

Application for Faculty Research Support Funding for 2016-2017

Science Research at Franklin Pierce University

Effects of Opioids on the Brain

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Project Conception and Definition

The purpose of this request is to renew funding for a research project that was first proposed in 2015. My interest lies in the field of drug use, opiates, and opioids in particular, and their effect on the brain. The use and abuse of these drugs has been a source of concern at a national level¹ and for New Hampshire in particular. A summary report released by the NH medical examiner has shown that, as of January 28, 2016, there were 399 confirmed opiates/opioids deaths for the year 2015. A final number was projected to be over 400 once toxicology on pending cases was completed (see appendix 1). Over 400 deaths would be double the number of 201 deaths reported for the year 2011.

I have the privilege of receiving assistance from Dr. Stanley F. Seligman, a retired forensic pathologist from Cleveland, Ohio. He has examined the brain samples that have already been obtained from autopsy and has confirmed that the sections obtained from the ME included all regions of interest.

Our project is focused on investigating the disruptions of opioids/opiates have at the anatomical and histological levels in human brain samples obtained at autopsy, from opioids/opiates overdoses. We will analyze very specific regions in the brain, regions implicated in drug addiction. This includes the amygdala, and nucleus accumbens, amongst other regions.

Methodology

The Institutional Review Board at Franklin Pierce University has approved our study. Dr. Thomas Andrew, Chief Medical Examiner (ME) for the State of New Hampshire has agreed to collaborate with us. We provided containers filled with formalin fixative and Dr. Andrew agreed to collect samples of brain tissue for our project. The collection takes place during autopsy of what is suspected to be opiates/opioids overdoses. These overdoses are eventually confirmed when toxicology is completed. As of January 31, 2016, we had obtained 8 brain samples. We are planning to obtain 25 brain samples total. The coronal brain sections received are 4 cm in thickness and contain the regions of interest, including amygdala, hippocampus, and nucleus accumbens. The work of dissecting these regions of interest out of the organ is performed at Franklin Pierce University. Each dissected section is then placed in 70% ethanol and shipped to Mass Histology Services, a histopathology laboratory in MA. Funding obtained in the 2015/2016 academic school year was used to cover for the trips back-and-forth to the ME office in Concord and for the processing of the initial samples at Mass Histology Services.

In addition to brain samples obtained from autopsies, we have obtained from the Miami University Brain Bank, one sample of a brain amygdala from a heroin overdose of an individual that did not have any other brain disorder or any neurological condition other than drug use.

Project Significance

Analysis of brain sections from opiates/opioids overdoses could have important clinical implications for uncovering the effects of long-term prescription opioid use on brain structure and function. Our goal is to conduct extensive observational analysis, with emphasis on the morphology and histology of deep brain structures, with special attention to the amygdala.

For students at Franklin Pierce University, this project provides an opportunity to get hands-on experience in observing human brain tissue, identifying, and dissecting specific human brain regions, while using laboratory techniques specific for tissue harvesting and histology work. The students will also observe the tissues under microscopy, and practice their knowledge in neuroanatomy. Critical thinking will be essential, as we will have to compare and contrast such tissues with normal variable-matched controls. Students will be encouraged to plan future studies including immunohistochemistry testing. This project will also require them to extensively read the current literature.

Budget

It is very important to keep the project running. Our brain samples are being harvested by the MEs, and the processing of our regions of interest has begun. Obtaining this preliminary data will be crucial for the application of larger funds, available through outside sources such as the National Institute on Drug Abuse

(drugabuse.gov). Initial moneys allowed us to cover the costs of trips to Concord, shipping costs of histology slides obtained from Miami University Brain Bank, and initial expenses for histology services.

We are asking renewed funding:

- 1) To obtain additional containers and fixative to provide to the ME (\$500).
- 2) To order additional histology services, including more specific molecular detection of dopamine molecule and other molecules we would like to localize in the tissues (\$1,000).
- 3) To obtain a more permanent set-up for the observation of the samples and capturing of micrographs. We are currently using a student microscope mounted with Dr. Jabbour's own digital camera. We would like to have a more appropriate microscope/camera set-up for to production of publication-quality images (quote of \$5,460.02 provided as Appendix 2).

The total amount requested is: \$6,960.02

Reference

1. Dart RC, Surratt HL, Cicero TJ, et al. Trends in opioid analgesic abuse and mortality in the United States. *N Engl J Med.* 2015;372(3):241-8.