Proton Tunneling Accelerates ATP Hydrolysis in Eg5 Kinesin
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INTRODUCTION

A major question of interest for biological ATP hydrolysis is how rate acceleration is achieved in proteins. Recent studies have shown that ATP hydrolysis is associated with water molecules in the presence of a water molecule in the transition state. By introducing a water molecule into the transition state, the presence of water molecules could play a role in the rate acceleration of ATP hydrolysis.

The goal of this work is to determine whether the presence of water molecules is required for Eg5 kinesin catalysis. ATP hydrolysis is a key step in the Eg5 kinesin catalytic cycle. The presence of water molecules in the transition state is thought to be essential for the catalytic activity of Eg5 kinesin.

We hypothesized that the presence of water molecules is required for ATP hydrolysis in Eg5 kinesin. We tested this hypothesis by determining the effect of water molecules on the catalytic activity of Eg5 kinesin. Our results indicate that the presence of water molecules is required for the catalytic activity of Eg5 kinesin.

SIGNIFICANCE

The results of this study provide insights into the role of water molecules in the catalytic activity of Eg5 kinesin. Our findings contribute to the understanding of how water molecules interact with the catalytic center of Eg5 kinesin. The results also have implications for the design of therapeutic interventions targeting Eg5 kinesin.

REFERENCES

Acknowledgments

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Optimization of TH-P1 Human Monocytes Culture Conditions Prior to Mycobacterium Tuberculosis Infection

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Introduction
Tuberculosis (TB) is one of the leading causes of death in humans worldwide. Tuberculosis is a disease caused by Mycobacterium tuberculosis (MTB). MTB is an intracellular pathogen able to survive and multiply within macrophages. It remains unclear whether the L-Arginine-Nitric Oxide pathway plays a role in host infection with MTB. L-Arginine is a non-essential amino acid that is a substrate for the enzyme arginase (ARG) to produce nitric oxide (NO). These pathways determine the survival and death of the bacteria. Infection has been established using MTB-infected human macrophages cell lines (RAW 264.7) with successful infection rates. Recently, Dr. Zas’s laboratory found that infection of these cells with MTB induced high amounts of ARG and polyamines. When ARG was obstructed, a significant decrease in MTB growth was observed. We believe that more applicable research can be found by using human cell lines. Dr. Zas’s lab has been trying to establish MTB infection in human cell lines for the past 6 months with negative results. The focus of my summer research was to establish the optimal culture conditions for MTB infection using the immortalized human cell line TH-P1. For the experiments we used an analog of CAMP (8-Bromo-cAMP) to induce ARG activity in TH-P1 monocytes. These findings are important because they are the first step towards understanding the role of monocytes in TB infection.

Objective
To establish the optimal conditions for TH-P1 human cells to be sensitive to arginase induction.

L-Arginine Pathway

Polyamines
L-Ornithine
Arginase (ARG)
L-Arginine
Nitric Oxide
NOS2
Citrulline

Results

Figure 1: Schematic representation of the L-arginine metabolic pathway.

Figure 2: Effect of 8-Bromo-cAMP on arginase activity.

Figure 3: Development of methodology: This scheme represents the final culture condition in which TH-P1 cells were infected with MTB. The scheme includes the presence of 8-Bromo-cAMP in the culture medium, which resulted in increased arginase activity and nitric oxide production, leading to MTB inhibition.

Conclusions

Acknowledgement

Figure 4: Arginase activity, polyamine and nitric oxide levels in TH-P1 cells infected with MTB.

Figure 5: Effect of 8-Bromo-cAMP on arginase activity in TH-P1 cells infected with MTB.

Figure 6: Nitric oxide levels in TH-P1 cells infected with MTB in the presence of 8-Bromo-cAMP.

Figure 7: Polyamine levels in TH-P1 cells infected with MTB in the presence of 8-Bromo-cAMP.
Glioblastoma Multiforme-Induced Epileptogenesis in in vivo Mouse Models

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Mentor: Alberto Musto, Louisiana State University Health and Sciences Center, New Orleans, LA, USA

Background
Objective 1: Evaluated pentylenetetrazol neuronal network and proved that GBM growth induces epileptiform activity in electric field.
Objective 2: Comparing bioactivity of drugs A and B (anti-inflammatory and anti-seizure drugs) on tumor growth.

Results
Novel Health Score and RMP Test
Reduction in Tumor Size and Growth

Stable Health Scores in Two Weeks

Methods
Objective 3: Experimental Design-prolonged Treatment B

Reduction of Hyperexcitability

Conclusion

This research was supported by grant #1359140 through the National Science Foundation
Amyloid Precursor Protein and Inhibitor-2
Duaa Hashim, Hongtian Yang, Hugh Xia
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Introduction
Alzheimer's disease (AD) patients suffer from long-term memory loss, which is thought to be related to the accumulation of beta amyloid plaques in the brains of these patients. Amyloid Precursor Protein (APP) is a well-studied transmembrane protein that is best known in the precursor molecule whose proteolysis generates beta amyloid (Aβ), a short peptide, which is the primary component of amyloid plaques.

Protein phosphorylation 1 (PPI) plays a significant role in synaptic plasticity [1, 2], learning and memory [3]. Inhibitor-1 (I-1) has been found to inhibit PPI's catalytic activity in vitro [4] and our lab found that I-2 plays a critical role in memory formation [5], indicating that it is an important PPI's regulatory binding protein for PPI's function in synaptic plasticity, learning and memory.

Previous Mass-spectrometry studies [4] have shown that APP can interact with I-2. In this study, we attempted to characterize APP and I-2 in cells was used determine where in cells APP and I-2 interact. Both human embryonic kidney (HEK) cells and embryonic rat cortical neurons were used. Immunofluorescence and time-lapse imaging of APP and I-2 movement in response to NMDA receptor activation was also performed.

Materials and Methods
HUMAN EMBRYONIC KIDNEY CELLS:
- Grow human embryonic kidney (HEK) cells in DMEM culture medium
- Transfer HeLa cells with Lipofectamine 2000 reagent and antibiotics that were extracted using Quigen lysis method.
- 1 hour after, fresh DMEM medium was used to wash out the transfection mix and allow cells to grow overnight.
- Solid state infected cells onto Poly-L-lysine (PLL) coated glass coverslips
- Allow cells to grow 3 to 5 hours
- Live image cells using confocal microscopy

EMBRYONIC RAT CORTICAL NEURONS:
- Isolate embryonic rat cortical neurons and grow on PLL coated glass coverslips.
- Allow cells to grow for 10 days.
- Transplant 10 days old neurons with 100 μg/ml of Lipofectamine 2000 reagent and antibiotics that were extracted using Quigen lysis method.
- Allow to grow for 2 days
- Live image performed using confocal microscopy.

This research was supported by grant #139140 through the National Science Foundation

References

Conclusions and Future Studies
- The results of this study support the role of PPI's and I-2 in synaptic plasticity and memory formation.
- Future studies will focus on the mechanism of interaction between APP, PPI's, and I-2 in memory formation.

Background:
A. APP-mcherry co-localization with GFP-I-2 in HEK cells
B. APP-mcherry co-localization with GFP-I-1-2: Example 1
C. APP-mcherry co-localization with GFP-I-1-2: Example 2
D. APP co-localization with I-2: Time Lapse

The Use of the Penumbra Aspiration Catheter for Proximal Embolic Protection Device During Intracranial Vertebral Artery Angioplasty and Stenting
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Louisiana State University Health Sciences Center, Department of Neurosurgery
Cytoarchitecture of the Dendritic Spines in Glioblastoma Multiforme-induced Epilepsy

Student: Jatauria Lathan (Dillard University)
Mentor: Alberto Musio M.D., Ph.D. Neuroscience Center of Excellence

Introduction

Hypothesis

Experimental Design

Results

Conclusion

References:

Keith Perkins1, Robert Rosencrans1, Sharon Felner1, David Vumbaco1, Cori Richards-Zawack2 and Hamilton E. Ferris3

1. Neuroscience Center, Louisiana State University Health Sciences Center New Orleans LA; 2. Ecology and Environmental Biology, Tulane University, New Orleans LA

1. Abstract

In order to understand visual accommodation to either light or different light intensities, we studied the sensitivity of the retina of nocturnal and diurnal animals. We measured retinal sensitivity in three species of nocturnal animals: a bat, a mouse, and a person. The results showed that the sensitivity of the retina is higher in nocturnal animals than in diurnal animals. This is consistent with previous studies that have shown that nocturnal animals have a larger fovea than diurnal animals. The study also showed that the sensitivity of the retina is affected by the duration of exposure to light. The study is important because it sheds light on the mechanisms underlying the differences in sensitivity between nocturnal and diurnal animals.

2. Sensory Ecology of Subject Species

Nocturnal Animal: Bat, Mouse, Person

<table>
<thead>
<tr>
<th>Species</th>
<th>Sample Size</th>
<th>Habitat</th>
<th>Diet Activity</th>
<th>Retinal Light Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bat</td>
<td>20</td>
<td>Nocturnal</td>
<td>Insectivorous</td>
<td>Night vision</td>
</tr>
<tr>
<td>Mouse</td>
<td>100</td>
<td>Nocturnal</td>
<td>Omnivorous</td>
<td>Day vision</td>
</tr>
<tr>
<td>Person</td>
<td>50</td>
<td>Diurnal</td>
<td>Omnivorous</td>
<td>24-hour vision</td>
</tr>
</tbody>
</table>

3. Methods: Electrophysiology

<table>
<thead>
<tr>
<th>Experimental Setup</th>
<th>Ocular ERG Response</th>
<th>Bimodal Light Intensity</th>
<th>Dark Adapted Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stimulus Protocol</td>
<td>Light onset</td>
<td>Light offset</td>
<td>Light offset</td>
</tr>
</tbody>
</table>

4. Results: Example ERG from Each Species

- Bat: Normal ERG response
- Mouse: Abnormal ERG response
- Person: Normal ERG response

5. Results: B-Wave Amplitude vs. Log Light Intensity with Bimodal Fits

- Bat: B-Wave amplitude increases with increasing light intensity
- Mouse: B-Wave amplitude decreases with increasing light intensity
- Person: B-Wave amplitude remains constant with increasing light intensity

6. Results: Threshold and Bistability of Light Adaptation

- Bat: Lower threshold with bistability
- Mouse: Higher threshold with bistability
- Person: Lower threshold without bistability

7. Conclusion

Our results suggest that nocturnal animals have a higher retinal sensitivity than diurnal animals. This may be due to the larger fovea in nocturnal animals. Further studies are needed to understand the underlying mechanisms.
Overexpression of CHAC2 Depletes Glutathione
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LSUHSC Department of Pharmacology and Experimental Therapeutics

Abstract

CHAC1 and CHAC2 Active Site Align

Experimental Design

CHAC2 Depletes Glutathione

Conclusions

Hypothetical: Overexpression of CHAC2 overexpression plasmid into HEK293a cells will cause depletion of glutathione.

Introduction

Background

Methods

Results

Figure 1: CHAC1 and CHAC2 Depletion. HEK293a cells were transfected with CHAC1 or CHAC2 overexpression plasmids. Glutathione was assayed by the Tietze Recycling Assay. One-way ANOVA, Dunnett's post test. **p<0.001.

Figure 2: CHAC1 and CHAC2 Depletion. Heatmap of heat shock protein expression data. The heat shock proteins are clustered with the gene expression profiles of the cell lines.

CHAC2 Clone Verification

Conclusions

- CHAC2 overexpression depletes glutathione in human cells
- CHAC2 has catalytic activity similar to CHAC1
- Further studies will focus on comparisons between CHAC1 and CHAC2
- The catalytic site of CHAC2 is currently being studied.

This research was supported by grant #1R35MH116540 through the National Science Foundation.