

# *Investigating Alzheimer's Disease, One Lesion At a Time*

By: Diana Boyrazyan, sophomore majoring in Biological Sciences



Annie Der Avedissian is a graduate student who is pursuing her Master's Degree in Global Medicine at USC's Keck School of Medicine. A native of Southern California, she also attended USC as an undergraduate student and majored in Health Promotion and Disease Prevention Studies. Der Avedissian says that many of her professors at USC have inspired her research; "The environment of USC fosters a research mindset. Students are encouraged to formulate hypotheses and use scientific methods to solve problems.", says Der Avedissian. She is very interested in neuroscience and neurological conditions, two topics that motivated her to conduct research on Alzheimer's disease. Alzheimer's disease is a complex and continuous neurological disorder with various genetic, biochemical, and environmental risk factors.

She has been conducting research on Alzheimer's since January 2012 and mentions that although the disease is not well understood, the increasing number of medical and technological advancements will support future breakthroughs in understanding Alzheimer's. Der Avedissian's faculty advisor has also had a significant influence on her research. He has guided her on how to analyze published studies, how to approach the research topic, and what methods should be used to minimize error. Der Avedissian mentions that her adviser has helped her establish a research timeline in order to efficiently reach the goal of the study.

### **Kinases Role in Alzheimer's Disease**

The main purpose of Der Avedissian's research is to understand kinases that cause *tau hyperphosphorylation* and how they are expressed in people with Alzheimer's disease. Hyperphosphorylation of this protein is associated with neurofibrillary tangles, one of the lesions of Alzheimer's disease. Through the use of bioinformatics, Der Avedissian has been able to analyze gene sequences of the specific kinases or biological catalysts that are involved with hyperphosphorylation of the tau protein. The variables measured in this experiment were genetic sequences. The data that is being collected is still an ongoing process, since it is a fairly new research project.

### **Using Histopathologies to Elucidate Alzheimer's**

Through the examinations of histopathologies, or tissue that reveals indications of disease, Alzheimer's has been shown to exhibit two major lesions: neurofibrillary tangles and beta-amyloid plaques. As mentioned, neurofibrillary tangles are associated with hyperphosphorylated tau proteins. A neurofibrillary tangle is an accumulation of twisted protein filaments within nerve cells of the cerebral cortex.

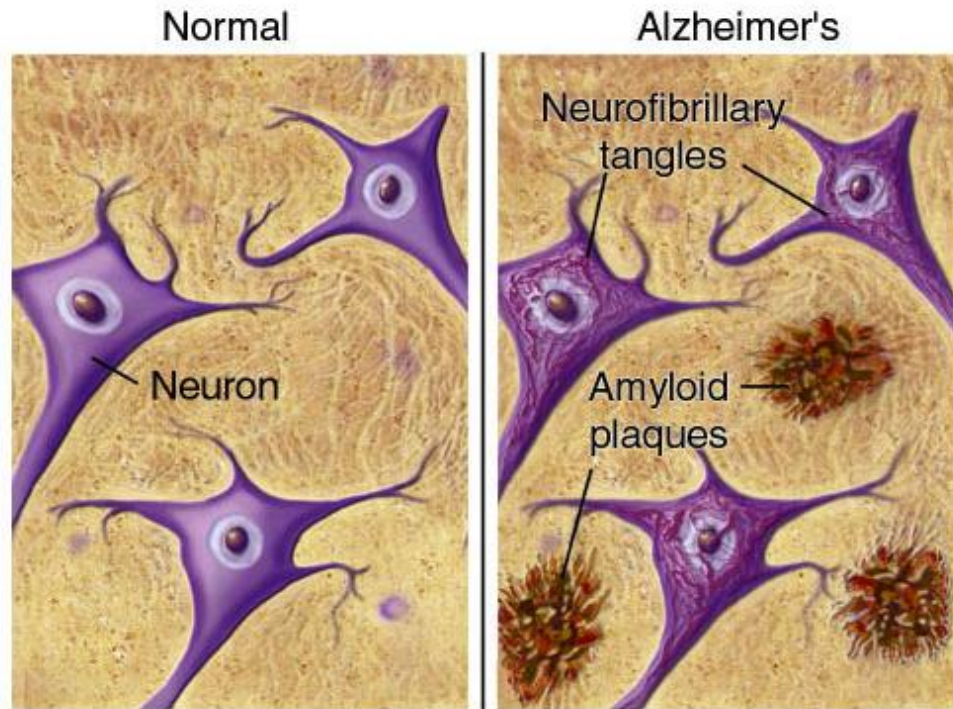
The cerebral cortex is the part of the brain that plays an important role in memory, thought, language, and consciousness. Hyperphosphorylation is an event in which all the phosphorylation sites of a biochemical are fully filled. The biological agents of hyperphosphorylation are kinases, enzymatic catalysts that phosphorylate various bodily compounds. This process is involved with different functions in the body. In the case of Alzheimer's, the hyperphosphorylation of tau proteins, which are found in the axons of healthy nerve cells, is believed to be one of the major factors in causing the disease.

The second major lesion found in patients exhibiting Alzheimer's disease is beta-amyloid plaques. An amyloid is a firm deposit made up of protein and sugars that is a result of degraded tissue. The central investigation of the research is focused on the kinase. Der Avedissian mentions that her research will be geared toward understanding the relationship between the two lesions in the future.

### **Methods**

Der Avedissian used various research methods, including online surveys, interviews, and archival studies. She is currently using literature analysis and published data as research methods. The purpose of this study isn't to disprove any belief; rather, it is to further elaborate one specific theory on two lesions associated with Alzheimer's disease.

This photo displays the two major lesions in Alzheimer's Disease; Neurofibrillary tangles and Amyloid plaques.



### **Research Significance and Implications**

The research evidently has significance in unveiling the mystery behind Alzheimer's disease. Der Avedissian explains that "this study is only in its preliminary stages but I hope the study provides additional theories that can contribute to the understanding of Alzheimer's disease etiology or maybe even shed light on potential application in treatment.". There are many unanswered questions about the disease. According to the Alzheimer's Association, Alzheimer's disease is the sixth leading cause of death in the United States, and 5.4 million Americans are dealing with it.

Research about Alzheimer's disease plays an important role in improving diagnosis of the disease, the cause and risk factors, and how it may be prevented. Despite the daunting task of elucidating a complex condition like Alzheimer's, Der Avedissian remains hopeful, and concludes that she is "optimistic that many breakthroughs will be made in understanding and treating Alzheimer's." It is through the work of individuals like Der Avedissian that diseases such as Alzheimer's can be resolved through dedication in research.