

BOARD MEETING DATE: March 6, 2020

AGENDA NO. 11

PROPOSAL: Annual Meeting of the Health Effects of Air Pollution Foundation

SYNOPSIS: This item is to conduct the annual meeting of the Health Effects of Air Pollution Foundation. The Foundation staff will present an annual report detailing the research supported by the Foundation over the past year, the Foundation's plans for the future, and a financial report.

COMMITTEE: No Committee Review

RECOMMENDED ACTION:

Receive and file the annual report and ratify the Foundation's disbursements described in the annual report.

Wayne Nastri
Executive Officer

BTG:ML

2020 Annual Report

Background

In February 2003, the Board directed staff to establish the Brain Tumor and Air Pollution Foundation to implement an initiative by the Board Chairman to fund research into the potential connections between air pollution and brain cancer. After years of supporting research related to the impacts of air pollution on brain tumors, in March 2017 the Board changed the Foundation's name to the Health Effects of Air Pollution Foundation and expanded the Foundation's mission to support research on the incidence, detection, and causes and cures of various health conditions that may be caused or aggravated by air pollution. To date, the Foundation has received contributions of almost \$12.5 million and has funded studies with leading medical and public health researchers in Southern California.

Directors and Officers

The Directors of the Foundation are: Ben Benoit, Chairman
Dr. William A. Burke, Vice Chairman
Dr. Clark E. Parker, Sr.
Judith Mitchell

The Foundation's staff is: Wayne Nastri, Chief Executive Officer
Denise Whitcher, Secretary
Sujata Jain, Treasurer

Report on the Foundation's Activities

Completed Research Projects

The following research projects have been completed:

“A Cohort Study of Air Pollution, Malignant and Benign Brain Tumors in Los Angeles County” (BTAP010)

Principal Investigator: Dr. Anna Wu (University of Southern California)

Approved Funding: \$758,978

Summary: The study leveraged data from the Multiethnic Cohort study to examine whether air pollution is associated with primary malignant and benign brain tumors. The investigators evaluated exposures to PM10, PM2.5, NO2, NOx, ozone and CO, and air toxics, including ultra-fine particles, and examined associations between traffic air pollution and malignant primary brain cancer and meningiomas (non-cancerous brain tumors). The study found that among men, long-term exposures to higher levels of benzene and PM10 were associated with increased brain cancer risk, especially among Latino men. In contrast, air pollution exposures were not associated with increased brain cancer risk in women. The study also analyzed exposures to ultra-fine particles from airplanes and found that these pollutants may be associated with some increased brain cancer risk among African American men and women. Ozone was the only pollutant associated with meningioma risk, and only among men. This project was completed in January 2020.

“Role of Particle-Induced Inflammation in Progression of Brain Tumors” (BTAP011)

Principal Investigator: Dr. Keith Black (Cedars-Sinai Medical Center)

Approved Funding: \$733,461

Summary: The investigators studied whether exposure to ambient air pollution-derived particulate matter (PM) alters the progression of brain tumors in mice. The mice used in the experiments have brain tumors initiated from human glioblastoma cell lines. The PM samples were collected from Irvine, CA ambient air. As part of this study, changes in tumor progression and inflammatory markers (measured by changes in gene expression) and stem cell activation were evaluated. The mice were separated into 4 groups, and exposed to filtered air, coarse PM, fine PM, and ultrafine PM for one month. The

exposure period was originally planned to be 2 months, but it had to be reduced to one month due to the tumor-bearing animals showing signs of distress and malaise. Molecular analyses (RNAseq and proteomics) were performed on the brain tissues of the non-tumor bearing mice, and the study found changes in gene expression in certain pathways that play a fundamental role in cancer development, neuroinflammation, and immune response, particularly for mice exposed to ultrafine PM. The study identified neuroinflammation signaling and immune system cytokine signaling pathways as key biological mechanisms for air pollution related responses. The findings suggest that PM exposures may cause brain tissue changes that create an environment that enhances the proliferation and progression of brain tumors. This project was completed in June 2019.

“Role of Particle-Induced Inflammation on Progression of Neurodegenerative Brain Disease” (HEAPF013)

Principal Investigator: Drs. Keith Black and Julia Ljubimova (Cedars-Sinai Medical Center)

Approved Funding: \$750,000

Summary: The investigators studied whether exposure to ambient air pollution-derived particulate matter (PM) alters the progression of neurodegenerative disorders in mice. The mice used in the experiments include ones that were genetically modified so that they developed Alzheimer’s disease, as well as control wild-type mice. The mice were separated into 4 groups, which were exposed to filtered air, coarse PM, fine PM, and ultrafine PM for 3 months or 6 months, and followed until they died. The PM was from samples collected from Irvine, CA ambient air. As part of this study, changes in disease progression and biomarkers of Alzheimer’s disease were evaluated using RNAseq and proteomic analysis to identify key biomarkers for Alzheimer’s disease. The study found that air pollution did not accelerate the formation of amyloid beta plaques, which is one of the signature features of late-stage Alzheimer’s. The study instead identified that air pollution enhanced cell stress and tau protein accumulations, which may be used as an early biomarker of Alzheimer’s. The study further identified air pollution to be associated with changes in gene expression that down-regulated certain proteins that help protect brain cells (collagen assembly) and upregulated certain proteins that check for errors in gene expression (nonsense-mediated decay pathway). This project was completed in June 2019.

Current Research Projects

The following research currently funded by the Foundation is in progress:

“Do Changes in Amount and Composition of Ambient PM Influence Induction or Exacerbation of Brain and Lung Tumors?” (HEAPF012)

Principal Investigator: Dr. Arthur Cho (University of California, Los Angeles)

Approved Funding: \$979,182

Summary: This study used cellular and mouse models to investigate whether exposure to air pollution (PM and vapor phase) increases the expression of biological markers that are

associated with the development or progression of lung or brain cancers. The investigators collected ambient air samples at several locations and in different seasons in the South Coast Air Basin. The samples were characterized for their potential biological actions, and then used in studying the potential effects in human lung cancer cells and brain cancer cells, as well as in a mouse study (induced with brain cancer cells). Preliminary results of this study found that exposure to the vapor phase air pollutants increased cellular expression of heme oxygenase-1 (HO-1), while exposure to PM air pollution only marginally increased this inflammatory biomarker. The study also found that both PM and vapor air pollution samples decreased the expression of CAV-1, a protein that helps to suppress tumors. These results suggest potential pathways for air pollution to trigger cancer proliferation at the cellular level. This project is scheduled to be completed in May 2020.

In addition, the Foundation approved the following research proposals at its January 2020 meeting:

Institution (Principal Investigator)	Title of Proposal	Amount of Funding Approved
Cedars-Sinai Medical Center (Dr. Keith Black)	Development of the Alzheimer's disease under the exposure of air pollutants 2019-2022	\$2,250,000
University of California, Los Angeles (Dr. Arthur Cho)	Adverse Health Effects of Volatile Organic Compounds	\$471,000
University of Southern California (Dr. Anna Wu)	Impact of ambient air pollution on the risk of breast cancer and survival in Los Angeles County: The Multiethnic Cohort Study	\$804,189

Financial Report

The Foundation's fiscal year ended June 30, 2019. Financial statements were prepared by staff and audited by BCA Watson Rice, LLP (Auditor). Total expenses for the fiscal year were \$1,039,371 and included grants (\$1,038,053), audit fees (\$1,200) and other fees/taxes (\$118). The Auditor issued an unmodified opinion, indicating that the financial statements were presented fairly, in all material respects, and in accordance with generally accepted accounting principles.

As of January 31, 2020, the Foundation had a cash balance of \$4,156,485. The following is an accounting of the Foundation's operations since its inception (7/23/03):

Revenue from Operations	
Contributions	\$12,472,568
Interest Income	44,827
<i>Total Revenue from Operations</i>	\$12,517,395
Operating Expenses	
Grants	
-Cedars-Sinai	\$6,710,607
-UCLA	761,254
-USC	867,419
Corporation Filing Costs	1,745
Bank charges	598
Professional fees-audit	19,287
<i>Total Operating Expenses</i>	\$8,360,910
Cash Balance	\$4,156,485

Plans for the Upcoming Year

The Foundation will work with the researchers as they begin the three continuation projects that were approved for funding at the January 2020 Foundation meeting, and will continue to monitor the progress of the existing research project. Staff will provide an update to the Board once these projects have been completed.

Resource Impacts

None.