

SYNAPTIC REGULATION OF ERK-MEDIATED AMYLOID-BETA METABOLISM

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USA

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SYNAPTIC REGULATION OF ERK-MEDIATED AMYLOID-BETA METABOLISM

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5

The project/programme is most relevant to:

Alzheimer's disease & other dementias

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Research Abstract

DESCRIPTION (provided by applicant): Alzheimer's disease (AD) is initiated by the progressive

accumulation of amyloid- β (A β) peptide in the brain as toxic structures such as amyloid plaques and soluble oligomers. Conversion of A β into these toxic species appears to be concentration-dependent; therefore identifying mechanisms that regulate or lower A β levels will provide a fundamental understanding of the underlying causes of AD and may lead to new therapeutic strategies. Recent work by our group demonstrates that activation of serotonin receptors (5HT-Rs) cause an acute reduction in brain A β levels in mouse models of AD (Cirrito et al., 2011). Systemic administration of SSRI antidepressants or direct infusion of serotonin into the hippocampus of a mouse model of AD causes brain interstitial fluid (ISF) A β levels to decline by 25-30% within a few hours and with A β levels remaining low for over 24 hours after a single administration. This reduction in A β is completely blocked if mice are pretreated with inhibitors of the extracellular regulated kinase (ERK), the prototypical MAP kinase. ERK activation appears to increase γ -secretase cleavage of APP, thus reducing A β generation as well as may reduce mRNA levels of several components of the γ -secretase complex. Chronic administration of a SSRI for 4 months dramatically reduces plaque load and CSF A β levels in a mouse model of AD. The objective of this proposal is to define the ERK signaling pathways and related molecules that regulate A β generation, in particular the pathways that lead from serotonin receptor to activation of ERK and then ERK to changes in APP processing. While many molecules can activate ERK and ERK can have many downstream substrates, its activity is remarkably regulated so that each extracellular receptor can very specific effects within a cell. This specificity is partially controlled via scaffold proteins that link receptors with appropriate signaling complexes. Not all molecules that activate ERK suppress A β generation; therefore we will determine the role that scaffold and localization proteins, such as β -arrestin and Self, play in providing target specificity for this signaling pathway. Using a combination of genetics, biochemistry, and pharmacology, as well as an in vivo microdialysis technique we developed to assess brain ISF A β levels over time; we will assess the cellular pathways linking 5HT-Rs, ERK, and A β generation in living mice. SSRIs are one of the safest neuroactive drugs approved by the FDA. A demonstration not only of their effectiveness in lowering A β levels, but also the cellular mechanisms by which they act, may provide a strong impetus for testing this class of compounds for their ability to attenuate, and possibly prevent, AD in human subjects.

Lay Summary

Reducing levels of amyloid- β , the peptide that accumulates and initiates Alzheimer's disease (AD), is the most likely method to treat or prevent this disease. Our preliminary data from humans and mouse models of AD strongly suggest the serotonin signaling suppresses A β generation by activating the extracellular regulated kinase (ERK) signaling pathway. Chronic treatment with selective serotonin reuptake inhibitor (SSRI) antidepressants reduces brain A β levels and plaques in mouse models of AD and is associated with less plaques humans. This proposal will determine the cellular pathways and molecules that link serotonin receptors, ERK, and A β suppression in living mice.

Further information available at:

Types:

Investments > €500k

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United States of America

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Alzheimer's disease & other dementias

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