THE mARTinos GALLERY

Often, we undermine the intersection between art and science. Here at the Martinos Center, while we're trying to devise techniques to make a difference in the scientific and medical world, we pause to marvel at the beauty of the human body observed through our images.

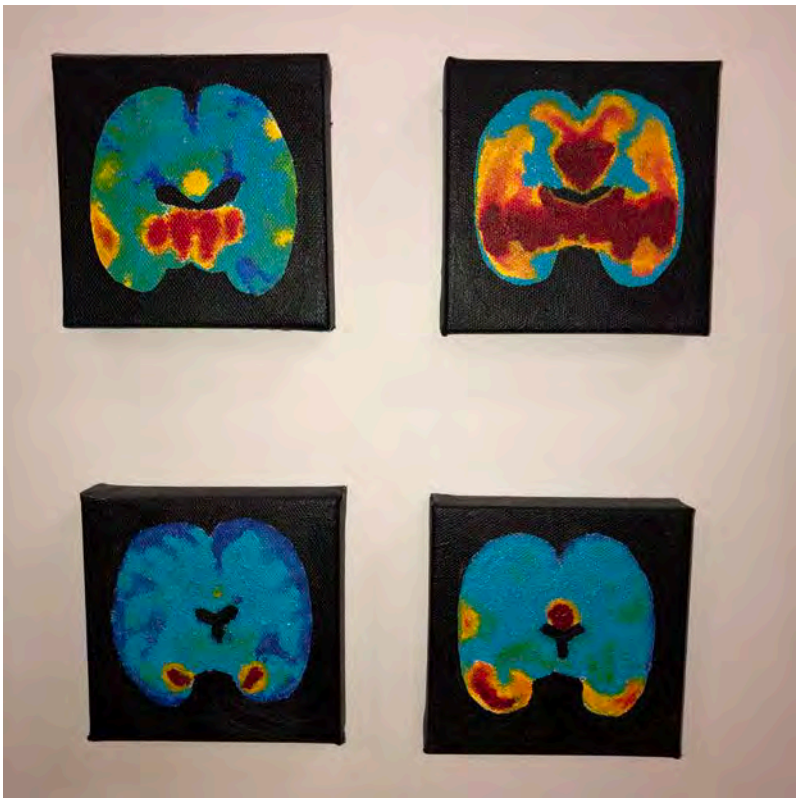
A special thanks to all of those who contributed and all of those who came and showed support!

CONTENT

ARTIST PROFILES

ARABIYE ARTOLA

FAMILIAL ALZHEIMER'S DISEASE

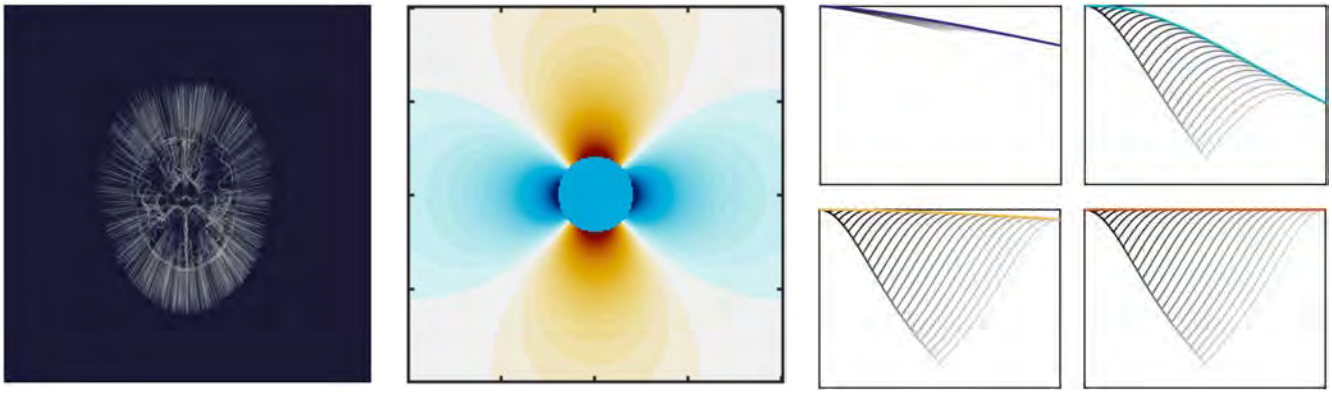


Arabiye is a clinical research coordinator for the Familial Dementia Neuroimaging Lab. In her free time she enjoys yoga and cooking and will occasionally dabble in acrylic/watercolor painting.

Canvases recreating the PET images from a Colombian Cohort showing Amyloid-β + Tau accumulation in unimpaired and impaired autosomal-dominant Alzheimer's Disease mutation carriers

AVERY BERMAN | VESSELNESS

Avery is a research fellow working in the Magnetic Resonance Physics & Instrumentation Group under the supervision of Dr. Jonathan Polimeni. Avery's research seeks to improve the specificity of functional MRI to neural activity through developing high-resolution fMRI pulse sequences and modeling the underlying vascular responses to brain activity. Prior to joining the Martinos Center, Avery did his Ph.D. in Biomedical Engineering at McGill University in Montreal, where he studied the biophysical basis of the blood oxygenation level-dependent (BOLD) signal—the most widely used form of functional MRI—to simplify the measurement of oxygen consumption across the brain.



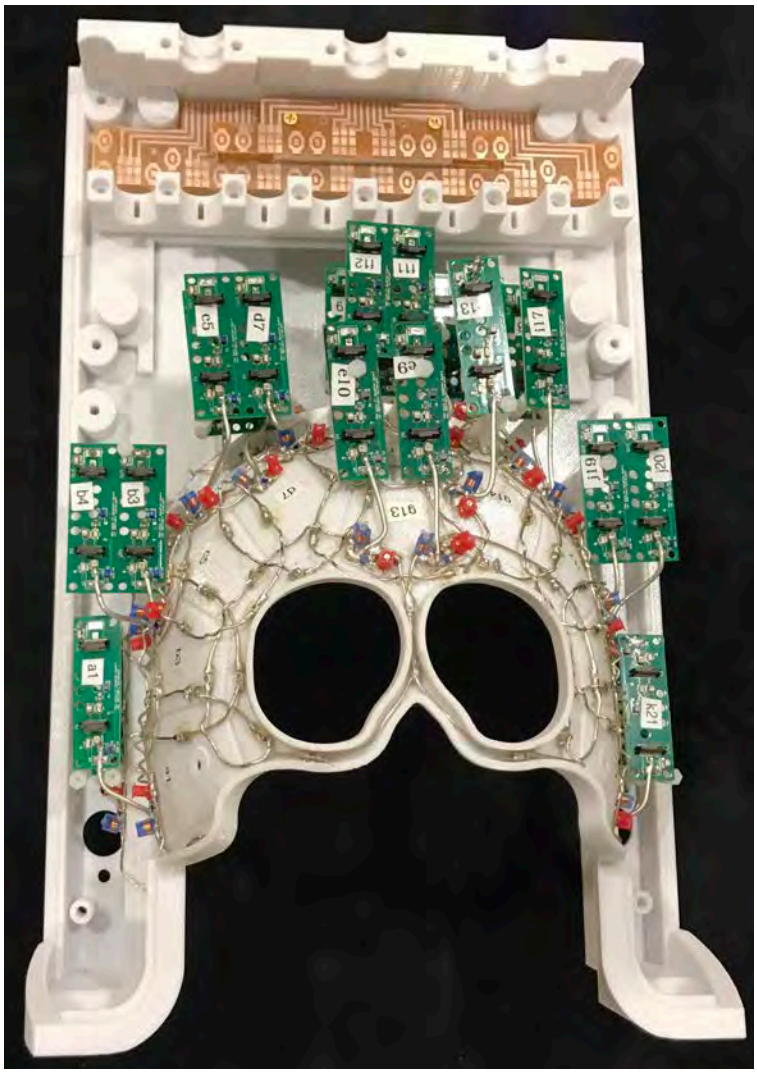
These three pieces showcase our vasculature at different spatial scales and under different lenses.

Emanate: Human time of flight magnetic resonance angiography. This image has been processed with a "vesselness" filter to emphasize and identify the vasculature. Further processing resulted in the (erroneous) rays that radiate from the vessels. The original image was acquired at a spatial resolution of 200 microns isotropic on the Martinos Center's 7 T MRI scanner.

Dipole: Modelled magnetic field distortion created by a vessel in a magnetic field, like in an MRI. The dipole pattern, consisting of the blue and orange lobes, is seen outside the vessel cross-section. The hemoglobin molecules in red blood cells are paramagnetic but lose this magnetic property when they bind oxygen. The packing of red blood cells into vessels results in this overall distortion of the magnetic field, and its magnitude varies with oxygenation, enabling the measurement of brain activity by the *BOLD effect* (blood oxygenation level-dependent).

Refocus: Simulated MRI BOLD signal decay and refocusing generated by vessels of four different sizes in a spin echo MRI sequence. In each block, there is a competition between the amount of signal decay and the strength of refocusing. This vessel size dependence helps us better interpret the BOLD signal and how we can make it more specific to the site of neural activation.

AZMA MAREYAM | RF COIL



Azma works in the design and construction of MRI hardware (RF coils) in the very famous Wald group.

Top half of the 64-channel head coil for the 7T Terra MRI system. The system will be used for brain imaging.

ALEX ROCKHILL | NEUROETYMOLOGY

Alex is a TMS-EEG and DBS researcher in the psychiatry department. He is currently working with and on MMVT (mmvt.org) to revolutionize visualization of the brain.

An MMVT rendering of a brain with textures that symbolize the etymology of the brain area (i.e. cortex is from the Latin corti meaning bark). How many etymological roots can you spot?

ALEX ROCKHILL & KATELYN OLIVER

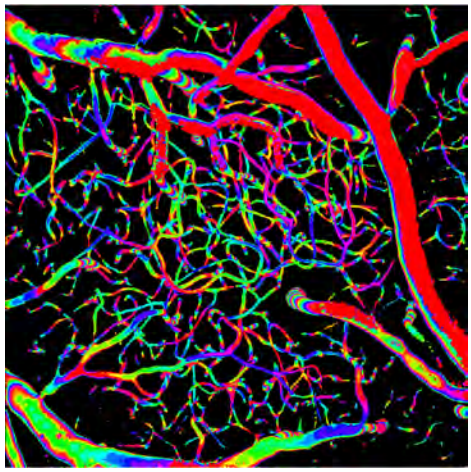
A MELANCHOLY BRAIN

Alex and Katelyn are researchers in psychiatry who study patient populations effected by trauma, anxiety, depression and other psychiatric disorders. They research fear conditioning and deep brain stimulation to help understand the mechanisms of these disorders and guide therapy.

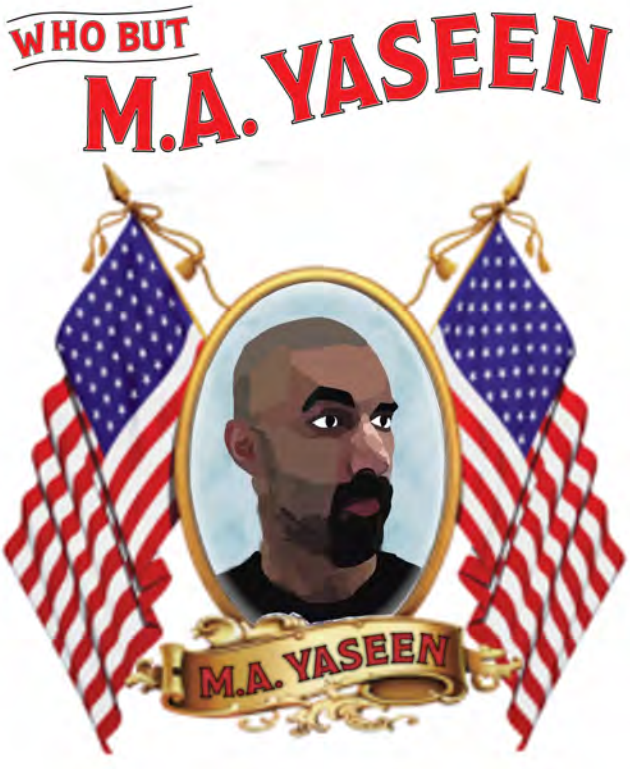
Second century Galenic theory proposed that disease was caused by imbalances of humors; blood, phlem, yellow bile and black bile. This idea, formulated as early as 400 BC, held sway until the 16th century. In line with this theory, Galenic medical scholars explained melancholia or depression as an excess of black bile. Although black bile was never discovered [citation needed], this idea presaged modern interpretations of the pathophysiology of depression, in which neurotransmitters, specifically serotonin, are thought to be out of balance. By inflating a balloon under the sculpture, we formed cracks in this piece and added black clay between the gyri to represent dysfunctional synapses that cause pathological connections in the brains of patients suffering from psychiatric disorders, representing a modern, neurocircuitry-based interpretation. These cracks are then fixed, representing the brain's incredible ability to heal itself, especially with the aid of psychiatric medicine.

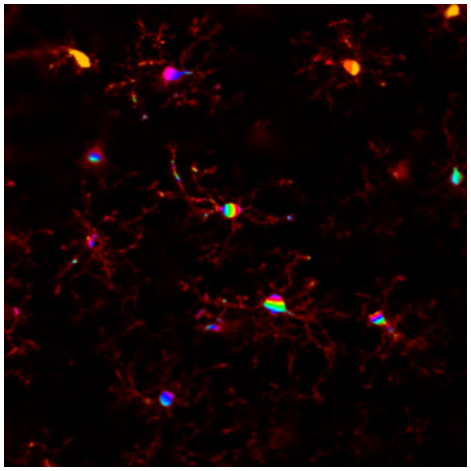
ABBAS YASEEN & BAOQIANG LI

NEUROINFLAMMATION



MICROVASCULAR DYSFUNCTION





GUARDIANS

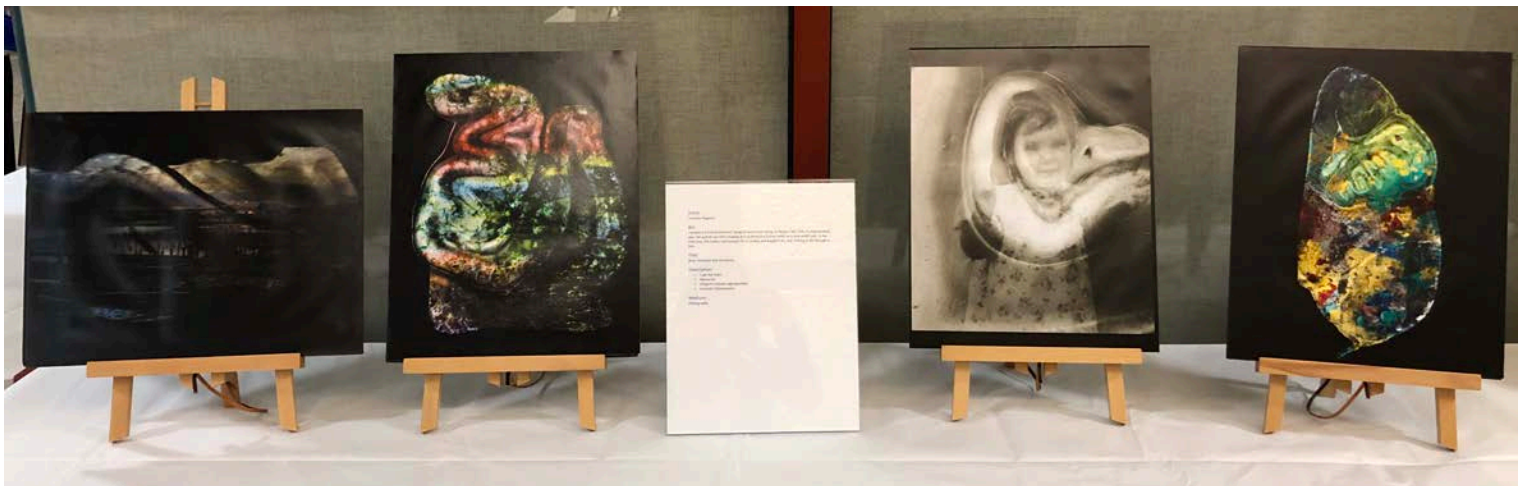
OF THE

GALAXY

CAROLINE MAGNAIN

BRAIN FUNCTIONS AND STRUCTURES

Caroline is a French physicist, living far away from home, in Boston, MA, USA. During the work day, she spends her time imaging and studying the human brain, at a very small scale. In her free time, she trades microscopes for a camera and wanders the city, looking at life through a lens.



Icelandic hippocampus | I see the Tobin | Memories | Chipped medulla segmentation

CHOUKRI MEKKAOUI

Le petite fille au Coeur pur de Renoir

Choukri Mekkaoui, Ph.D. Physics, École Normale Supérieure, Paris, France.

Choukri's medical imaging-art hybrid pieces are inspired by Leonardo da Vinci's artistic approach towards using mathematics as a powerful tool to understand human anatomy:

"*The noblest pleasure is the joy of understanding*" – Leonardo da Vinci

This image was created by combining diffusion MRI tractography of a living human heart with the color and texture of Pierre-Auguste Renoir's painting "Petite fille a la grebe".

HEIRANGI TORRICO-TEAVE

SLICES

Heirangi is a clinical research coordinator working in the psychiatry department under various laboratories researching cognitive aging through MRI in healthy, mild cognitively impaired, Alzheimer's, and autosomal dominant inherited disease individuals. In her free time, she enjoys playing instruments as she covers songs or writes music, painting, snowboarding and occasionally doing yoga.

"Since MR images are taken in slices, I chose to paint a previously devised DTI image into a 'modern' painting with acrylic."

KATELYN OLIVER

SPROUT OF AN IDEA

Katelyn is a Clinical Research Coordinator at the Martinos Center studying sleep and anxiety disorders.

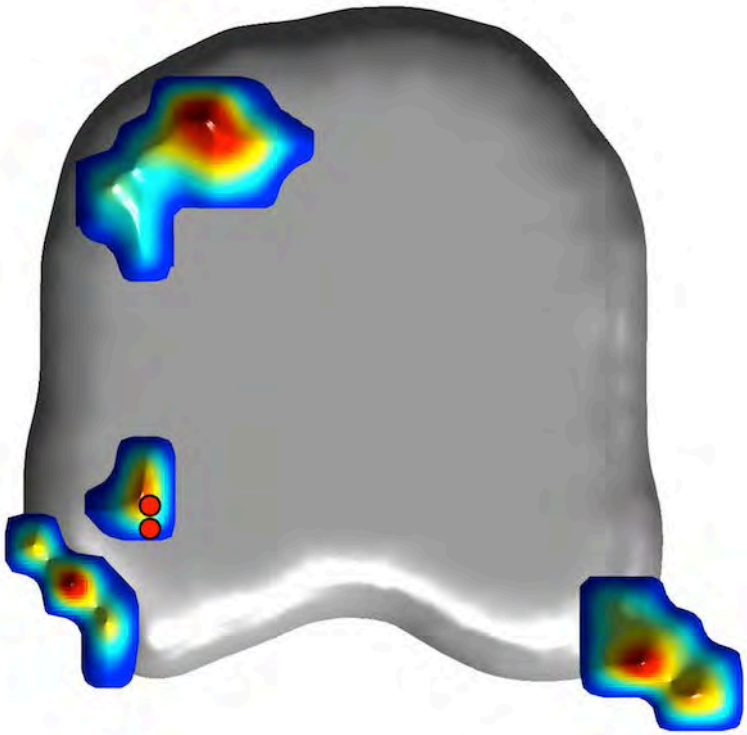
Inside the hollowed out head of this piece is a small plant. The open back allows viewers to glimpse into the head, much like we as neuroimagers use MRI and other techniques to look into the heads of people in order to understand more about the brain and its disorders. However, I'd also like to think this piece, and specifically the plant, represents the scientists themselves. It takes a lot of creative thinking and ideas to do what they do. Sometimes, it all starts with a simple idea.

SAM MEHL
O’BAY

Sam has worked at the Martinos Center since November 2004 at the ITHelp Desk. He is the founder of community@nmr.mgh.harvard.edu mailing list, and Winner of the May 2017 Partners iSuggest suggestion of the month

Parody of street artist Shepard Fairey's iconic "OBEY" print, featuring hall-of-fame professional wrestler Andre the Giant. My rendition is intended as a tribute to Mary O'Hara, who is a giant in the field of MRI facilities management and whose rules must be obeyed for the good of the Center. As denizens of the physical universe we are constantly in the presence of entropy, and are, moreover, all too often prone, if not impelled, towards it. There are some presences in our lives who exert a resistive influence on that inclination. We may not understand those influences very well, much less have the sagacity to appreciate them. Hence the thankless nature of Mary's work makes it all the more commendable. She's protecting us from ourselves.

PADMA SUNDARAM | DIPOLE



Modelled magnetic field distortion created by a vessel in a magnetic field, like in an MRI. The dipole pattern, consisting of the blue and orange lobes, is seen outside the vessel cross-section. The hemoglobin molecules in red blood cells are paramagnetic but lose this magnetic property when they bind oxygen. The packing of red blood cells into vessels results in this overall distortion of the magnetic field, and its magnitude varies with oxygenation, enabling the measurement of brain activity by the BOLD effect (blood oxygenation level-dependent).

JON POLIMENI

untitled

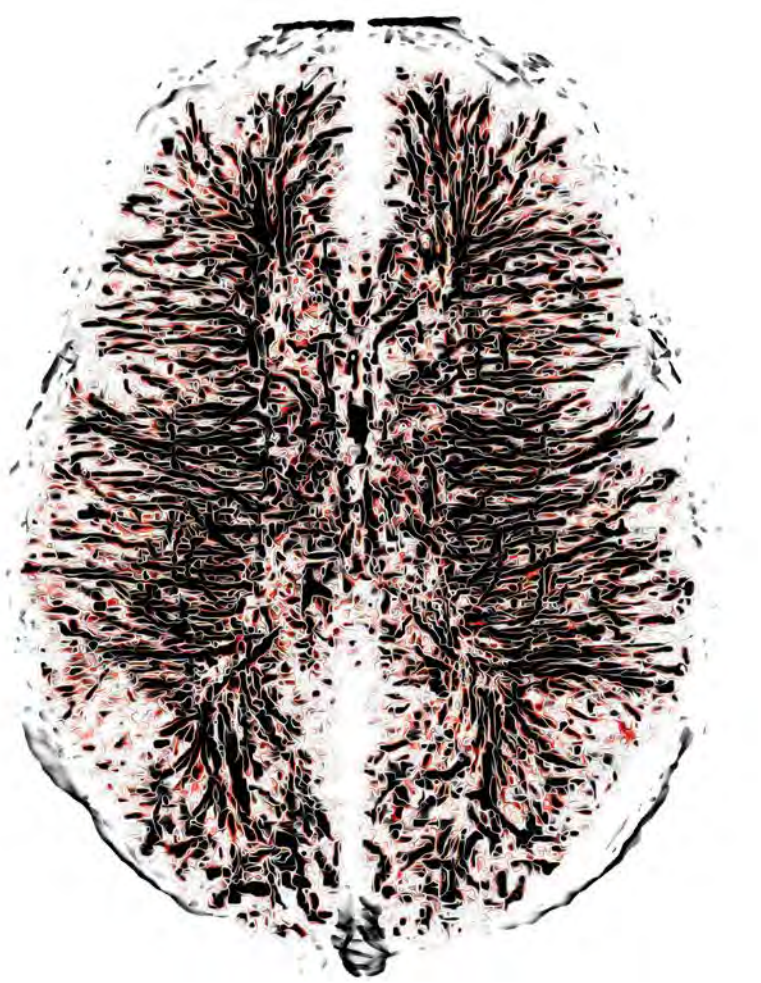
In high school Jon was an avid black-and-white photographer and spent much of his time in the darkroom. After a brief stint in art school doing black-and-white film, he went on to electrical engineering building artificial retinas, which sparked an interest in vision. He has also performed in several punk bands, playing nearly every instrument (poorly) and even singing (badly).

Blood vessels of the human brain in a healthy volunteer shown using non-contrast 3-micron isotropic 3-D Time-of-Flight Magnetic Resonance Angiography maximum intensity projection from a whole-body 7-Tesla MRI.

MICHAËL BERNIER

The white-matter vasculature of the human brain

Originally from Sherbrooke in Québec, Canada, Michaël developed an expertise in image processing and machine-learning approaches, which he later applied to medical imaging. His PhD thesis focused on understanding the origin of the fMRI signal and its vascular bias, from which a vascular extraction tool now used on multiple MRI and non-MRI acquisitions was developed and shared publicly. Michaël has been a postdoctoral researcher in Jon Polimeni's lab since July 2018 and collaborates to further expand his expertise and knowledge of brain vasculature.



White matter vascularisation, as illustrated here, is very difficult to observe non-invasively. With an injection of ferumoxytol, an iron-based supplement that also acts as a contrast agent in the bloodstream for MRI, the contrast between tissues and blood vessels is consequently enhanced. This allows an efficient vascular segmentation normally impossible to obtain at 3T field strength. This 3D representation from a single subject (axial point of view) shows the vesselness score obtained from Braincharter's vascular toolbox, overlaid on a T1-MRI extracted skull.

LENA TREBAUL

INSIDE JOHNNY'S HEAD

Lena was pushed by an eastern wind from the West Coast of France just before the summer 2018 to land on Boston's shores. After lounging on the southern Mediterranean beaches, experimenting a hectic Parisian life and (almost) climbing the French Alpes -following the path of a computer scientist becoming a neuroimaging researcher-, she now enjoys coding, painting, playing music and acting in Massachusetts. It was obvious for her that working in the neuromodulation field was the best way to keep her neurons alert and to manage a multitasking and, honestly, a quite messy brain.

Johnny's life has been painful lately. His mood was not the same as before, he who devoured croissants could barely eat one anymore and he couldn't manage to close the eye at night. Then somebody told him about transcranial magnetic stimulation and he got hope again. He is still not sure this will make him better but maybe there is a chance this will give him the strength to fight his demons... This work describes Johnny's, the depressive mannequin, fears and hopes toward getting better thanks to TMS.

VIVIANA SILESS

BRAIN CELLS POTPOURRI

Viviana is a post doctoral research fellow at the Martinos Center. She is a self-taught drawer, painter, and photographer. Additionally, she has been sporadically studying music since a young age and is currently adept in circus arts. Her preferred painting medium is oil but she enjoys exploring with more flexible and portable mediums for travelling. With ink and watercolor is possible to take a snapshot of a moment from the street, the subway, a bar, just as you would with a camara.

Purkinje cell Pyramidal cell Astrocyte

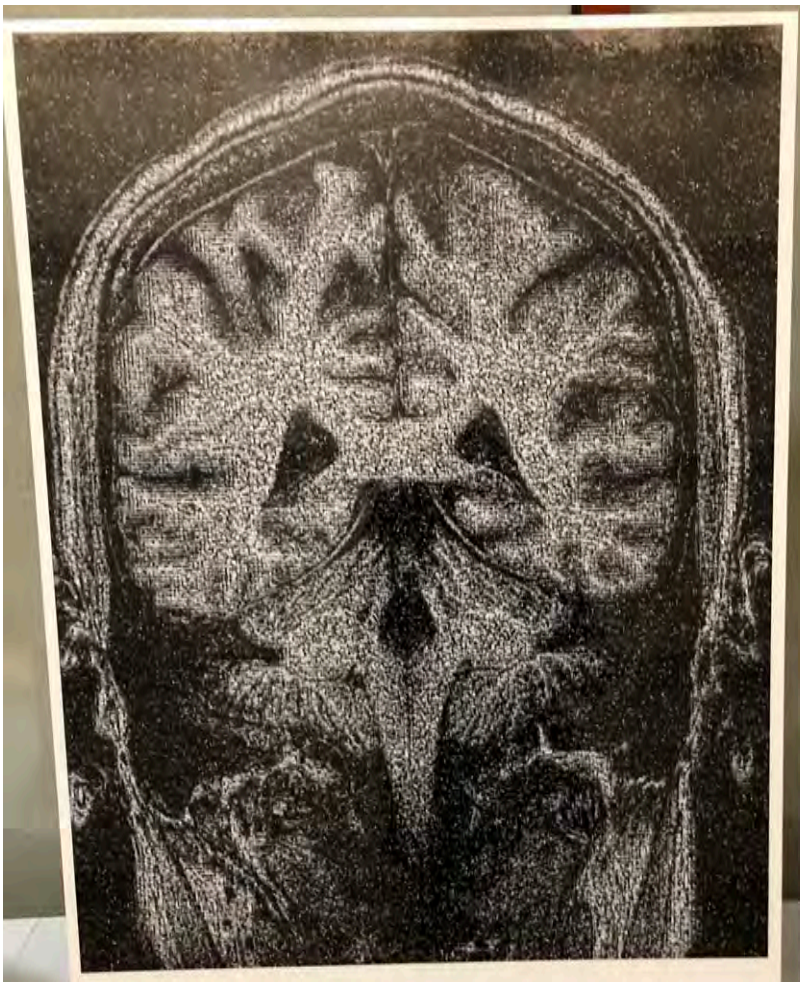
MUHLIS BURAK CINDIK

FIELDS

Burak is a fifth year student at Northeastern University studying Neuroscience. Currently, he is working for Sara Lazar as a research assistant.

The electric field originated from the MRI scanners at the Martinos Center.

THOMAS BENNER | mMRI

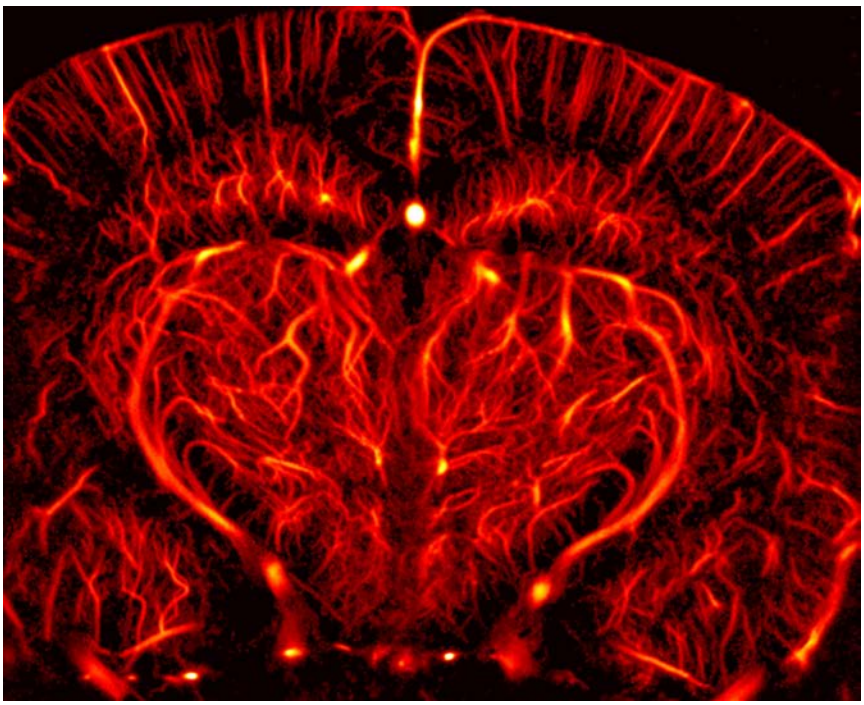


Thomas was a former Martinos Center employee and is now at Siemens Healthineers.

Mosaic of coronal brain scan using many MR images

JIANBO TANG

LIVING MOUSE BRAIN VASCULATURE



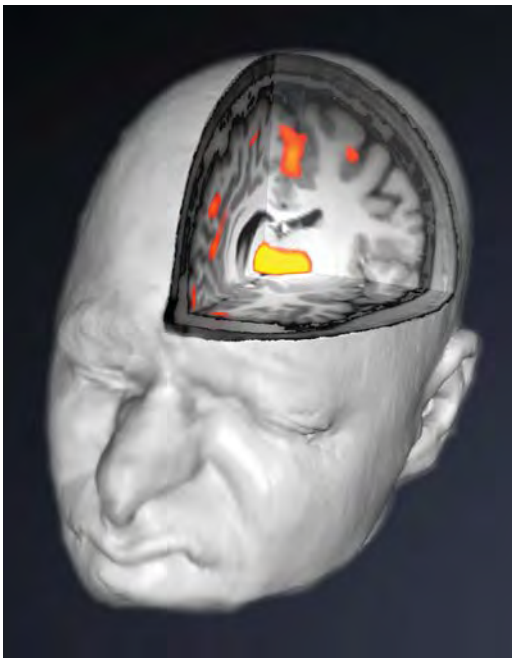
Jianbo Tang received his PhD in University of Florida in 2016. Currently, he is a postdoctoral research fellow working with Dr. David Boas in the Department of Biomedical Engineering at Boston University and the Athinoula A. Martinos Center for Biomedical Imaging at MGH-Harvard Medical School. He likes to take 'functional photos' of the brain by using the novel functional imaging technologies he developed/built.

Coronal plane vasculature image of a living mouse obtained with super-resolution ultrasound localization microscopy.

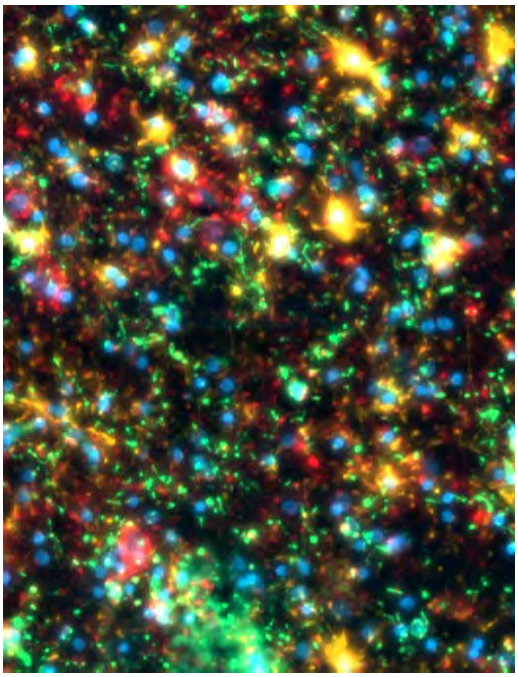
MARCO LOGGIA

Marco Loggia is an assistant professor of Radiology and leader of the Loggia Lab at the MGH Martinos Center. His research focuses on the use of neuroimaging techniques – including functional magnetic resonance imaging (fMRI) and positron emission tomography (PET) – for the study of pain. He is particularly interested in the use of brain measures as potential biomarkers of chronic pain.

In addition to his long and fruitful research career, Marco has extensive experience as a pianist and keyboardist. He performed with a jazz combo at Montreal's McGill University, where he earned his PhD, and has played in several bands otherwise. Among these: not one but *two* Pink Floyd tribute bands, a gospel group, and an R&B outfit amazingly called “Camarillo Brillos and the Magic Bones.”



Pain. This image is supposed to represent somebody in pain. The three pieces showcase our vasculature at different spatial scales and under different lenses. All images are “technically" real: a real structural MRI volume of somebody doing a “pain expression” (the person is not a real patient, though…) and the “colored blobs” showing real PET data indicating brain inflammation in real patients suffering from chronic pain (morphed to overlay that MRI image).



The human brain galaxy. Post-mortem image of a human thalamus, stained to display cell nuclei (DAPI: blue), astrocytes (GFAP: green), microglia (IBA1: orange) and a protein called “18 kDa translocator protein” (TSPO: Red). TSPO is used in human imaging experiments to study neuroinflammation. In collaboration with Bertrand Russell Huber, MD, PhD (Boston University) and Sofia Trogu (Bowdoin College).

MICHAEL DATKO

Funk-tional MRI

Michael is a Postdoctoral Research Fellow at the Martinos Center, and has a dual postdoctoral appointment at the Cambridge Health Alliance Center for Mindfulness and Compassion. He earned his Ph.D. in Cognitive Science at the University of California, San Diego, where he studied the development of functional and structural brain organization in children and adolescents with autism, as well as how neurofeedback training affects brain networks and behaviors related to social imitation in children with autism. In his previous postdoctoral position, Michael used fMRI to examine whether smartphone-based mindfulness training can affect the default mode network and lead to reductions in smoking in individuals attempting to quit smoking cigarettes. He currently studies how a combination of mindfulness training and transcutaneous vagus nerve stimulation affects patients with chronic migraines. While not working to collect and analyze neuroimaging data, Michael can be found biking or walking around the city, making music and other creative endeavors, and sharing good food with good company.

This is a musical performance and interactive exhibit featuring an electronic drum kit that has been programmed to play MRI scanner sounds. Michael used sounds recorded during many scanner protocols (EPI, MPRAGE, diffusion, MRS, etc.), cut very small samples from the full recordings, and then mapped each of those sounds to different components of his Roland electronic drum kit using a digital audio sampling program.

LABORATORY FOR COMPUTATIONAL NEUROIMAGING (LCN)

Patient H.M. in 3D

Using 3D glasses, you can immerse yourself in the structural MRI surface data and diffusion tract data, acquired on Patient H.M., in situ.

EVENT PICTURES


CENTER

EVENT COORDINATORS

Stacey Ladieu
Gary Boas
Will Coon
Alex Rockhill
Heirangi Torrico-Teave

BOOKLET CREDITS

Pictures by Stacey Ladieu + Will Coon + Danielle Carr
Booklet composition by Heirangi Torrico-Teave