ALZHEIMER’S BANE

CUTTING-EDGE RESEARCH BRINGS US CLOSER TO A CURE
If you met Jackie Candland, age 76, on the street, you would probably not be able to immediately tell that she has a serious neurological disorder. She can still talk to people, get dressed, and perform most day-to-day tasks with ease. But, says her adult daughter, Becky Arrowood, "it wouldn't take long to realize that there was something wrong." And indeed, there is: Jackie suffers from Alzheimer's disease. 

"My mom calls me at least several times a week," says Becky, "sometimes daily, or hourly, and starts to bawl, thinking it's her birthday and we have all gone to celebrate without her. There is no use disagreeing with her, even though her birthday isn't for six months. We have learned that you cannot reason with someone who has lost their reasoning ability." Arrowood says that the best remedy is to tell her mother that her birthday is coming up next week and that they're excited. "That will placate her for about 30 seconds, and then she will start bawling again. This will go on for 20 minutes until she finally calms down." 

Not every Alzheimer's patient suffers from the extreme anxiety that Jackie is prone to, but in such cases, antianxiety medication is only somewhat helpful. Because of this, Alzheimer's often proves to be a tremendous burden—not just for the person diagnosed with the disease but for that person's loved ones as well. "My dad says he cannot get much done," reports Arrowood. "(My mom) is at times very needy, with the same endless questions, at times accusing him of everything from having affairs to taking over her kitchen. Other times she is pleasant and easy to be around. But that can change in a second." 

Jackie's story, and that of her family, is, unfortunately, becoming all too common. An estimated 5.5 million Americans of all ages suffer from Alzheimer's.¹ In older adults, the disease is the leading cause of dementia.² That number rises every year with the country's aging population. In fact, according to the U.S. Census Bureau, the number of people 65 and older will more than double between 2010 and 2050,³ and researchers have predicted that an additional 8.4 million will develop Alzheimer's disease before 2050.⁴
Alzheimer’s disease is caused by a loss of neurons and synapses in certain parts of the brain. The mental and physical effects are gruesome: due to atrophy, a brain with Alzheimer’s looks significantly different than a brain without. The brain damage results in symptoms that impair the memory and, later, decision-making, language, and general cognitive function. The final stages often find patients completely dependent upon caregivers, as they are unable to speak or perform simple tasks independently. Muscles can deteriorate until a patient is bedridden, and in the body’s weakened state, death is usually caused by an infection, pneumonia, or some other external factor.

The disease is the sixth leading cause of death in the United States. Among people age 70, 6.5 percent of those with Alzheimer’s are expected to die before age 80, compared with 30 percent of those without Alzheimer’s. That picture is bleak enough without considering the magnitude of the impact that it has on family members of patients with Alzheimer’s. In 2015 the 15.9 million family and other caregivers of people with Alzheimer’s disease and other dementias provided an estimated 181.1 billion hours of unpaid care, with an estimated economic value of $213.1 billion. It is estimated that if left unchecked, Alzheimer’s disease could cost Americans $1 trillion by 2050.

More Research Is Needed to Bring Hope to Sufferers and Their Families

More research is needed to understand protective measures and risk factors for dementia. It behooves us then to better understand the risk factors for possible new treatments, and potential cures for Alzheimer’s to mitigate those devastating effects. The rising incidence of not only Alzheimer’s but also other neurodegenerative disorders such as Parkinson’s and ALS (amyotrophic lateral sclerosis) has created more urgency to understand the brain. Thankfully, progress made in the field of neuroscience—the scientific study of the structure or function of the nervous system and brain—has already provided developments that would have been previously unthinkable. In fact, Dr. Ramona Hopkins, director of Brigham Young University’s neuro-science program, says that the field of neuroscience, and her program in particular, have seen “exponential progress” in recent years.

Dr. Hopkins, whose own father (a retired BYU faculty member) passed away after a long battle with Alzheimer’s disease, has been a faculty member of the Neuroscience Center since 1999 and has served as its director since July 2015. In that time, she has seen the program undergo tremendous growth that has more or less paralleled the growth of the field. In 2011, BYU’s neuroscience majors averaged less than 300 students per semester. Now, just five years later, that number has jumped to almost 600.

What has caused this massive leap? Indirectly, but ultimately, it’s the result of many factors in combination, most notably the increased affordability and availability of medical technology. This progress has increased the number of opportunities available to those majors, as well as the possibilities for what they might accomplish. Take, for instance, the cost of sequencing a human genome. In 2000, someone who wanted to get their genome sequenced would have had to pay a relatively hefty sum—by conservative estimates, $300 million. Needless to say, it wasn’t a common practice. But now, just fifteen years later, the progression of sequencing technology has been so dramatic that the exact same analysis costs little more than $1,500. Since the technology used in research is both improving and getting cheaper, better research and better science are now available at a fraction of the former cost. Tools used for viral and molecular imaging, optogenetics, and chemogenetics are among the neuroscientific technologies to see the exponential advancement Dr. Hopkins speaks of. Such advances are being adopted throughout the entire field, and new discoveries in neuroscience are being made every day.

Possible New Imaging Predictors of the Disease

Dr. Jonathan Wisco, an associate professor in both the Neuroscience Center and the Department of Physiology and Developmental Biology, has made strides in Alzheimer’s research that may fine-tune future diagnoses and facilitate better treatment. At a 2016 BYU gerontology conference, he shared his findings about some potentially groundbreaking evidence for predictors of Alzheimer’s. Before coming to the university in 2012, he had collected a lot of data on specific indicators of the disease, but he didn’t know quite what to do with it all.

“At one point while I was at UCLA, my work had stalled,” he said. “I had no idea how I was going to interpret the data I was amassing on Alzheimer’s hippocampus pathology. Then, when I arrived here at BYU, Dr. John Kauwe from the Biology Department invited a bunch of us faculty who were interested in Alzheimer’s to meet together. Dr. Richard Watt from the Chemistry and Biochemistry Department was in attendance, [and] he had some data that he couldn’t make sense of. His data was all over the map, as was mine.” Wisco and Watt did some comparisons and were able to make some links between symptoms that could potentially be used as imaging predictors of Alzheimer’s disease.

“What we didn’t expect to find in our research was that the inflammatory response to the formation of amyloid plaques and hyper-phosphorylated tau tangles is probably contributing to the signal decay in our MRI images,” says Dr. Wisco. “Thus, the physiological response to the accumulation of pathological proteins could also be contributing to the progression of Alzheimer’s disease. The results were exciting to see, and we’re curious and anxious to know if this is happening in different parts of the brain that we haven’t yet analyzed.”

Changing the Tangle of Prediction

Likewise, Dr. Lance Erickson, a member of the college’s sociology Department and a recipient of a Hinckley Young Scholar award, has been conducting research on predictors of Alzheimer’s. “We know that tangles and plaques are associated with Alzheimer’s disease,” he says. Tangles are twisted strands of protein contained in dead and dying nerve cells, and plaques are abnormal clusters of protein fragments that build up between nerve cells. “However, postmortem examination of brain tissue suggests that about 40 percent of people that pass clinical thresholds for Alzheimer’s disease do not show symptoms [of the disease] during their lives. In other words, they had Alzheimer’s . . . based on the biology of their brains, but they functioned as if they did not. We [are examining] early-life social and psychological factors that might account for this.”

PAMs May Improve Brain Communication

A research project conducted by Doris Jackson, an FHSS neuroscience PhD student, shows promise regarding the treatment of the underlying causes of Alzheimer’s, as opposed to just its symptoms. Positive allosteric modulators—or PAMs—offer a new kind of solution...
Possible Obstacles

These developments, while definitely encouraging, don’t mean that the neuroscience field in general and BYU’s neuroscience program specifically don’t have challenges that might impede their progress toward finding cures for Alzheimer’s and other neurological disorders. Besides the logistical challenges that such exponential growth poses, there are those posed by the common misconception among current college students that all neuroscience graduates go on to medical school or that the usefulness of such a degree is limited to medical applications, possibly limiting the number of students who decide to major in neuroscience for other reasons.

To be sure, plenty of neuroscience grads do go on to successful medical careers—one third, in fact—but alternative options are plentiful. Over 10 percent of BYU’s neuroscience graduates go on to attend dental school. Others become lab technicians, get involved with pharmaceuticals, or attend graduate school. But some don’t even stay near the field at all.

Tyler Slater, a neuroscience graduate in 2012 who served as editor-in-chief of the Neuroscience Center’s Journal Chiasm and graduated as valedictorian, left the university with his degree in hand and cofounded a software company called Iolt. Despite his business success and high-profile clients, Slater still finds that mentioning his neuroscience degree is what gets people’s attention.

“I’m surprised sometimes at how much people respect and … revere the term neuroscience,” he said. “It makes people think I’m really smart because it sounds really brainy.” Of course, the increased credibility isn’t all Slater gained from his degree. “I was challenged intellectually,” he said of his classes, “I learned a lot of critical thinking skills. The field of neuroscience is one that involves a lot of unknowns, being a relatively new and exploding field where we’re just barely beginning to understand the brain, and it really instilled in me a sense of discovery which helps me in all of the work that I do. Now, I’m constantly looking for new ways to improve and to make what I do faster, better, and easier to innovate. The research mentality I have learned has bled into everything I do.”

A Bright Future

In contrast, many of the new drugs in development aim to modify the disease process itself, by impacting one cause of Alzheimer’s. In contrast, many of the new drugs in development aim to modify the disease process itself, by impacting one cause of Alzheimer’s. In contrast, many of the new drugs in development aim to modify the disease process itself, by impacting one cause of Alzheimer’s. In contrast, many of the new drugs in development aim to modify the disease process itself, by impacting one cause of Alzheimer’s. In contrast, many of the new drugs in development aim to modify the disease process itself, by impacting one cause of Alzheimer’s. In contrast, many of the new drugs in development aim to modify the disease process itself, by impacting one cause of Alzheimer’s.


