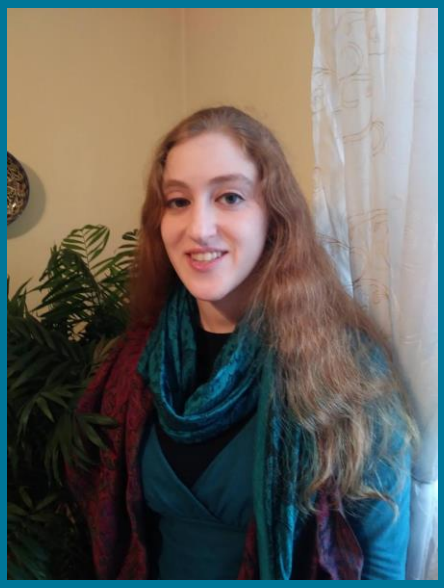
UNIVERSITY of MARYLAND
CENTER TO ADVANCE CHRONIC PAIN RESEARCH

RELIEVING PAIN IN AMERICA



CACPR Member Spotlight

Miriam Weiss, RN, BSN

Miriam Weiss, RN, BSN, a PhD student in the Department of Pain and Translational Symptom Science at the University of Maryland School of Nursing has been awarded a PA-19-195 Ruth L. Kirschstein National Research Service Award (NRSA) Individual Predoctoral Fellowship (Parent F31) entitled “Testing the therapeutic effectiveness of a topical agent to reduce diabetic wound pain and improve healing.” The award was co-sponsored by Dr. Susan G. Dorsey, PhD, RN, FAAN, Tenured Professor at University of Maryland School of Nursing, Chair of the Department of Pain & Translational Symptom Science, and co-director of the UMB CACPR;

and Dr. Cynthia L. Renn PhD, RN, FAAN Tenured Professor at University of Maryland School of Nursing.

The original study proposed to test a novel topical compound that was designed to improve healing and reduce pain in diabetic wounds in a porcine model. Due to the outbreak of COVID-19, the company manufacturing the compound that I had planned to test is no longer able to collaborate on any new projects, which includes my predoctoral research. Because my primary interest is in the development and testing of large animal models of pain, and not diabetic wound healing and pain, my committee and I obtained approval from NIH to change the pain type that I will be testing, while remaining with the originally-proposed porcine model. The project will study the nocifensive behavior and biomarkers of pain severity in animals that will receive cisplatin therapy, which often leads to chemotherapy-induced peripheral neuropathy (CIPN), compared with vehicle therapy.

CIPN is a highly prevalent and devastating side effect of cancer treatment; resulting in stocking-and-glove numbness, paresthesia, weakness, and pain. The pain is so severe that it is not uncommon for patients to refuse to continue the potentially lifesaving cisplatin therapy. Even up to 15 years after remission, approximately half of all survivors continue to experience symptoms. At present, there are no effective evidence-based methods to fully protect against CIPN. Since most CIPN studies have been conducted in rodent models, one reason for the lack of effective therapeutics may be the lack of a translational large animal. Thus, in this study, we will attempt to develop a suitable translational model. Pigs were selected as

models because they exhibit highly individualized nociceptive responses, rendering them advantageous for pain studies. Furthermore, their cancer pathology is more closely aligned with that of humans as compared to traditional rodent models.

Under the award, I plan to determine the range and variability of the effects of cisplatin administration on nocifensive behavior in pigs. Degree of nocifensive behavior experienced by pigs with and without cisplatin treatment will be assessed using an Adult Pig Grimace Scale that I will adapt from an existing neonatal pig scale. Furthermore, I will use RNA sequencing to analyze RNA obtained from pain-relevant tissues (e.g., dorsal root ganglion, spinal dorsal horn) to identify any potential biomarkers that are linked to CIPN development.

The project has been developed with the collaboration of Dr. Joel Greenspan, PhD, who is a Tenured Professor and Chair of the Department of Neural and Pain Sciences at the University of Maryland School of Dentistry, the director of the Brotman Facial Pain Clinic, and co-director the CACPR.

CACPR Member Laurels

Highlights of recent grant awards, publications, and presentations.

Vinita Agarwal, PhD

Agarwal, V. (Oct. 27–28, 2020). Identifying Whole-Person Traditional Medical System Therapeutic Relationship Themes in Long-Term Breast Cancer Survivorship: Implications for Integrative Patient-Centered Care. Poster to be presented at the *Global Approaches of Integrative Oncology* session at

the *National Cancer Institute, Trans NCI-NIH Conference on International Perspectives on Integrative Medicine for Cancer Prevention and Cancer Patient Management,* Natcher Conference Center, NIH Main Campus, Bethesda, MD USA

Agarwal, V. (Oct. 27–28, 2020). Conceptualizing Pain in Ayurvedic Protocols for Chronic Pain Management: A Case Study of Ayurvedic Physicians from India. Poster to be presented at the *Global Approaches of Integrative Oncology* session at the *National Cancer Institute, Trans NCI-NIH Conference on International Perspectives on Integrative Medicine for Cancer Prevention and Cancer Patient Management,* Natcher Conference Center, NIH Main Campus, Bethesda, MD USA

Simon Akerman, PhD

Summ O, Andreou AP, **Akerman S**, Holland PR, Hoffmann J, Goadsby PJ. Differential actions of indomethacin: clinical relevance in headache. Pain 2020. (https://pubmed.ncbi.nlm.nih.gov/32796319/).

Here, we demonstrate the unique ability of indomethacin, over other common OTC NSAIDs, to inhibit nitric oxide-induced migraine-like dural-trigeminovascular neuronal changes, compared to similar effects in response to glutamate. It highlights its potential differential mechanism of action, via disruption of nitric oxide signaling, and why it might be specifically efficacious in the treatment of paroxysmal hemicrania and hemicrania continua.

Simon Akerman, PhD and Marcela Romero- Reyes, DDS, PhD

Akerman S, **Romero-Reyes M**. Preclinical studies to dissect the neural mechanism for the comorbidity of migraine and temporomandibular disorders (TMD): the role of CGRP. Br J Pharmacol 2020. (https://pubmed.ncbi.nlm.nih.gov/32929719/).

Here, we demonstrate a unique preclinical approach to study the co-morbidity of migraine and TMD. The only approach that directly translates to the clinical co-morbid phenotype. Using this approach we begin to dissect the neural mechanisms involved, highlighting the likely importance of the release of CGRP in these mechanisms.

Man-Kyo Chung, DMD, PhD

Dr. Man-Kyo Chung received NIDCR Award for Sustaining Outstanding Achievement in Research (SOAR) (R35) entitled “Trigeminal Nociceptors: Neural Intersection of Chronic Pain and Alveolar Bone Remodeling”. In this project, dual roles of trigeminal sensory afferents on two fundamental areas in oral health. This award supports total $8M for 8 years. **Co- Investigators are Drs. Feng Wei, David Seminowicz and Vivek Thumbigere-Math**.

Luana Colloca, MD, PHD, MS

Interview

2020 (Sept 23, 2020) - Jessica Hamzelou - **New Scientist** - Blood test could reveal if you will experience the placebo effect. https://www.newscientist.com/article/2255163-blood-test-could-reveal-if-you-will-experience-the-placebo-effect/

This interview is related to a recent article on proteomics as a tool to predict nausea-related placebo effects.

E-book

Weimer K, Enck P, Dodd S, **Colloca L.** Editorial: Placebo and Nocebo Effects in Psychiatry and Beyond. Front Psychiatry. 2020 Aug 7;11:801. http://doi.org/10.3389/fpsyt.2020.00801.

This eCollection can be found here: https://www.frontiersin.org/research-topics/7727/placebo-and-nocebo-effects-in-psychiatry-and-beyond

Publications

Okusogu C, Wang Y, Akintola T, Haycock NR, Raghuraman N, Greenspan JD, Phillips J, Dorsey SG, Campbell CM, **Colloca L.** Placebo hypoalgesia: racial differences. Pain. 2020 Aug;161(8):1872-1883. http://doi.org/10.1097/j.pain.0000000000001876

Racial influences were tested on conditioning strength, reinforced expectations, and placebo hypoalgesia. We found that white participants reported greater conditioning effects, reinforced relief expectations, and placebo effects when compared with their AA/black counterparts. This is the first and largest study to analyze racial effects on placebo outcomes.

Darnall BD, Mackey SC, Lorig K, Kao MC, Mardian A, Stieg R, Porter J, DeBruyne K, Murphy J, Perez L, Okvat H, Tian L, Flood P, McGovern M, **Colloca L**, King H, Van Dorsten B, Pun T, Cheung M. Comparative Effectiveness of Cognitive Behavioral Therapy for Chronic Pain and Chronic Pain Self-Management within the Context of Voluntary Patient-Centered Prescription Opioid Tapering: The EMPOWER Study Protocol.Pain Med. 2020 Aug 1;21(8):1523-1531. http://doi.org/10.1093/pm/pnz285

The EMPOWER study seeks to address multiple unmet needs of patients with chronic pain who desire to reduce long-term opioid therapy, and provide the clinical evidence on effective methodology to inform clinical systems changes, clinical care, patient satisfaction, and patient outcomes for opioid reduction.

Mitsikostas DD, Blease C, Carlino E, **Colloca L**, Geers AL, Howick J, Evers AWM, Flaten MA, Kelley JM, Kirsch I, Klinger R, MaassenVanDenBrink A, Moerman DE, Sfikakis PP, Vase L, Wager TD, Benedetti F; European Headache Federation. European Headache Federation recommendations for placebo and nocebo terminology. J Headache Pain. 2020 Sep 25;21(1):117. http://doi.org/10.1186/s10194-020-01178-3

Despite recent publications, practitioners remain unfamiliar with the current terminology related to the placebo and nocebo phenomena observed in clinical trials and practice, nor with the factors that modulate them. To cover the gap, the European Headache Federation appointed a panel of experts to clarify the terms associated with the use of placebo in clinical trials. 5. Pain. 2020 Sep 10. http://doi.org/10.1097/j.pain.0000000000002064 Online ahead of print.

Olson EM, Akintola T, Phillips J, Blasini M, Haycock NR, Martinez PE, Greenspan JD, Dorsey SG, Wang Y, **Colloca L.** Effects of sex on placebo effects in chronic pain participants: a cross-sectional study.Pain. 2020 Aug 17. http://doi.org/10.1097/j.pain.0000000000002038 Online ahead of print.

Independent of gonadal hormone levels, women showed stronger placebo effects than men. Our findings suggest that women experience larger conditioning effects, expectations, and placebo effects emphasizing the need to consider sex as a biological variable when placebo components of any outcomes are part of drug development trials and in pain management.

Wai-Lan Yeung V, Geers AL, **Colloca L.** Merely Possessing a Placebo Analgesic Improves Analgesia Similar to Using the Placebo Analgesic. Ann Behav Med. 2020 Sep 1;54(9):637-652. http://doi.org/10.1093/abm/kaaa007

Our results suggest that merely possessing a placebo analgesic could enhance pain outcomes similar to that of applying the placebo analgesic.

Joel Greenspan, PhD

The following seven papers constituted a special issue of the *Journal of Oral and Facial Pain and Headache.* This compendium is the final series of papers from the OPPERA study: Orofacial Pain: Prospective Evaluation and Risk Assessment, although several individual papers will still follow. This series examined the impact that chronic overlapping pain conditions (COPC) have upon the incidence and severity of any given pain condition. In addition, these reports describe the impact that COPCs have upon psychological state, pain sensitivity, sleep disorders, and other clinical features impacting chronic pain conditions. A consistent pattern observed in these analyses is that both clinical and psychological measures show progressively greater dysfunction with increasing numbers of COPCs. These finding emphasize the need to not just view a single condition in isolation, but rather consider any given chronic pain condition in the context of co-morbidities, and their relevance to the pain and suffering of the patient.

Ohrbach R, Fillingim RB, **Greenspan JD**, Maixner W, Sanders AE, Sharma S, Slade GD. Authors' Response: When You Come to the Fork in the Road, Take It! Future Research into Chronic Pain as a General Condition. J Oral Facial Pain Headache. 2020 Suppl;34:s12-s14. http://doi.org/10.11607/ofph.2020.suppl.ar PMID: 32975537.

Fillingim RB, Ohrbach R, **Greenspan JD**, Sanders AE, Rathnayaka N, Maixner W, Slade GD. Associations of Psychologic Factors with Multiple Chronic Overlapping Pain Conditions. J Oral Facial Pain Headache. 2020 Suppl;34:s85-s100. http://doi.org/10.11607/ofph.2584 PMID: 32975543.

Sanders AE, **Greenspan JD**, Fillingim RB, Rathnayaka N, Ohrbach R, Slade GD. Associations of Sleep Disturbance, Atopy, and Other Health Measures with Chronic Overlapping Pain Conditions. J Oral Facial Pain Headache. 2020 Suppl;34:s73-s84. http://doi.org/10.11607/ofph.2577 PMID: 32975542.

Sharma S, Slade GD, Fillingim RB, **Greenspan JD**, Rathnayaka N, Ohrbach R. Attributes Germane to Temporomandibular Disorders and Their Associations with Five Chronic Overlapping Pain Conditions. J Oral Facial Pain Headache. 2020 Suppl;34:s57-s72. http://doi.org/10.11607/ofph.2582 PMID: 32975541.

Greenspan JD, Slade GD, Rathnayaka N, Fillingim RB, Ohrbach R, Maixner W. Experimental Pain Sensitivity in Subjects with Temporomandibular Disorders and Multiple Other Chronic Pain Conditions: The OPPERA

Prospective Cohort Study. J Oral Facial Pain Headache. 2020 Suppl;34:s43-s56. http://doi.org/10.11607/ofph.2583 PMID: 32975540.

Ohrbach R, Sharma S, Fillingim RB, **Greenspan JD**, Rosen JD, Slade GD. Clinical Characteristics of Pain Among Five Chronic Overlapping Pain Conditions. J Oral Facial Pain Headache. 2020 Suppl;34:s29-s42. http://doi.org/10.11607/ofph.2573 PMID: 32975539.

Slade GD, **Greenspan JD**, Fillingim RB, Maixner W, Sharma S, Ohrbach R. Overlap of Five Chronic Pain Conditions: Temporomandibular Disorders, Headache, Back Pain, Irritable Bowel Syndrome, and Fibromyalgia. J Oral Facial Pain Headache. 2020 Suppl;34:s15-s28. http://doi.org/10.11607/ofph.2581 PMID: 32975538.

The following paper sought to identify genetic factors associated with sleep quality. A GWAS performed on OPPERA data identified two genetic polymorphisms associated with sleep quality. A meta-analysis of 12 separate cohorts replicated one of those genetic polymorphisms on chromosome 7 between NPY and MPP6. Expression data from the BRAINEAC database showed an association of this locus with both NPY and MPP6 mRNA levels in brain tissues. Moreover, knockdown of an orthologue of MPP6 in Drosophila melanogaster sleep center neurons resulted in decreased sleep duration. With convergent evidence, this report describes a new locus impacting human variability in sleep quality through known NPY and novel MPP6 sleep genes.

Khoury S, Wang QP, Parisien M, Gris P, Bortsov AV, Linnstaedt SD, McLean SA, Tungate AS, Sofer T, Lee J, Louie T, Redline S, Kaunisto MA, Kalso EA, Munter HM, Nackley AG, Slade GD, Smith SB, Zaykin DV, Fillingim RB, Ohrbach R, **Greenspan JD**, Maixner W, Neely GG, Diatchenko L. Multi-ethnic GWAS and meta- analysis of sleep quality identify MPP6 as a novel gene that functions in sleep center neurons. Sleep. 2020 Oct 9:zsaa211. http://doi.org/0.1093/sleep/zsaa211 Epub ahead of print. PMID: 33034629.

Ohannes Melemedjian, PhD

R01 NS116759 (Melemedjian, PI)
NIH/NINDS
09/30/2020 – 05/31/2025
Amount: $1,931,250 (Total direct and indirect)
“Validating ASCT2 for the Treatment of Chronic Postsurgical Pain”

Project Summary: Pain associated with surgery is experienced by millions of patients every year. Post-surgical pain usually resolves as the surgical site heals. However, up to half of the patients develop chronic pain after surgery. Crucially, little is known about the mechanisms that aid in the resolution of postoperative pain. Moreover, opioids remain the mainstay treatment for post-surgical pain which are fraught with serious side-effects and crucially - abuse liabilities. This grant proposes to validate ASCT2 as an endogenous mechanism that aids in the resolution of postoperative pain. Moreover, an innovative RNA-based strategy that enhances the translation of ASCT2 and alleviates postoperative pain will be validated. Uncovering endogenous targets that resolve postoperative pain can have a broad impact in advancing our knowledge of the transition of acute pain to chronic and lead to urgently needed public health advancements.

R01 CA249939 (Melemedjian, PI)
NIH/NCI
09/21/2020 – 08/31/2025
Amount: $1,931,250 (Total direct and indirect)
“Identification of novel targets for the treatment of chemotherapy-induced painful neuropathy:”

Project Summary: Chemotherapy-induced painful peripheral neuropathy (CIPN) is the most common toxicity associated with widely used chemotherapeutics. CIPN is the major cause of dose reduction or discontinuation of otherwise life-saving treatment. Unfortunately, CIPN can persist in cancer-survivors which adversely affects their quality of life. Moreover, available treatments are vastly inadequate which necessitates the development of novel mechanism-based therapies that can either prevent or treat CIPN. This grant will validate novel mechanism-based molecular targets that not only prevent or treat CIPN but might also potentiate the anticancer effects of chemotherapeutics.

Kristen Weaver, PhD, CRNP

Weaver KR, Boulineaux CM, Robinson JM, Butler K, Heitkemper MM, Henderson WA. Sex Hormones, BDNF, Leptin, and TGF-β1 in Females With IBS: A Pilot Investigation. Biological Research for Nursing. 2020, Aug 18, Online ahead of print:1-7. http://doi.org/10.1177/1099800420948589

This pilot study reports elevated estradiol in female participants with IBS versus female healthy controls, and differential patterns of biological and psychological indices between groups. Such findings encourage further inquiry

on sex hormones, BDNF, leptin, and TGF-β1 to facilitate insight on pathophysiology and female sex bias in IBS.

JunFang Wu, B.M., PhD

Grants & Contracts

PI Name: Junfang Wu
Project Title: The New Roles of the Autophagy-lysosomal Pathway in Spinal Cord Injury-mediated Dementia
Application ID: R01 NS094527-05S1
Funding Period: 06/01/2020-05/31/2021
Funding Amount: $337,459 (direct and indirect)

Project Summary: Recent evidence, including large-scale longitudinal population-based study, indicate that isolated SCI (without concurrent brain injury) are at a high risk of dementia associated with substantial cognitive impairments. Yet little is known about the mechanisms of SCI-induced dementia or its relationship to age of onset or age-related neurodegenerative disorders such as Alzheimer's disease (AD). This represents an unmet health-care challenge. The autophagy-lysosomal pathway is essential for intracellular protein and organelle degradation and quality control. Impaired autophagy is strongly implicated in accumulation of pathological protein aggregates such as phospho-tau tangles and amyloid b plaques and consequent neuronal cell damage and death in neurodegenerative diseases. Recent data indicate that perturbation of autophagy can also alter inflammatory responses. Thus, inhibition of autophagy-lysosomal function could contribute to both neuronal cell damage and inflammation observed in age-related AD/ADRD. We will use young adult autophagy deficient mice and aged animals to delineate the roles of autophagy-lysosomal pathway as a key regulator of brain inflammation and neurodegeneration in SCI.

Publications

1. Li Y, Cao T, Ritzel RM, He J, Faden AI, Wu J. Dementia, depression and associated brain inflammatory mechanisms after spinal cord injury. Cells, 2020 Jun 8; 9(6): 1420; doi:10.3390/cells9061420. PMID: 32521597.

This review summaries clinical and experimental work on the complex and varied responses in the brain following SCI. We also discuss potential mechanisms responsible for these less well-examined, important SCI consequences. In addition, we outline the existing and developing therapeutic

options aimed at reducing SCI-induced brain neuroinflammation and post-injury cognitive and emotional impairments.

2. Li Y, Ritzel RM, Khan N, Cao T, He J, Matyas JJ, Sabirzhanov B, Liu S, Li H, Stoica BA, Loane DJ, Faden AI, **Wu J**. Delayed microglial depletion after spinal cord injury reduces chronic inflammation and neurodegeneration in the brain and improves neurological recovery in male mice. Theranostics, 2020; 10(25): 11376-11403. doi: 10.7150/thno.49199

The study showed that microglial depletion, whether initiated prior or after injury, significantly reduced inflammation in both injured spinal cord and the brain during the acute stages of injury. Chronic neuroinflammation was also reduced by PLX5622, and further supported by NanoString neuroinflammation panel analysis. These findings strongly implicate chronic neurotoxic inflammation as a major pathophysiological factor in SCI-mediated brain pathology and related neurological impairments. Furthermore, these studies support the concept that depression after SCI is not necessarily “reactive”, but rather may reflect specific neuropathological changes that can be improved by targeting neuroinflammation.

3. Li Y, Ritzel RM, He J, Cao T, Sabirzhanov B, Li H, Liu S, Wu L-J, **Wu J**. The voltage-gated proton channel Hv1 plays a detrimental role in contusion spinal cord injury via extracellular acidosis-mediated neuroinflammation. Brain, Behavior, and Immunity, 2020 Oct 8:S0889-1591(20)31892-4. doi: 10.1016/j.bbi.2020.10.005. Online ahead of print. PMID: 33039662

This paper examined the induction and molecular mechanism of pathological acidosis after SCI, revealing a novel regulatory role for the Hv1 proton channel. We demonstrated that Hv1 activity, while essential for phagocyte function and intracellular pH regulation, can become dysregulated following traumatic SCI, resulting in the extracellular release of protons and ROS. These findings establish a direct causal link between inflammation and acidosis. Targeting this ion channel by genetic deletion led to attenuation of these pathological processes in the acute stage and enhanced long-term recovery. Therefore, early intervention aimed at inhibiting Hv1 activity may mitigate tissue acidosis and alleviate the damage caused by spinal cord trauma.

New Grant Spotlight

Novel Target Identification for Treatment of Chronic Overlapping Pain Using Multimodal Brain Imaging
Richard Traub, Ohannes Melemedjian, David Seminowicz, Joyce Da Silva, Robert Ernst, Alison Scott

NIH/NIDCR
$3.75 million for 5 years

Many chronic pain conditions have no obvious cause based on injury or disease. Irritable bowel syndrome (IBS), temporomandibular disorder (TMD), fibromyalgia and migraine headache are a few of these conditions collectively known as Chronic Overlapping Pain Conditions (COPCs). They occur in tens of millions of Americans with annual costs exceeding $100 billion and represent a highly significant pain management challenge for physician and patient. Epidemiological data indicate many of these conditions overlap in presentation in the same patient, with odds of presenting 2 or more conditions exceeding 50%. Often spatially separate areas of the body are affected (e.g., TMD and IBS), which strongly suggests the involvement of central nervous system mechanisms. Additionally, stress triggers or exacerbates many of these conditions, which occur more frequently or exclusively in women. The convergence of pain from different peripheral tissues and perceived stress most likely occurs in the brain. Our project proposes an innovative, multidisciplinary, discovery-driven approach to *identify novel targets for therapeutic intervention* to treat these chronic pain conditions. We will use a recently reported rat model of comorbid pain hypersensitivity: masseter muscle inflammation followed by stress inducing *de novo* chronic visceral hypersensitivity, a defining characteristic of IBS. Combining visceral and orofacial pain measurement in awake animals, functional magnetic resonance imaging of brain activity during different phases of acute and chronic pain, mass spectrometry imaging of brain sections, and genetic and molecular approaches will allow identification of specific lipids and their metabolic pathways that change expression in the brain during the transition from acute to chronic overlapping pain. A longitudinal design will allow changes in brain activity in individual animals to be followed over weeks to months. In addition, areas of the brain that contribute to known sex differences in the magnitude and duration of the stress-induced and comorbid pain hypersensitivity should be identified. In three specific aims we will: 1) Identify changes in structure/function of brain regions in response to stress alone and pain plus stress which correlate with changes in visceral sensitivity and orofacial mechanosensitivity in male and female rats. Further, we will identify lipid moieties and the underlying metabolic pathways that change between baseline, acute and chronic pain conditions; 2) determine the effect of genetic knockdown of identified metabolic pathways in rat models of stress-induced and comorbid pain hypersensitivity. siRNA microinjected into brain regions identified in Aim 1 will be used to knockdown expression of enzymes that mediate the changes in lipid expression in the rat models. The effects of siRNA on the sensory and affective components of pain will be examined to help identify “drugable targets” for therapeutic intervention; and 3) Use pharmacological tools to test identified targets in order to confirm the clinical

utility in reversing these conditions. The proposed studies will significantly advance understanding of chronic overlapping pain conditions and identify novel treatment targets.

Accolades

Joyce Teixeira da Silva, Ph.D was selected to be a mentor in the BUILD2 ASCEND program.

The NIH-funded BUILD2 ASCEND program is a collaboration between UMB and MSU designed to increase diversity in the biomedical community. This program will provide MSU underrepresented undergrad students pursuing biomedical research careers with training in hypothesis testing, project design and implementation. Compensations will be provided to mentor and mentees. For more information please click here.

Announcements

Please see an important message below from Jennifer Haythornthwaite, Ph.D.

We are busy planning the **first (virtual) annual meeting of the USASP, December 9-11**, which will be held in the afternoons of each day.

We are now accepting **abstract submissions** for presentation of posters (https://www.softconf.com/k/usasp2020/). The deadline for these submissions is 11/13 and please encourage your colleagues, particularly trainees, to submit. In the application, there is the option to be selected to present as part of a data blitz, which will be brief oral presentations during the sessions.

We look forward to hearing from you and please plan to participate. There will no NO CHARGE for this meeting for USASP members. Please direct any questions to me or Michael Gold (msg22@pitt.edu).

Jennifer A. Haythornthwaite, Ph.D.
Professor | Department of Psychiatry & Behavioral Sciences | Johns Hopkins University School of Medicine

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We encourage all CACPR members to join the USASP and submit your best work to *The Journal of Pain.*

The UM Center to Advance Chronic Pain Research (CACPR) is a multidisciplinary center composed of nationally and internationally renowned clinical and preclinical translational scientists whose principle research focus is on the physiological, genetic, and psychosocial underpinnings of the development and persistence of debilitating chronic pain conditions.

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SUBSCRIBE TO OUR MAILING LIST