describe the creation of a hybrid connectome that leverages data from the most informative cases in CoCoMac and we compare the topological properties of this graph to other "single-space" graphs derived from CoCoTools.

A106

A WHOLE-BRAIN ANALYSIS OF CORTICAL ASYMMETRIES Christine Chiarello[1], David Vazquez[1], Adam Daily[1], Adam Felton[1], Christiana Leonard[2]; [1]University of California, Riverside, [2]University of Florida, Gainesville — Functional brain asymmetries are numerous, but, aside from a few areas such as the planum temporale, there is limited knowledge about the extent to which the cerebral cortex is structurally asymmetrical. The goal of this study was to examine structural asymmetries across the entire cortex and to identify which anatomical features of the cortex display the greatest left/right asymmetries. Asymmetry in cortical surface area, volume, thickness, and curvature (secondary and tertiary folding) was computed for each FreeSurfer cortical parcellation in a sample of 200 healthy young adults. Asymmetries for surface area and volume were robust and strongly correlated (r = .72), and were statistically significant for over 85% of the regions: large leftward asymmetries were observed for superior temporal, frontal and central opercular, ventral occipital-temporal, and superior parietal regions, and large rightward asymmetries were obtained for the anterior cingulate, angular gyrus, and posterior occipital areas. Asymmetries for thickness were considerably smaller, and greater right than left cortical thickness was observed for 70% of brain regions. Thickness asymmetry was positively correlated with volume (r = .47), and weakly negatively correlated with surface area (r = -.17), asymmetries. Curvature asymmetries were also very small, and significant for only 48% of regions. Curvature was weakly correlated with both surface area (r = .15) and volume (r = .14) asymmetries. These data suggest that most regions of the cortex are reliably asymmetrical, with asymmetry manifested by increased surface area and volume, but not increased secondary/tertiary folding.

A107

RELATIONSHIP BETWEEN CARDIORESPIRATORY FITNESS AND HIPPOCAMPAL SUBFIELDS ANATOMY IN HEALTHY OLDER ADULTS Mark Fletcher[1], Rachel Boyd[1], Kathy Low[1], Nils Schneider-Garces[1], Andrew Freeman[1], Edward Northrup[1], Rachel Hopman[1], Christine Ventrella[1], Benjamin Zimmerman[1], Chin Hong Tan[1], Gabriele Gratton[1], Monica Fabiani[1]; [1]University of Illinois at Urbana-Champaign — There is substantial evidence indicating that both aging and fitness influence hippocampal size (Erickson et al. 2011). In a previous study, we (Fletcher et al., 2012) employed Free-Surfer® to examine brain anatomy in a sample of 55 older adults (ages 55-87), and showed general effects of age and fitness in sub-cortical gray matter regions, including the medial temporal lobe, basal ganglia, and hippocampus. Our data also indicated an association between fitness and scores on the modified mini-mental status examination. The current study analyzes our data further to determine which subfields of the hippocampus are affected by aging, fitness, and education. Although there were several subfields whose normalized volumes correlated with age and fitness, when all three of these parameters were entered in a multiple regression model, age but not fitness effects remained significant. In addition, raw correlations of age and fitness with hippocampal subfield volumes were strongly correlated across areas (r=-.55). Interestingly, there was also an area (the fimbria) showing effects of education independent of age and fitness. These data suggest that fitness and aging may have largely overlapping and difficult to distinguish effects on the hippocampus.

A108

3D ANATOMY OF THE CORPUS CALLOSUM IN EARLY- AND LATE-BLIND SUBJECTS FROM SURFACE MULTIVARIATE TENSOR-BASED MORPHOMETRY Liang Xu[1], Olivier Collignon[4], Gang Wang[1], Yue Kang[2,3], Franco Lepore[5], Jie Shi[1], Yi Lao[2,3], Anand Joshi[3], Yalin Wang*[1], Natasha Lepore*(* = equal last author contribution)[2,3]; [1]Arizona State University ,Tempe, [2]Children's Hospital Los Angeles, CA, USA, [3]University of Southern California, [4]University of Trento, [5]University of Montreal — Studying the respective impact of congenitally (CB) versus lately acquired blindness (LB) on the anatomy of the corpus callosum (CC) provides a unique model to probe how experience at different developmental periods shapes the structural organization of the brain. We used a new framework that we recently developed to understand shape change of the corpus callosum in blind adults from T1-weighted MRI. Our data set consists of 14 early-blind, 11 late blind and 20 sighted control subjects. While other studies have looked at surface differences in the mid-sagittal cross-section of the CC, we use its full 3D shape. We manually trace the CCs, generate a conformal grid on their surface and automatically segment them into superior and inferior patches. We estimate the thickness at each vertex between the two patches using a harmonic field. All CCs are fluidly registered to a common template. The deformation tensors from the registration give the direction and size of the changes in surface area at each vertex of the grid between the template and each subject. We combine the area changes and thickness information into a vector at each vertex to be used as a metric for the statistical analysis. Results revealed significant differences in several regions of the CCs between both blind groups and the sighted group, although to a lesser extend in LB when compared to CB. These results demonstrate the crucial role of the developmental period of visual deprivation in re-shaping the structural architecture of the CC.

A109

POST-CHEMOTHERAPY BRAIN MATTER CHANGES IN FEMALE BREAST CANCER PATIENTS Chris Lepage[1], Carole Scherling[2], Nancy Wallis[1], Rocio A. López Zunini[1], Joyce MacKenzie[3], Barbara Collins[3], Andra M. Smith[1]; [1]University of Ottawa, [2]University of California, [3]Ottawa Civic Hospital — Cognitive decline is a common complaint of breast cancer survivors following adherence to adjuvant chemotherapy regimens. The authenticity of this purported sequela remains to be unanimously accepted in the scientific community and its interaction with brain structure remains largely unexplored. This study aimed to examine neurophysiological changes attributable to chemotherapy exposure by investigating brain matter volumes before and after chemotherapy treatment while also examining neuropsychological performance over time. Female breast cancer patients (n = 20) and matched cancer-free controls (n = 20) underwent structural imaging and completed neuropsychological tests before the patients underwent chemotherapy and again following regimen completion. Structural images were acquired using a 1.5 Tesla Siemens Magnetom Symphony magnetic resonance scanner. VBM8 was used to conduct voxel-based morphometry to compare white matter and grey matter volume differences both within and between groups. Independent samples t-tests were used to compare the domain scores between groups on the neuropsychological battery. Compared to the healthy control group, the breast cancer group showed reduced volumes in the left anterior cingulum, in the left middle occipital lobe, in the left superior parietal lobe, and bilaterally in the caudate. Consistent with other studies of neuropsychological functioning in breast cancer survivors exposed to chemotherapy, analysis of the neuropsychological data revealed that the patient group performed more poorly compared to the control group, specifically in measures of executive functioning and working memory. The results of this study afford credence to the authenticity of 'chemo-fog'.

A110

DISTURBED CORPUS CALLOSUM MICROSTRUCTURE IN THE PRESENCE OF NORMAL VOLUME CHARACTERIZES PATIENTS WITH ADULT ADHD A. Marten H. Onnink[1], Marcel P. Zwiers[2], Martine Hoogman[2,3], Jeanette C. Mostert[2,4], Cornelis C. Kan[4], Jan Buitelaar[1,5], Barbara Franke[1,4]; [1]Radboud University Nijmegen Medical Centre, Donders Institute for Brain, Cognition and Behavior, Nijmegen, The Netherlands, [2]Radboud University Nijmegen, Donders Institute for Brain, Cognition and Behavior, Nijmegen, The Netherlands, [3]Max Planck Institute for Psycholinguistics, Nijmegen, The Netherlands, [4]Radboud University Nijmegen Medical Centre, Nijmegen, The Netherlands, [5]Karakter Child and Adolescent Psychiatric University Centre, Nijmegen, The Netherlands — Background: Microstructural changes and volume reductions in the corpus callosum (CC) are implicated in childhood ADHD. There are however indications that, in adulthood ADHD, reduced white matter integrity is persistent whereas CC volume normalizes. Our goal was to investigate this in a relatively large adult ADHD sample. In addition to commonly used fractional anisotropy (FA) and mean diffusivity (MD), we calculated parallel (axial diffusion; AD) and perpendicular (radial diffusion; RD) diffusivities to white matter tracts which may offer additional information regarding tissue microstructure. Methods: White matter integrity and volume of the CC were investigated in 87 adult ADHD patients and 98 matched controls. We used diffusion tensor imaging in conjunction with tract-based spatial statistics to examine FA, MD, AD and RD within the genu, body and splenium of the CC. Volumetrics of the CC and its subdivisions were determined using FreeSurfer software. Results: The body of the CC showed lower FA (p = .005) and higher MD (p = .019) and RD (p = .008) values in ADHD patients, compared to controls. Volume of the CC did not differ between the groups (p = .633). Conclusions: Our findings show that callosal volume becomes normal while disturbed white matter integrity of the CC is persistent in adult ADHD. Abnormalities in the body of the CC, the subdivision that contains the commissural fibers connecting the somatosensory, auditory and motor areas may play an important role in the pathophysiology of ADHD.

A111

COMPLEX REGIONAL PAIN SYNDROME (CRPS) CAUSES FINGER AGNOSIA AND DYSCALCULIA VS Ramachandran[1], Baland Jalal[1]; [1]Center for Brain and Cognition, University of California at San Diego — We report a striking example of peripheral nerve injury possibly causing brain (CNS) changes that result in cognitive/perceptual deficits. Following a small injury to a finger (e.g., metacarpal bone fracture) there is inflammation, swelling, redness (hyperemia), pain and reflex immobilization ("paralysis") of the finger. After the fracture heals in a few weeks all changes reverse in 95% of cases. But in some cases pain persists unabated; pain, swelling, redness and paralysis then spread to involve the whole hand; indeed sometimes the whole arm (CRPS). Based on a suggestion we made in the 90's it has been shown by several groups that mirror visual feedback (MVF) can be used to create "false" feedback that the "paralyzed" hand can be moved with impunity. This partially alleviates the pain and even reverses the paralysis, swelling and temperature permanently. These effects suggest that CRPS involves a strong CNS component (e.g., McCabe, 2003). We report data on two patients with CRPS in their right hands. Upon conducting several tests we found strong indications of finger agnosia and dyscalculia (their medications did not affect other cognitive skills) and mild apraxia in these patients. We suggest that the painful immobilization retrogradely produces a functional lesion in the inferior parietal lobule (long implicated in apraxia). This lesion "spreads" into adjacent cortical regions disrupting finger representation and even higher "cognitive" capacities like arithmetic and judgment of chirality of ears, eyes, and feet etc. If these preliminary findings are confirmed they would represent a powerful example of body/mind interactions.

A112

TRANSCRANIAL MAGNETIC STIMULATION PROVIDES CAUSAL EVIDENCE FOR "WHAT" AND "WHERE" PATHWAYS IN HUMAN AUDITORY CORTEX Jyrki Ahveninen[1], Samantha Huang[1], Aapo Nummenmaa[1], John W. Belliveau[1], An-Yi Hung[1], Iiro P. Jääskeläinen[2], Josef P. Rauschecker[3], Stephanie Rossi[1], Hannu Tiitinen[2], Tommi Raij[1]; [1]Harvard Medical School – Athinoula A. Martinos Center for Biomedical Imaging, Department of Radiology, Massachusetts General Hospital, [2]Department of Biomedical Engineering and Computational Science (BECS), Aalto University, Espoo, FINLAND, [3]Laboratory of Integrative Neuroscience and Cognition, Department of Neuroscience, Georgetown University Medical Center — Although evidence for distinct activations of object-identity and audiospatial features is accumulating, the existence of parallel "what" and "where" pathways in the human auditory cortex (AC) has been questioned due to inconsistent neuroimaging evidence. Here, in a full factorial design, we utilized MRI-guided paired-pulse transcranial magnetic stimulation (TMS, 2.5 ms interval) to induce transient deactivations of AC during sound localization and identification tasks. Subjects were presented with Reference/Probe sound pairs. In the localization task, subjects discriminated whether Probe arrived from 5^o to the left or 5^o to the right relative to Reference (25^o to the right). In the identification task, subjects discriminated whether the amplitude-modulation frequency of Probe (1/6 octaves±40 Hz) was higher or lower than that of Reference (40 Hz). Fifty percent of the trials did not include TMS and therefore provided baseline reaction time (RT) data. For the other 50% of trials, bilateral TMS was delivered 55–145 ms after the Probes, at either the anterior or posterior non-primary ACs. TMS targeting was confirmed with electromagnetic forward computations on each individual's cortical surface. The results showed a significant interaction between the task (location vs. identity) and TMS target (anterior vs. posterior): TMS to posterior ACs delayed RTs significantly more during localization than identification performance, whereas TMS to anterior ACs delayed RTs more during identification than localization. This double dissociation provides direct causal support for the dual pathway model of human non-primary AC.

A113

COMPLEX INPUT CREATES COMPLEX NETWORKS Michael Andric[1], Uri Hasson[1]; [1]University of Trento — Continuous auditory inputs can vary on multiple dimensions. Whether there exists a stable functional network arrangement that processes inputs with different properties, or, alternatively, if the network arrangement itself dynamically changes in response to an input property is unknown. Our current investigation targets this question. We show that the brain's network arrangement demonstrates significant systematic re-organization as a function of a pivotal feature of the input – its regularity. To examine whether network organization tracks input regularity we presented participants (N=21) with four types of auditory series, while recording fMRI signals at 4T. The auditory series (150 s each) consisted of rapidly presented tones (3.3Hz). The series varied in their regularity, formalized here by conditional entropy determining transitions between tones. To assess changes in network topography across the four conditions, we analyzed every voxel's connection to every other voxel (connection thresholded at Pearson's r > 0.5). From these per-condition connectivity matrices we identified network modularity ("Q", Newman & Girvan, 2004), a measure of the network's arrangement into modules, or densely intra-connected communities. A group level analysis showed that network modularity was highest for the most random series and lowest for the most ordered series. Thus, the brain's modular arrangement simplifies when input regularity increases. This simplification is seen in the brain's arrangement into fewer, but more globally connected, networks. In other words, complex input creates complex networks.

A114

ORTHOGONAL ACOUSTIC DIMENSIONS DEFINE AUDITORY FIELD MAPS IN HUMAN CORTEX Brian Barton[1], Jonathan H. Venezia[1], Kourosh Saberi[1], Gregory Hickok[1], Alyssa A. Brewer[1]; [1]University of California, Irvine — Introduction: To date, human tonotopy studies have not agreed on the organization of core auditory cortical areas. Recently, an orthogonal dimension to tonotopy, known as periodicity, has been observed in cat primary auditory cortex (Langner et al. 2009) and the primate midbrain (Baumann et al. 2011). Periodicity refers to the preferred temporal receptive field over which an auditory neuron integrates, measured by presenting broadband noise to the auditory system at different modulation rates. Methods: Tonotopy and periodicity were measured independently in humans, using the fMRI travelling wave method that is the field standard in visual field mapping studies, modified into a sparse-sampling paradigm. Subjects were asked to attend to 5s of narrow- or broadband noise at 60dB on each trial and indicate whether a change of 3dB at the midpoint of stimulus presentation was up or down. Tonotopy was measured using narrowband noise centered on frequencies of 400, 800, 1600, 3200, and 6400 Hz with a bandwidth of 100Hz, amplitude modulated with a frequency of 8Hz. Periodicity was measured using broadband noise at modulation frequencies of 2, 4, 8, 16, 32, 64, 128 and 256 Hz, with a bandwidth spanning our narrowband noise range (300-6500Hz). Results: Our findings extend previous work done in cat and monkey to human, and we evaluate organizational models that were developed in these model species. Our findings match human cytoarchitecture and provide an organizational framework that not only clarifies the auditory core, but may apply throughout the hierarchy of the human auditory system.

A115

EFFECTS OF DECODED-EEG NEUROFEEDBACK ON AUDITORY PERCEPTUAL LEARNING Alex Brandmeyer[1], Makiko Sadakata[1], Loukianos Spyrou[1], James McQueen[1,2,3], Peter Desain[1]; [1]Donders Institute for Brain, Cognition and Behaviour, Radboud University Nijmegen, [2]Behavioural Sciences Institute, Radboud University Nijmegen, [3]Max Planck Institute for Psycholinguistics — Multivariate pattern classification methods are increasingly utilized in cognitive neuroimaging research to analyze high-dimensional data at the single-trial level. The present study made use of decoded EEG signals to provide participants with online feedback regarding ongoing passive auditory perception of tone stimuli presented in oddball sequences. Ten par-