31/20, **Intergenerational Effects of Maternal Childhood Trauma on the Fetal Brain.** We investigate the intergenerational transmission of the effects of maternal exposure to severe trauma in her childhood, with outcomes related to fetal development and on the role of maternal-placental-fetal endocrine and immune biology as the pathway of transmission. Role: Site PI

R33 MH104198 Coe (Styner UNC-PI), 07/01/16-06/30/20, **Maternal and infant microbiome determinants of brain and behavioral development.** This project investigates how the maternal microbiota are transferred and established in the young infant, and the pathways through which gut bacteria and the enteric nervous system affect the developing central nervous system Role: Site PI

R01 MH109662 Davis/Hankin (Gilmore, UNC-PI), 04/01/17-03/31/22, **Reducing Fetal Exposure to Maternal Depression to Improve Infant Risk Mechanisms,** This project tests whether manipulating maternal depressive symptoms will benefit infant outcomes. Maternal depressive symptoms will be reduced using brief interpersonal therapy (IPT) and testing whether this reduction leads to an improvement in the development of infant mechanisms associated with risk for later psychopathology. Role: Subcontract Investigator

R01 MH104324, Elison (Styner UNC-PI) , 07/01/14-06/30/20, **Infant and Brain Behavioral Signatures of Later Emerging Risk for Psychopathology**, the primary goal is to characterize the developmental pathways that anticipate and predict later emerging patterns of clinically impairing behavior and thus could potentially be targeted in future efforts aimed at strategic prevention of mental illness. Role: Site PI

R01 HD090068, Kim (Styner UNC-PI), 02/01/17-01/31/22, "**Prenatal Pathways for How Poverty Influences Brains of Two Generations",** We will determine how a mother's prenatal exposure to poverty could influence the development of her fetus's brain, as well as her own brain's adaptation to parenthood. Role: Site PI

R01 MH070890, Gilmore (PI) , 07/13/04-03/31/20, **Early Brain Development in Twins**: This project will continue our study of early childhood brain development in twins, using structural MRI, diffusion tensor imaging, and cognitive assessments. Role: Co-Investigator

R01 MH111944, Gilmore (PI) , 07/01/17-06/30/22, **"The Origins of Preadolescent Risk for Psychiatric Disorders in Early Childhood Brain Development"**. Knowledge gained in this study will improve our basic understanding of brain development in childhood to delineate predictors of risk phenotypes in late childhood, and ultimately help target periods of childhood development for early intervention. Role: Investigator

R21 MH104330 Santelli-Knickmeyer (PI), 07/01/14-06/30/20, **Gut Microbiota and Anxiety: A Mechanistic Study of Human Infants,** This will be the first study to test if and how microbial composition relates to anxious behavior in a human cohort. It is an essential first-step in developing novel interventions to promote a healthy microbiome and reduce risk for psychiatric illness. Role: Investigator

R01 MH110274, Piven (PI), 2001/17-06/30/21, **A Longitudinal Brain and Behavior Study of Autism from Infancy through School Age,** The main goals are a) to identify predictors of school-age cognitive, behavioral and learning problems, b) to characterize the brain development in autism from infancy through school age; (c) to derive new HR subgroups based on longitudinal brain and behavior. Role: PI of Imaging Core

R01 HD091148, Propper/Short (PI), 04/01/17-03/31/22, **A Mechanistic Study of the Association Between Poverty and Executive Functions in Early Childhood:** This study will investigate the influence of poverty on executive functioning at age 3 and neurological development over the first two years. Role: Investigator

U01 MH110274, Lin/Gilmore (PI), 09/01/16-05/31/20, **UNC/UMN Baby Connectome Project:** This is a hybrid longitudinal/cross-sectional project designed to enable detailed characterization of early brain development and balances between advantages offered by a longitudinal design and attribution rate. Role: Investigator

P50MH106438, Amaral (Styner UNC-PI), 04/01/17-03/31/20, **Project 3: Multimodal Neuroimaging of Altered Brain Development in Maternal Immune Activation Models and Schizophrenia'**, The objectives are to establish MIA-induced abnormal brain organization signature in the NHP and compare it to that of MIA-exposed mice and human patients undergoing their first episode of SZ. Role: PI of Subcontract

P50 MH100029, Bachevalier (Styner, UNC-PI) 06/01/12-05/31/22, **CYCLES OF SOCIAL CONTINGENCY: PIVOTAL TRANSITIONS THAT SHAPE BRAIN-BEHAVIOR DEVELOPMENT IN MONKEYS, Project 1** – this

project proposes a nonhuman primate model for interrogating the underpinnings of social disability in genes, brain, and behavior. Role: UNC site PI

R01HD089989, Rao (Styner, UNC-PI) 09/22/17-06/30/22**, Detection and Correction of Iron Deficiency Induced Abnormal Brain Metabolism,** The goal is to develop new biomarkers for detecting early risk of brain impairment, and to confirm that iron supplementation earlier than the current recommendation will help promote healthy brain development in vulnerable children. Role: UNC site PI

R01AG064086, Wu (PI), 07/01/19-06/30/24, **Enabling Precision Medicine for Early Diagnosis of Alzheimer's Disease by Establishing a Neurobiological Basis Through Functional Neuroimaging Genetics**: The proposed study is built upon our previous works on functional dynamics, brain-wide genome-wide association, and neuroimaging-based classification method for early AD detection, Role: Investigator

R00MH108700, Swanson (Styner, UNC-PI), 05/01/19-04/30/22, **Early Social Communication Environment and Brain Development in Infants at Risk for Autism,** This longitudinal descriptive study in typically developing infants identifies periods of time when the caregiver speech has an especially pronounced impact on infant brain (as assessed via MRI) and behavior development. Such findings could provide key insight into the optimal timing and targets for future intervention studies. Role: Investigator

Completed research support (within last 3 years):

R01 DE024450 Cevidanes (Styner, UNC-PI) 07/01/09-06/30/19, **Quantification of 3D Bony Changes in Temporomandibular Joint Arthritis:** This work establishes robust imaging shape biomarkers for the diagnosis and assessment of the progression of Temporomandibular Joint (TMJ) in diseases of arthritic origin. Role: Site PI

U54 HD079124, Piven (PI), 09/24/13-06/30/18, **Clinical Translational Research Center for Neurodevelopmental Disorders.** This proposal has the overarching goal of supporting and promoting research relevant to understanding the pathogenesis and treatment of neurodevelopmental disorders. Role: Investigator

R01 HD055741, Piven (PI), 06/01/07-06/30/18, **A Longitudinal MRI Study of Infants at Risk for Autism: Autism Centers of Excellence (ACE) Network**: This collaborative network examines the brain of siblings of autistic individuals in a longitudinal study from 6 to 24 months of age. Role: Co-PI Neuroimaging Core

R01 MH064708 Reiss (PI), 07/05/12-06/30/17, **Longitudinal MRI Study of Brain Development in Fragile X**, This project is a longitudinal follow-up that provides a unique opportunity to elucidate the neurobiological basis and development in FXS that will have important implications for treatment. Role: Co-Investigator

R01 MH092335, Santelli (PI), 12/01/10-11/30/16, **Genome-wide Identification of Variants Affecting Early Human Brain Development:** This projects primary objective is to identify common and rare genetic variants which impact brain development in the early postnatal period. Role: Co-Investigator

R01 MH091645, Styner (PI), 07/01/10-03/30/16, **Developmental Brain Atlas Tools and Data Applied to Human**s and Macaques: This project generates a publicly available resource comprised of a developmental macaque brain MRI database with the corresponding computational toolbox for brain atlas building. Role: PI

P50 MH100034 Davidson (Styner, UNC-PI), 09/01/13-08/31/18, **Early Neurodevelopmental Origins of Anxiety**: Using a combination of structural, functional and diffusion MRI in humans and rhesus monkeys, we will characterize circuits that underlie anxiety and determine their expression and development over the first two years of life. Role: Site PI

R56NS097831, Philpot/Hazlett (PI's), 09/30/17-09/29/18, **White Matter Fiber Tract Pathology in a Genetically-Defined Neurodevelopmental Disorder**, Our research tests that white matter pathway impairments in Angelman Syndrome arise from delayed myelination and a loss of large-diameter axons that can be prevented by reinstatement of UBE3A expression in neurons. Role: Investigator

R01 HD053000, Gilmore (PI), 03/01/07-08/31/18, **Early Brain Development in One and Two Year Olds,** We will study early childhood brain development from birth to age 6 years using MRI in order to provide a improved framework for understanding abnormalities of early childhood brain development. Role: Investigator