ALZHEIMER’S DISEASE
DEMENTIA

Dementia is defined as a loss of memory which worsens over time. The time taken for dementia to worsen differs per person. Some people may remain the same for years, while others may loose their basic skills very quickly. It affects mental skills, including how to think and plan.

Causes of dementia include: Alzheimer’s disease; strokes, tumors, or head injuries (vascular dementia); or diseases such as Parkinson’s disease.

Dementia is usually not a treatable disease. However, if dementia is caused by a treatable issue then the treatment of the issue can cure dementia. Conditions such as hyperthyroidism, and normal-pressure hydrocephalus fall under this category.
WHAT IS ALZHEIMER’S

Alzheimer’s disease (AD) results in the loss of cognitive functions, due to the deterioration of brain cells (neurons). Alzheimer’s has no cure, but continues to worsen in victims over time. It affects primarily memory, judgement and reasoning, movement coordination, and pattern recognition. Advanced stages can cause all memory and mental functioning to be lost.

The cerebral cortex and hippocampus are the predominantly affected areas of the brain. They will lose mass and shrink as progression of Alzheimer’s continues.
CAUSES OF ALZHEIMER’S

One of the key causes of Alzheimer’s is aging and many victims of Alzheimer’s are over the age of 60. Research is being conducted on age-related changes in the brain harming neurons that leads to Alzheimer’s disease. Changes include the shrinking of certain parts of the brain, inflammation, production of unstable molecules (free radicals), and the breakdown of energy production within a cell.

Alzheimer’s disease is characterized by the development of amyloid plaques and neurofibrillary, or tau, tangles. This is the loss of connections between neurons in the brain; and the death of these nerve cells. Researchers have not found a specific gene that directly causes the late-onset form of Alzheimer’s disease. However, having one form the apolipoprotein E (APOE) gene on chromosome 19 does increase a person’s risk of getting Alzheimer’s.
Alzheimer's disease is a very frightening, but unfortunately common disease usually found in older people. Essentially, AD disrupts critical metabolic processes. Through slow, tedious work, scientists have discovered that amyloid plaques and neurofibrillary tangles are possibly some of the main causes or effects of AD. These abnormal structures are generally made of misfiled proteins.

After connections and communications are cut off, most neurons die, or lose their function.

Disruption from these dangerous molecules cause nerve cells in the brain to stop working, lose connections with other nerve cells, and finally die.
Amyloid plaques are found in the spaces between the brain’s nerve cells. These plaques are formed during a long process that only happens to some people, and they start from the highly toxic protein called beta-amyloid. Scientists still do not know whether amyloid plaques themselves cause AD or whether they are a by-product of the AD process.

An amyloid precursor protein, or APP, is the starting point for amyloid plaques, which is one of many proteins associated with the cell membrane of the neuron. As it is being made inside the cell, APP becomes embedded in the membrane. In the cell membrane, specific enzymes snip APP into discrete fragments. APP processing can follow one of two pathways that have very different consequences for the cell.
AMYLOID PLAQUES

In the harmless pathway, enzymes snip the APP molecule in a place where it can't become beta-amyloid, and this avoids plaque buildup. If done correctly, the pieces on the outside of the neuron promote neuronal growth, and the pieces left inside help the nucleus.

In the harmful pathway, the APP molecule is snipped in the wrong place and becomes the molecule beta-amyloid. This molecule sticks to other beta-amyloid peptides, and forms oligomers. It is theorized that oligomers affect synapses between neighboring neurons.

As oligomers grow, they become increasingly insoluble and combine with other proteins and cellular matter. In the end, these become the plaques that cause damage to neurons.
NEUROFIBRILLARY TANGLES

Tangles are abnormal collections of twisted protein threads found inside nerve cells. The main protein found in tangles is called tau. In healthy neurons, microtubules help transport nutrients and other cellular components down the axon.

Normally, tau has a certain number of phosphate molecules attached to it, but people with Alzheimer's disease has quite a few more. This causes the tau to separate from the microtubules to combine with more tau fibers, causing a mesh to form in the cell and for microtubules to break down. A collapse like this causes a loss of communication between neurons.
LOSS OF COMMUNICATION AND CELL DEATH

In the formations and actions of both plaques and neurofibrillary tangles, many neurons lose the important communications they have between each other. With this loss of connection, the brain atrophies as the affected regions begin to shrink, and many cells die. By the final stage of AD, the damage is widespread, and brain tissue has shrunk significantly.
SYMPTOMS

MILD

- The first stage usually lasts from 2 to 4 years. The symptoms include:
  - Having less energy, drive, and interest in work as well as social activities.
  - More time spent just sitting, watching TV, or sleeping.
  - Loss of more recent memories, and having language problems, like trouble putting their thoughts into words or understanding others.
  - Mild coordination problems, such as trouble writing or using familiar objects, or trouble driving, like getting lost on familiar routes.
  - A hard time with everyday tasks, and having mood swings. Loss of interest or depression may ensue.
SYMPTOMS

MODERATE

This stage usually lasts for 2 to 10 years, some symptoms include:

- Rambling speech
- A hard time planning
- Confusion about time and place
- Not dressing for the whether
- Trouble sleeping
- Delusions
- Wandering
SYMPTOMS
SEVERE

>This stage usually lasts 1-3 years, some symptoms include:

- Major confusion about the past and present.
- Can't express themselves or remember information
- Problems with normally unconscious functions like going to the bathroom or swallowing
- Weighty loss and seizures
- Mood swings, and loss of control over movements
TREATMENT

Although there is no cure for Alzheimer’s disease, treatment is available to slow the effects or make the patient more comfortable during their lifetime. Medication is a prominent form of treatment, easing the symptoms of Alzheimer’s sometimes until they are unnoticeable.

Cholinesterase inhibitors are prescribed to treat symptoms related to memory, thinking, language, judgment and other thought processes. These include donepezil, rivastigmine, galantamine.

Memantine is prescribed to improve memory, attention, reason, language and the ability to perform simple tasks.

Vitamin E may protect brain cells and other body tissues from certain kinds of chemical wear and tear.
## TREATMENT

<table>
<thead>
<tr>
<th>Generic</th>
<th>Brand</th>
<th>Approved For</th>
<th>Side Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Donepezil</td>
<td>Aricept</td>
<td>All stages</td>
<td>Nausea, vomiting, loss of appetite, and increased frequency of bowel movements</td>
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<tr>
<td>Galantamine</td>
<td>Razadyne</td>
<td>Mild to moderate</td>
<td>Nausea, vomiting, loss of appetite, and increased frequency of bowel movements</td>
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<tr>
<td>Memantine</td>
<td>Namenda</td>
<td>Moderate to severe</td>
<td>Headache, constipation, confusion, and dizziness</td>
</tr>
<tr>
<td>Rivastigmine</td>
<td>Exelon</td>
<td>Mild to moderate</td>
<td>Nausea, vomiting, loss of appetite, and increased frequency of bowel movements</td>
</tr>
<tr>
<td>Vitamin E</td>
<td>Not applicable</td>
<td>Not approved</td>
<td>Can interact with antioxidants and medications prescribed to lower cholesterol or prevent blood</td>
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</table>
WHO IS AFFECTED

In 2011, 747,000 Canadians were living with Alzheimer’s disease and other dementias, and that’s about 14.9 % of Canadians 65 and older.

As well, 35 million people worldwide have Alzheimer’s disease.

Although Alzheimer's disease strikes both sexes, it is a disease that particularly affects women. More women than men are affected by the disease, but this is possibly because women generally live longer than men.
In the early days of research on Alzheimer's disease, some scientists figured out that early-onset AD, one of the more uncommon forms of AD, ran in families. A search for a common denominator began, and that was when they found Chromosomes 21, 14, and 1. The scientists found that some families have a mutation on these chromosomes.

On chromosome 21, the mutation causes an abnormal amyloid precursor protein to be produced.

On chromosome 14, the mutation causes an abnormal protein called presenilin 1 to be produced.

On chromosome 1, the mutation causes another abnormal protein to be produced. This protein, called presenilin 2, is very similar to presenilin 1.

Even if only one of these genes that are inherited from a parent contains a mutation, the person will almost inevitably develop early-onset AD.
MORTALITY

- Unless a cure is found, more than 16 million Americans will have the disease by 2050.
- Alzheimer’s disease is the 6th leading cause of death in America.
- 1-in-3 seniors die with Alzheimer’s or another kind of dementia.
- Typical life expectancy after an Alzheimer’s diagnosis is 4-to-8 years. Alzheimer’s disease is terminal.
INTERESTING FACTS

- Alzheimer’s is the only cause of death in America’s top 10 that cannot be prevented, cured, or slowed.
- Almost 2/3 of American’s with Alzheimer’s disease are women.
- One in three seniors will die due to Alzheimer’s or another form of dementia.
- In 2015, Alzheimer’s and other dementias cost the US 226 billion dollars. By 2050, this could raise up to 1.1 trillion dollars.
- Worldwide, nearly 44 million people have Alzheimer’s disease or dementia.
- Only 1 in 4 people with Alzheimer’s are diagnosed.
- Alzheimer’s and other dementias are the top cause for disabilities in later life.
RACIAL MAKEUP OF ALZHEIMER’S

65-74 Years of Age
\( \infty 2.9\% \) White  
\( \infty 9.1\% \) African American  
\( \infty 7.5\% \) Hispanic

75-84 Years of Age
\( \infty 10.9\% \) White  
\( \infty 19.9\% \) African American  
\( \infty 27.9\% \) Hispanic

85 Years of Age and above
\( \infty 30.2\% \) White  
\( \infty 58.6\% \) African American  
\( \infty 62.9\% \) Hispanic
In this project, something that was challenging was trying to find statistics that were not partial to the United States. As well, another challenging aspect was trying to understand the chemical interactions that happen with amyloid plaques and neurofibrillary tangles, and trying to understand the biology terminology.

In terms of treatment, it would be beneficial to learn more about the genes involved in Alzheimer's, and the drugs used to treat it. As well, if there are any possible to ways to prevent it.
Alzheimer’s disease is a type of dementia that causes loss of cognitive function, due to the loss of neurons. It is mostly seen in people aged 65 and up. It is caused by the development of amyloid plaques and neurofibrillary tangles which ends in the nerve’s death due to loss of connection and results in the diminution of the nerve function. Scientists have found links between early onset Alzheimer's and mutations on the chromosomes 14, 21 and 1; all which cause abnormal proteins to grow. Alzheimer’s affects: speech, judgement, memory, and basic unconscious functions, among others. Alzheimer's disease is categorized in three stages of severity.
SUMMARY

∞ Mild (2-4 years) is mostly a significant decline in energy, loss of recent memories, having a hard time with coordination and mood swings.

∞ Moderate (2-10 years) consists of a hard time planning, sleeping, speaking and may include wandering and delusions.

∞ Severe (1-3 years), this is the final stage before imminent death. The line between past and present is hazy, very little speech, can’t retain information, trouble with unconscious tasks and drastic mood swings.

∞ Alzheimer's disease is incurable however there are treatments to extend a patient’s lifetime and make them more comfortable. Such as medication and therapy.
CITATIONS

http://www.webmd.com/alzheimers/tc/dementia-topic-overview
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