Chinese Neurotrauma Scholar Association

華人神經創傷學會

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CNSA Newsletter May 2021

News

CNSA & Journal of Neural Regeneration Research (NRR) Joint Webinar: Emerging Animal Models for Translational TBI Research

Time: Saturday, May 8th, 2021, 9-10:30 am (US Eastern Standard Time, EST)/9-10:30 pm (Beijing Time, BJT);

Link: https://us02web.zoom.us/j/83380527332?pwd=V3kvUUkzWW5YSzNvemwwM2IyOU5PZz09

Meeting ID: 833 8052 7332

Password: brain

Program description: The classical TBI models that have been used in TBI research are mostly rodent models generated over 20 years ago. These models including fluid percussive injury, controlled cortical impact, weight drop model etc. resemble some or partial neuropathological development of TBI seen in clinic. In recent years, several new models have emerged to represent the increasing clinical cases of mild repetitive injury, blast injury for better clinic translation. The selection of a model system is critical for achieving research goals. This session will introduce recently developed new rodent TBI models and discuss their relevance for clinical translations.

Program:

9:00-9:05 Meng Zhao (From NRR), Introduction

9:05-9:10 Dr. Dong Sun (CNSA President, Session Chair), Opening remarks

9:10-9:30 Dr. Zhihui Yang, PhD, Assistant Professor, Department of Emergency Medicine and Associate Director at Center of Neuroproteomics and Biomarker Research, University of Florida.
Speech Title: An updated on experimental closed head injury models

9:30-9:50 Dr. Riyi Shi, PhD, Professor, University of Purdue.
Speech Title: Rodent Models of Mild Blast-Induced Traumatic Brain Injury

9:50-10:10 Dr. Zezong Gu, MD, PhD. Professor, Department of Pathology and Anatomical Sciences at the University of Missouri (MU) School of Medicine; Health Research Scientist at Harry S. Truman VA Hospital Research Division.
Speech Title: Open-field "Missouri Blast" in Mice: Physical and physiological impact of the low-intensity blast exposure

10:10-10:30 Q&A

CNSA PIs

LABORATORY OF XIAO-MING XU

Dr. Xiao-Ming Xu is a Professor and Mari Hulman George Chair of Neurological Surgery, and the founding Scientific Director of the Spinal Cord and Brain Injury Research Group at Stark Neurosciences Research Institute, Indiana University School of Medicine. He is also a Research Career Scientist at Richard Roudebush VA Medical Center, Indianapolis IN.

Dr. Xiao-Ming Xu received his Medical Diploma and MSc. from Shanghai Jiaotong University School of Medicine (previous name: Shanghai Second Medical University), and his Ph.D. in Anatomy/Neurobiology from The Ohio State University in 1990. He went through post-doctoral training in the Miami Project to Cure Paralysis at University of Miami under the mentorship of Dr. Mary Bartlett Bunge in 1991-1994. In 1994, Dr. Xu became an Assistant Professor in the Department of Anatomy and Cell Biology at Saint Louis University and later moved up to the rank of Associate Professor. Between 2001 and 2007, he joined the Kentucky Spinal Cord Injury Research Center and Department of Neurological Surgery as an Associate Professor/Professor and James R. Petersdorf Endowed Chair at University of Louisville (Louisville, KY). He also achieved the distinction of University Scholar at the University of Louisville. Since 2007, Dr. Xu has joined the Indiana University School of Medicine as a Professor and Mari Hulman George Chair of Neurological Surgery, and the founding Scientific Director of the Spinal Cord and Brain Injury Research Group at the Stark Neurosciences Research Institute. Dr. Xu's research has focused on neuroprotection, axonal regeneration, and recovery of function of traumatic spinal cord and brain injuries. In the past 20 years, he has received continuous support from the National Institutes of Health (NIH), Department of Defense (DOD), Department of Veterans Affairs (VA), the Craig H Neilsen Foundation, and other grant foundations. He has served as a standing member on various NIH study sections over 15 years. He has published over 200 research papers in prestigious scientific journals including Cell Metabolism, Cell Stem Cell, Nature Neuroscience and Nature Communications. He is the Editor-in-Chief of Neural Regeneration Research (http://www.nrronline.org/). He has served on Editorial Boards of multiple journals including Experimental Neurology and Journal of Neurotrauma. He co-edited three books entitled "Animal Models of Acute Neurological Injuries (I & II)" and "Neural Regeneration". In 2020, he was listed on the "World's Top 2% Scientists 2020". He has been a co-chair of the International Neural Regeneration Symposium since 2011 (http://www.inrs-nrr.org).

The goal of the Xu Laboratory is to study mechanisms underlying traumatic spinal cord and brain injuries (SCI and TBI, respectively) and to develop novel repair strategies to promote neural reorganization and functional recovery in experimental models of these injuries. To reach this goal, two lines of research are being conducted. The first line of research is on neuroprotection. Our lab was among the first to report programmed cell death (or apoptosis) following acute SCI, and to report phospholipase A2 (PLA2) as a key mediator of the secondary SCI. The second line of research is on axonal plasticity, remodeling and regeneration. To bridge the gap of damaged spinal cord, we were among the first to transplant Schwann cells (SCs) into the lesion gap to promote axonal regeneration and recovery of function following SCI. In addition to SCs, we extent our cell therapy to include oligodendrocyte progenitor cells (OPCs) and human embryonic stem cell-derived glial progenitors (hESC-GPs) in their ability to support neural circuit remodeling and recovery of function. These cell-based strategies are combined with other efficacious treatments (e.g., exercise training, small therapeutic molecules, and nanoparticles) on boosting intrinsic and extrinsic regenerative capacities. We are particularly interested in promoting regeneration and/or reorganization of descending motor pathways including the corticospinal tract (CST), the rubrospinal tract (RST) and the descending propriospinal tract (dPST). In our research, we apply cutting-edge and multidisciplinary approaches including novel injury models, cellular and molecular biology, in vivo imaging, optogenetics, electrophysiology, behavioral, and histology/immunohistochemistry approaches.

Recent representative publications (*corresponding author):

1. Wang Y, Wu W, Wu X, Sun Y, Zhang YP, Deng L-X, Walker MJ, Qu W, Chen C, Liu NL, Han Q, Dai H, Lisa B.E. Shields LBE, Shields CB, Sengelaub DR, Jones KJ, Smith GM, and **Xu X-M*** (2018) Remodeling of lumbar motor circuitry remote to a thoracic spinal cord injury promotes locomotor recovery. ***eLife*** Sept. 12, 2018; doi: 10.7554/eLife.39016.
2. Han Q, Ordaz JD, Liu N, Richardson Z, Wu W, Xia Y, Qu W, Wang Y, Dai H, Zhang YP, Shields CB, Smith GM, **Xu X-M*** (2019) Descending motor circuitry required for NT-3 mediated locomotor recovery after spinal cord injury in mice. ***Nat. Comm.*** **10** (1) 1-16, https://doi.org/10.1038/s41467-019-13854-3
3. Qu W, Liu N-K, Wu X, Wang Y, Xia Y, Sun Y, Lai Y, Li R, Shekhar A, and **Xu X-M*** (2020) Disrupting nNOS-PSD95 interaction improves neurological recovery following traumatic brain injury ***Cerebral Cortex.*** 30 (7) 3859-3871,2020 https://doi.org/10.1093/cercor/bhaa002
4. Han Q, Xie Y., Ordaz JD, Huh AJ, Huang N, Wu W, Liu N, Chamberlain KA, Sheng Z-H, **Xu X-M*** (2020) Recovering energy deficits promotes CNS axonal regeneration and functional restoration after spinal cord injury ***Cell Metabolism*** 31 (3) 623-641, March 3, 2020. DOI: https://doi.org/10.1016/j.cmet.2020.02.002
5. Tai W^{+}, Wu W^{+}; Wang L-L*, Ni H, Chen C, Yang J, Zou Y, **Xu X-M***; Zhang C-L* (2021) Latent neurogenic potential of NG2 glia enables adult neurogenesis and functional recovery following spinal cord injury ***Cell Stem Cell*** (CELL-STEM-CELL-D-20-00557R1, accepted) (*co-corresponding authors)

More information about Dr Xu's research, please find at: https://medicine.iu.edu/faculty/18840/xu-xiao-ming"

- CNSA members: please submit your updated information, e.g., promotion, significant publications, grants, and new recruits, for the next newsletter to be published

Research Highlights

冲击波物理指标与原发性非钝性爆破脑外伤相关

■ 研究亮点(Research Highlights) — 密苏里大学研究人员利用冲击波物理学和爆炸超压的知识来探索爆炸引发的创伤性脑损伤（TBI）的致病原因

密苏里大学医学院顧澤宗教授领导的研究团队与合作者，在 2021《Military Medicine》期刊发表了，题为“冲击波物理指标与原发性非钝性爆破脑外伤相关”的新近研究。暴露于炸药引爆在战场上和军队训练中是造成轻度脑创伤（mild traumatic brain injury, mTBI）的主要原因。爆炸引起的 mTBI 是由初始爆炸超压冲击波（shock waves）引起的。低强度爆炸（Low-intensity blast）超压所产生冲击波能量，传递到大脑组织造成“隐形损伤”，因此对该低度爆炸能量导致脑损伤的确切机制了解甚少。由于这种损伤发生在亚细胞水平，通常只能通过高清晰的神经成像技术（例如透射电子显微镜）以及组织病理学，生化和神经行为的总体评估来检测脑损伤程度。先前有关爆炸诱导的 mTBI 的研究未能将脑组织损伤与爆炸超压冲击波的不同物理特征阐述相关联。因此，对冲击波相关的爆炸诱发 mTBI 病变的完整理解，需要对冲击波表征特性进行详细的研究。

为了解开这一疑问，顧教授领导的科研团队深入采集了爆炸冲击波的物理特性，包括峰值压力，冲击波峰升时间，正相持续时间，脉冲，冲击速度和粒子速度，以及低强度爆炸所造成的对小鼠大脑的生物学效应（Rutter et al., 2021[1]; Konan et al., 2019[2]; 和 Song et al., 2018[3]）。在这项研究中，小鼠暴露于露天爆炸，检测爆炸冲击波的物理特性，然后使用神经行为学，组织学，生物化学，以及高分辨神经细胞亚结构像学进行评估。此外，在露天爆炸和冲击管（shockwave tubes）爆炸实验中比较不同的爆炸波形，研究表明这些类型的爆炸超压的物理特性存在主要差异。

正如所预期的，暴露于露天爆炸冲击波的物理特性与超微结构脑损伤和神经行为改变有密切关联。具体地说，轴突，线粒体和突触的异常，线粒体功能障碍的增加和氧化应激导致神经行为功能的下降。这些研究结果，结合露天爆炸和冲击管爆炸超压之间的波形比较，可以了解爆炸冲击波的物理特性。此外，研究结果提供了爆炸物理特性数据库，可直接与露天爆炸引起的生物学发现进行比较，而与露天或冲击管建模无关。了解冲击波物理学与导致脑损伤的组织损伤之间的联系将有助于制订 TBI 治疗方案。未来详细研究冲击波物理学与脑组织损伤之间关系的工作将有助于了解，预防，评估，和治疗现役、退伍军人以及平民因爆炸诱发的 TBI。

这项研究入选 U.S.国防部（DoD）爆炸伤害研究协调办公室（BIRCO）网站四月份的研究亮点(Research Highlights)，介绍 DoD 爆炸伤害研究项目相关重点领域所取得的成就（https://blastinjuryresearch.amedd.army.mil/index.cfm/news_and_highlights/research_highlights/FY21/shock_wave_physics）。

参考文献：[1]Rutter, et al., Shock Wave Physics as Related to Primary Non-Impact Blast-Induced Traumatic Brain Injury, Military Medicine, Military Medicine 2021; [2]Konan, et al., Multi-Focal Neuronal Ultrastructural Abnormalities and Synaptic Alterations in Mice after Low-Intensity Blast Exposure, J Neurotrauma. 2019; [3]Song, et al., Ultrastructural Brain Abnormalities and Associated Behavioral Changes In Mice After Low-Intensity Blast Exposure, Behav Brain Res, 2018.

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