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Analysis of the ABCC6 Variant in Association with Autism

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ABSTRACT

Autism spectrum disorder (ASD) is a neural and developmental disorder which affects the way people interact, communicate, learn, and behave. Autism spectrum disorder has an impact on the nervous system. ASD symptoms include struggle with communication, difficulty with social interactions, obsessive interests, and repetitive behaviors. The purpose of this study is to evaluate variants associated with ABCC6. Computational tools such as Simple ClinVar were used to identify genes associated with autism; ABCC6 has been identified to be linked with ASD. The ABCC6 gene gives instructions for producing a protein called multidrug resistance-associated protein 6 (MRP6, also known as the ABCC6 protein). This protein is found in the liver and kidneys, with lesser amounts in other tissues such as the skin, stomach, blood vessels, and eyes. At least 13 mutations in the ABCC6 gene have been identified. Computational tools PolyPhen2 were used to aid in evaluating this gene's variants. Missense mutation identified by Simple ClinVar in the ABCC6, Arg518Gln, is predicted to be pathogenic and damaging to the protein. The goal of this study is to provide research to the medical community and potentially treat and prevent this condition.

INTRODUCTION

Autism, or autism spectrum disorder (ASD), covers a large amount of l difficulties that include social interaction, repetitive behaviors and challenges in communication whether that be verbally or not. Autism is reported to affect an estimated 1 in 36 children and 1 in 45 adults in the United States(The Centers for Disease Control). It's important to understand that autism is not a singular condition but rather a spectrum with diverse manifestations. This means that each individual on the spectrum varies in treatment, abilities, and needs. ASD affects people of all genders, race, ethnicity, and economic background. Though this can be a lifelong disorder, there are certain treatments in aids that can help improve a person with autism.

Though some autistic individuals may have intellectual disabilities, others demonstrate average or above-average intelligence. Normally, by the age of five autism is diagnosed in the United States. However, as a child develops, one can see noticeable signs. The current diagnostic criteria outlined in the DSM-5-TR categorize ASD into three levels based on the level of support needed. Level 1 what indicates that the individual would need a minimal amount of support , level 2 would be a moderate amount, and lastly level 3 signifies a high level of support needed in various aspects.

METHODS

Simple Clinvar - find the gene associated with autism.

Phenotypes, missense mutations, and the protein mapping for the ABCC6 gene were also identified.

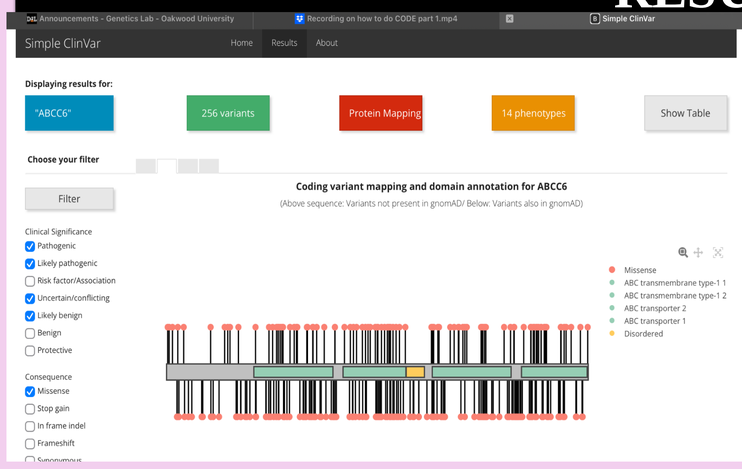
The National Library of Medicine - get the FASTA of the amino acid sequence, and to conserved domains.

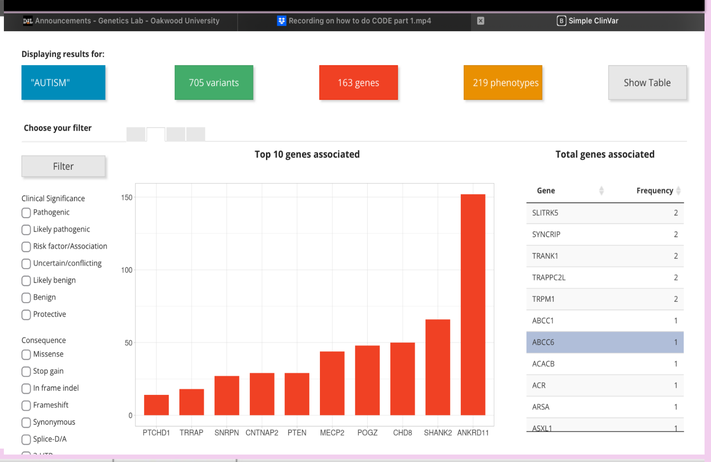
Polyphen 2 - used the FASTA sequence to analyze variants

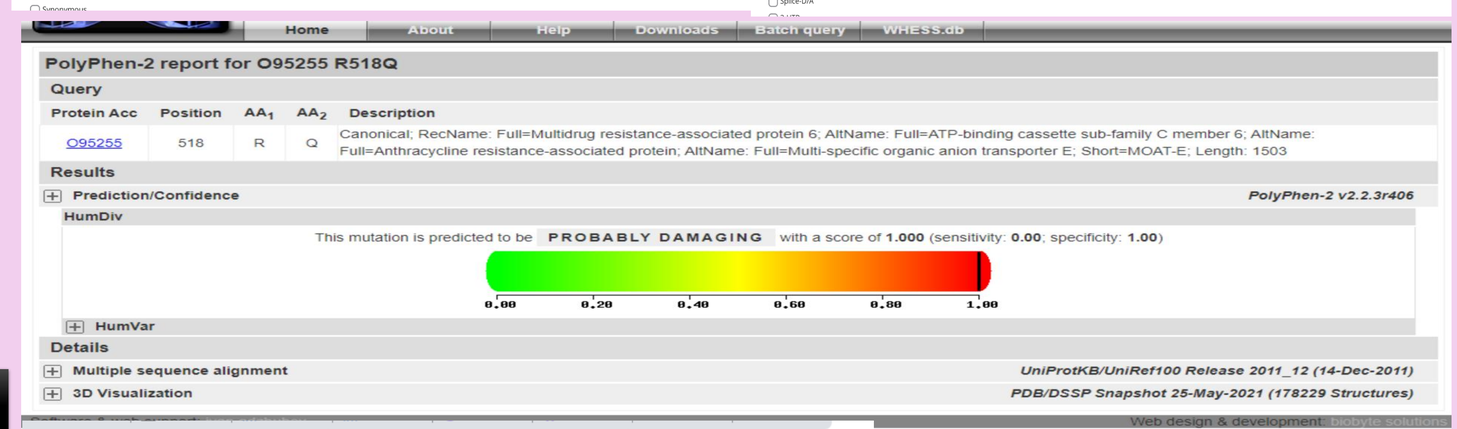
SIFT - the variants selected to affect protein function.

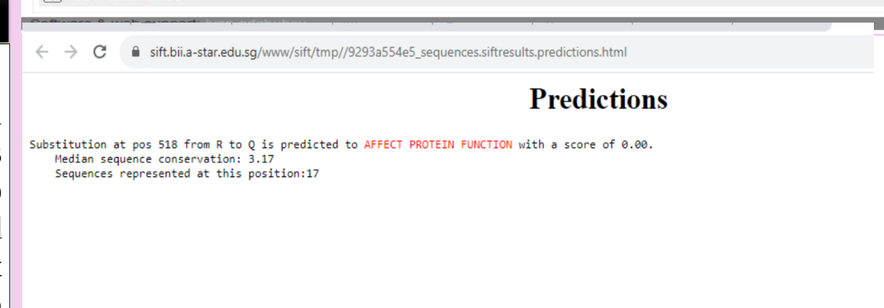
Swiss Model Pro - obtain models of the gene.

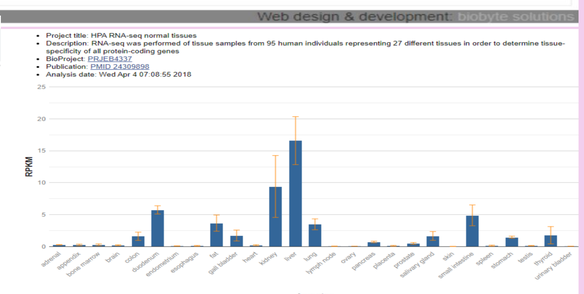
RESULTS

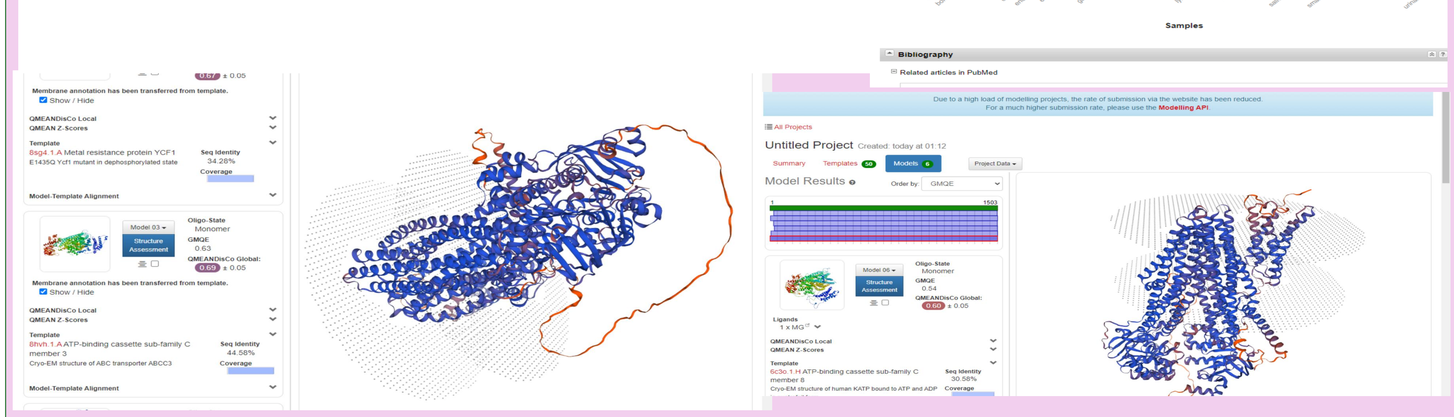












DISCUSSION AND CONCLUSION

During further research of the gene, ABCC6 it was made clear that, even though shown as a gene on Simple Clinvar it was not directly associated with autism. However, ABCC6 is associated with two conditions pseudoxanthoma elasticum (PXE), a rare genetic disorder that affects the skin, eyes, and cardiovascular system and coronary artery disease (CAD) this causes coronary arteries to narrow, limiting blood flow to the heart. Autism coronary artery disease (CAD) and pseudoxanthoma elasticum (PXE) are distinct conditions with different causes and symptoms. They do have some symptoms that may overlap or be mistaken for one another. These include social difficulties, whether it be social interactions or communications, understanding social cues. This is very similar to PXE and CAD that may lead to social challenges due to the changes that happen with vision, changing the way someone interacts with others. There may be sensory issues that occur not only in autism but the other diseases creating hypersensitivity to sounds, touch or light. Anxiety is also common in these three even though there may be different causes. Another overlap is cognitive differences, seen an autism where cognitive and social development is affected PXE, can lead to cognitive impairment in severe cases because calcification of blood vessels in the brain. There can be behavioral challenges where individuals of autism may exhibit repetitive behaviors and difficulties, transitioning, and due to the physical effects of PXE and CAD can cause behavioral changes as well. From analyzing and collecting all the data, it is clear that though there are a few common effects in the disorder and diseases, there is no direct link. As well as no direct link with the gene ABCC6. Hopefully further studies can be done to create better connection.

REFRENCES

"What is autism?" - https://www.autismspeaks.org/what-autism
National Institution of Mental Health "The role of rare compound heterozygous events in autism spectrum disorder" - https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7308334/
James K. Min, MD, FACC, FESC, MSCCT, Founder & CEO of Cleerly - https://cleerlyhealth.com/blog/new-staging-system-for-coronary-artery-disease
"Pseudoxanthoma Elasticum" Author: Sheila Z Jalalat, MD; Chief Editor: Dirk M Elston, MD -https://emedicine.medscape.com/article/1074713-overview

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HudsonAlpha Institute for Biotechnology
CODE
Characterizing Our DNA Exceptions