Study of gangliosides in Parkinson’s disease

HYPOTHESIS:
That ganglioside GM1 has a critical role in preventing Parkinson’s disease and provides a novel therapy for its treatment.

PROJECT DESCRIPTION (Include design, methodology, data collection, techniques, data analysis to be employed and evaluation and interpretation methodology)

Our studies have shown that Parkinson’s disease (PD) is characterized by deficiency of GM1 ganglioside in the dopaminergic neurons of the substantia nigra pars compacta region. We have a mouse model showing such deficiency which develops PD spontaneously. We are able to cure the animals by treatment with LIGA-20, a GM1 analog that is able to cross the blood brain barrier. Two concurrent studies are in progress:

1. To determine whether the GM1 deficiency observed in nigral neurons of PD patients represents a generalized suppression of GM1 synthesis. This will be studied by isolating leukocytes from PD patients and determining GM1 levels for comparison with non-PD controls. GM1 is extracted from the isolated cells, subjected to thin-layer chromatography, and quantified by densitometry. Additional data are obtained by immunohistochemistry employing flow cytometry.

2. To study rescue from PD symptoms by GM1 analogs that penetrate the blood brain barrier (e.g. LIGA-20). Using our mouse model with deficient GM1 we will attempt to prevent onset of parkinsonism by administering novel GM1 analogs prepared by a biotech company. Efficacy will be determined by tests to determine (a) physical impairment, (b) preservation of dopamine levels and dopamine-producing cells, and (c) suppression of alpha-synuclein aggregation in dopamine cells. These methods involve HPLC chromatography, immunohistochemistry, and western blot analysis.

SPONSOR’S MOST RECENT PUBLICATIONS RELEVANT TO THIS RESEARCH:


IS THIS PROJECT SUPPORTED BY EXTRAMURAL FUNDS?
Yes ☒ or No ☐
(IF YES, PLEASE SUPPLY THE GRANTING AGENCY’S NAME)

NIH

THIS PROJECT IS: ☐ Clinical ☒ Laboratory ☐ Behavioral ☐ Other

THIS PROJECT IS CANCER-RELATED ☐
Please explain Cancer relevance
Summer Student Research Program
Project Description

THIS PROJECT IS HEART, LUNG & BLOOD-RELATED □
Please explain Heart, Lung, Blood relevance

THIS PROJECT EMPLOYS RADIOISOTOPES □

THIS PROJECT INvolVES THE USE OF ANIMALS □
Pending □ Approved □ IACUC PROTOCOL #

THIS PROJECT INvolVES THE USE OF HUMAN SUBJECTS □
Pending □ Approved □ IRB PROTOCOL # M 10045D0713

THIS PROJECT IS SUITABLE FOR:
UNDERGRADUATE STUDENTS □ ENTERING FRESHMAN □
SOPHMORES □ ALL STUDENTS □

THIS PROJECT IS WORK-STUDY:  Yes □ or No □

THIS PROJECT WILL BE POSTED DURING ACADEMIC YEAR
FOR INTERESTED VOLUNTEERS?: Yes □ or No □

WHAT WILL THE STUDENT LEARN FROM THIS EXPERIENCE?
Quite a lot about Parkinson’s disease and how to use an animal model to study a form of treatment. Also, how to use human cells to test an hypothesis on PD pathology.