patterns of brain activation and connectivity of face processing regions. However, small sample sizes and inconsistent results have hindered clinical utility of these findings. The study aims to establish consistent patterns of brain responses to faces in ASD and provide directions for future research. METHODS/STUDY POPULATION: Neuroimaging studies were identified through a multi-database search according to PRISMA guidelines. In total, 23 studies were retained for a sample size of 383 healthy controls and 345 ASD. Peak coordinates were extracted for activation likelihood estimation (ALE) in GingerALE v2.3.6. Follow-up ALE analyses investigated directed Versus undirected gaze, static Versus dynamic, emotional Versus neutral, and familiar Versus unfamiliar faces. RESULTS/ANTICIPATED RESULTS: Faces produced bilateral activation of the fusiform gyrus (FG) in healthy controls (−42 −52 −20; 22 −74 −12, $p < 0.05$, FDR) and left FG activation in ASD (−42 −54 −16, $p < 0.05$, FDR). Activation in both groups was lateral to the mid-fusiform sulcus. Follow-up results pending. DISCUSSION/SIGNIFICANCE OF IMPACT: Reduced right FG activation to faces may inform biomarker or response to intervention studies. Mid-fusiform sulcus proved a reliable predictor of functional divides should be investigated on a subject-specific level.

2091

Neurophysiological substrates and developmental sequelae of sensory differences in infants at high risk for autism spectrum disorder

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OBJECTIVES/SPECIFIC AIMS: Background: Children with autism spectrum disorder (ASD) show a broad range of unusual responses to sensory stimuli and experiences. It has been hypothesized that early differences in sensory responsiveness arise from atypical neural function and produce "cascading effects" on development across a number of domains, impacting social and communication skill, as well as broader development in children affected by ASD. A primary challenge to confirming these hypotheses is that ASD cannot be definitely diagnosed in the earliest stages of development (i.e., infancy). A potential solution is to prospectively follow infants at heightened risk for ASD based on their status as infant siblings of children who are diagnosed. We examined the developmental sequelae and possible neurophysiological substrates of three different patterns of sensory responsiveness—hyporesponsiveness (reduced or absent responding to sensory stimuli) and hyperresponsiveness (exaggerated responding to sensory stimuli), as well as sensory seeking (craving of or fascination with certain sensory experiences). Infants at high risk (HR) for ASD were compared with a control group of infants at relatively lower risk for ASD (LR; siblings of children with typical developmental histories). Objectives: Research questions included: (a) Do HR infants differ from LR infants in early sensory responsiveness?, (b) Does sensory responsiveness predict future ASD and related symptomatology? and (c) Is sensory responsiveness predicted by resting brain states? METHODS/STUDY POPULATION: Methods: To answer these questions, we carried out a longitudinal correlational investigation in which 20 HR infants and 20 LR controls matched on sex and chronological age were followed over 18 months. At entry to the study, when infants were 18 months old, sensory responsiveness was measured using the Sensory Processing Assessment and the Sensory Experiences Questionnaire, and a number of putative neural signatures of early sensory differences were measured via resting state EEG. When infants were 24 and 36 months of age, ASD and related symptomatology was evaluated in a comprehensive diagnostic evaluation. RESULTS/ANTICIPATED RESULTS: Results: HR infants trended towards increased hyporesponsiveness and hyperresponsiveness and showed significantly elevated levels of sensory seeking relative to LR controls at 18 months of age. Both groups, furthermore, displayed a high degree of heterogeneity in sensory responsiveness. Atypical sensory responsiveness (increased hyperresponsiveness and/or hyporesponsiveness, as well as sensory seeking behavior) predicted several aspects of ASD and related symptomatology, including social, communication, and play skill, and was associated with differences in resting brain state, including metrics of oscillatory power, complexity, and connectivity, as well as hemispheric asymmetry. Moderation analyses revealed that several relations varied according to risk group, such that associations were stronger in magnitude in the HR Versus LR group. DISCUSSION/SIGNIFICANCE OF IMPACT: Conclusion: Findings provide empirical support for the notion that early sensory responsiveness may produce cascading effects on development in infants at heightened risk for ASD. Differences in resting brain states may underlie atypical behavioral patterns of sensory responsiveness. From a clinical standpoint, results suggest that early sensory differences may be useful for predicting developmental trajectories, and be potentially important targets for early preventive intervention, in infants at risk for autism.

2523

Noninvasive biomarkers for inflammatory bowel disease: Drawbacks and potential

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OBJECTIVES/SPECIFIC AIMS: Approximately 1.6 million Americans suffer from inflammatory bowel diseases (IBD), ulcerative colitis, and Crohn's disease. It is a challenge for both physicians and patients alike to manage the disease, primarily due to lack of disease specific biomarkers. Endoscopy remains the gold standard to diagnose and evaluate IBD activity. Current biomarkers or their combinations cannot adequately predict IBD progression or relapse, and response to therapy. METHODS/STUDY POPULATION: In total, 97 IBD patients recruited at University of Kentucky undergoing endoscopy. Patients medical information was collected from electronic database including C-reactive protein (CRP), fecal calprotectin (FC), endoscopy/pathology report. RESULTS/ANTICIPATED RESULTS: The mean CRP and FC levels were 1.3 (normal <1) and 679 (normal <162), respectively. FC (sensitivity 74%) was more reliable to predict mucosal inflammation compare to CRP (sensitivity 36%). However, 52% of patients did not have FC performed (vs. CRP only 4%), and 45% of these patients failed to submit stool sample for analysis. DISCUSSION/SIGNIFICANCE OF IMPACT: Our data suggests FC is the most promising noninvasive marker for disease monitoring in IBD. It correlates well with endoscopic activity and mucosal inflammation. However, further analysis must be done to evaluate barriers to testing and issues with compliance from patients. We feel strongly that a blood biomarker for disease activity is vital for disease monitoring and response to therapy in IBD.

2336

Novel PGF2a synthesis pathway in epithelial ovarian cancer

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OBJECTIVES/SPECIFIC AIMS: To understand the role of PGF2a and to characterize a novel cyclooxyrgenase (COX)-independent prostaglandin synthesis pathway in epithelial ovarian cancer. METHODS/STUDY POPULATION: We used high grade epithelial ovarian cancer cell line (OVCAR3) as a model to study our pathway. Our main mode of PGF2a detection is through mass spectrometry. RESULTS/ANTICIPATED RESULTS: Our current results suggest the OVCAR3 cells may synthesize PGF2a independently of COX enzymes. We anticipate this novel pathway may be dependent on the TGFb pathway. DISCUSSION/SIGNIFICANCE OF IMPACT: Understanding the role and synthesis pathway of PGF2a may allow us to uncover a novel therapeutic pathway for high grade ovarian cancer.

2126

Optimizing a technique for visualizing retinal and choroidal blood flow noninvasively

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OBJECTIVES/SPECIFIC AIMS: Diabetic retinopathy is an increasingly prevalent disease, difficult to screen for across the globe. We have developed and began optimizing an innovative technique to visualize and quantify retinal blood flow, to elucidate the role of the choroid in retinal pathologies such as diabetic retinopathy or choroidopathy. METHODS/STUDY POPULATION: Preliminary retinal was obtained from a surgical retina video library (Truvision, Goleta, CA, USA). Videos of different organs were recorded while vessels were occluded via a blood pressure cuff, using consumer-grade digital video cameras (NEX-5T, a7sii; Sony, New York, NY, USA). All other retinal videos were taken using a fundus camera (50×; Topcon, Oxland, NJ, USA) modified to support the above digital video cameras. All videos were processed using experimental software (MATLAB, Mathworks, Natick, MA, USA). RESULTS/ANTICIPATED RESULTS: Video imaging of the retina was optimized for lighting conditions and software requirements. Parameters were defined for the software imaging pipeline, such as frequency range of interest, sampling rate, and noise minimization. Software was developed to stabilize frames, accounting for eye saccades. Use of a biosensor enabled accurate measurement of pulse waveform, increasing signal-to-noise ratio. The optimal light requirements were determined such that adequate exposure of the retina is reproducible yet still

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comfortable for use in human subjects. DISCUSSION/SIGNIFICANCE OF IMPACT: This novel technique allows for an inexpensive, noninvasive, and reproducible ocular blood flow imaging platform. By optimizing this technique, we can proceed with our future plans for a pilot study to compare our imaging technique with the current standard, paving the way for future clinical studies.

2429

Optogenetic stimulation of corticotropin-releasing hormone expressing neurons in Barrington's nucleus recapitulates the social stress voiding phenotype in mice

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OBJECTIVES/SPECIFIC AIMS: Voiding postponement is common cause of LUT dysfunction in which children void infrequently with large volumes. This condition is modeled in mice that are subjected to social stress who show decreased voiding frequency and increased voided volumes along with increases in corticotropin-releasing hormone (CRH) expression in Barrington's nucleus (BN) (i.e., the pontine micturition center). Optogenetics is a technique to selectively stimulate cells or neurons of interest via light activated channel receptors [i.e., channel-2 rhodopsin (ChR2)]. Here we examined the effects of optogenetic manipulation of CRH BN neurons on the in vivo voiding phenotype and urodynamics in awake mice. We hypothesized that stimulating these neurons at higher frequencies (10–50 Hz) would lead to CRH-dependent alterations in voiding phenotype (i.e., larger voided volumes and longer intermicturition intervals. METHODS/STUDY POPULATION: Double transgenic mice expressing ChR2 in CRH cells were generated using the Cre-lox recombinase system and had fiberoptic probes implanted into BN at 8 weeks of age. The mice also underwent simultaneous catheter placement into the bladder for in vivo cystometry. In vivo cystometry before and during optogenetic stimulation at various frequencies was performed 5–7 days postoperatively. Saline was perfused at 10 μL/minute and baseline stable voiding cycles were established. Bladder capacity, threshold pressure, voiding pressure, and voided volume were recorded at baseline and at each optogenetic setting. In some mice, the protocol was repeated in the presence of CRH antagonist (NBI 30775). RESULTS/ANTICIPATED RESULTS: Fiberoptic stimulation (470 nm at 25 and 50 Hz) produced a significant rise in the intermicturition interval, bladder capacities and increased void volumes. This effect was especially pronounced in females in whom bladder capacity and intermicturition interval more than doubled at 50 Hz stimulation. Fluoroscopic images confirmed complete bladder emptying with each void. The increased bladder capacity at higher frequencies (25 and 50 Hz) was CRH-dependent as injection of a CRH antagonist (NBI 30775) blocked the optogenetic effect. Control non-double mice showed no effects from optogenetic stimulation. DISCUSSION/SIGNIFICANCE OF IMPACT: Our results suggest that optogenetic stimulation of CRH-expressing neurons in BN at high frequency (25 and 50 Hz) inhibits micturition and recapitulates the voiding phenotype seen in socially stressed mice (large, infrequent voids). Lower frequencies of optogenetic stimulation (2 and 10 Hz) had no effects on cystometry parameters or voiding phenotype. In addition, females had a greater response to optogenetic stimulation compared with males with larger bladder capacities and longer intermicturition intervals. The changes in voiding phenotype seen were CRH dependent as blockage of the CRH receptor prevented changes in cystometry parameters with optogenetic stimulation. Further elucidation of these and other neural subpopulations in BN are warranted to understand micturition and how it may be manipulated in disease states such as voiding postponement and acute urinary retention.

2566

Personalized models of distal airway epithelial-stromal unit in COPD

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OBJECTIVES/SPECIFIC AIMS: The objective of this study is to develop patient-derived "personalized" organotypic models of human distal airways, in which basal stem cells (BCs) isolated from the pre-/terminal conducting airway region are co-cultured with autologous stromal cells from the same region to reproduce patient-specific distal airway epithelial-stromal units and their remodeling in COPD. METHODS/STUDY POPULATION: We established a protocol to isolate and propagate epithelial BCs, fibroblasts, and endothelial cells from the distal airways of normal and COPD lung donors. Heterogeneous cellular and molecular phenotypes in the human distal airways were characterized using immunofluorescence and single-cell RNA sequencing. Patient-specific distal airway epithelial-stromal units were reconstructed by co-culturing BCs and autologous stromal cells using an air-liquid interface-based airway wall model and a bronchosphere-based 3D distal airway organoid assay. RESULTS/ANTICIPATED RESULTS: Histologic analysis of derived epithelial-stromal units revealed heterogeneous patient-specific phenotypes characterized by hypo-/hyper-/metaplastic lesions (hypo-regenerative phenotype, mucous cell hyperplasia, squamous metaplasia, distal-to-proximal repatterning) in the epithelial compartment, accompanied, in some samples, by stromal remodeling. Candidate epithelial-stromal cross-talk mechanisms were identified using quantitative real-time RT-PCR analysis of autologous epithelial and stromal compartments of established patient-specific distal airway unit models. DISCUSSION/SIGNIFICANCE OF IMPACT: Epithelial and stromal cells isolated from distal airways of subjects with and without COPD can be assembled into functional, organ-level tissue which mimics the architecture of human distal airways and, in patients with COPD, reproduces several distal airway remodeling phenotypes. Patient-specific models of distal airway epithelial-stromal cross-talk established in this study can be used to identify candidate pathways that mediate disease-relevant airway remodeling and potentially utilized as pre-clinical platforms for developing personalized therapeutic approaches to suppress the progression of distal airway remodeling in chronic lung diseases, including COPD.

2375

Pharmacokinetics of phosphatidylethanol 16:0/20:4 homolog in human blood after consumption of 0.4 and 0.8 g/kg alcohol in a laboratory clinical study

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OBJECTIVES/SPECIFIC AIMS: The purpose of this study was to characterize the pharmacokinetics of phosphatidylethanol (PEth) 16:0/20:4 homolog in uncoagulated, human blood samples taken from 18 participants in a clinical laboratory setting after consumption of 2 doses of ethanol. METHODS/STUDY POPULATION: Male and female participants received either 0.4 or 0.8 g/kg oral doses of ethanol during a 15-minute period. Blood samples were collected before and throughout 6 hours immediately after alcohol administration, then after 2, 4, 7, 11, and 14 days of administration day. PEth 16:0/20:4 levels were quantified by liquid mass spectrometry. Breath ethanol concentrations were measure concurrently with each blood collection during the administration day, as well as transdermal ethanol concentrations monitored constantly before, during and after ethanol administration day. RESULTS/ANTICIPATED RESULTS: (1) Single doses of 0.4 and 0.8 g ethanol/kg produced proportional increases in BrAC and PEth 16:0/20:4 levels; (2) the increase of Peth 16:0/20:4 from base line to Cmax was less than either PEth 16:0/18:1 or PEth 16:0/18:2 during the 6-hour period after ethanol administration; (3) the mean rate of formation of PEth 16:0/20:4 was lower than those of the other 2 homologs; (4) the mean half-life of PEth 16:0/20:4 was 2.18 days, which was shorter than that of either PEth 16:0/18:1 and PEth 16:0/18:2, which were 6.80 and 6.62, respectively. DISCUSSION/SIGNIFICANCE OF IMPACT: The results of this study further confirm that PEth homologs are a sensitive biomarker for ethanol consumption. The measurement of three PEth homologs appears to provide additional information about the level and time frame of drinking.

2555

Predictive cytological topography (PiCT): A radiopathomics approach to mapping prostate cancer

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OBJECTIVES/SPECIFIC AIMS: The objective of this study is to use machine Learning techniques to generate maps of epithelium and lumen density in MRI

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