

I. Abstract

Our idea is to cure PTSD (Post Traumatic Stress Disorder) with nanotechnology, specifically using artificial intelligent nanorobots to target specific neurons associated with the memory. We plan to also use light to control the neurons in the brain to prevent tragic memories from being painfully recalled using optogenetics. Sidran Institute estimated 70% have experienced a traumatic event and 20% of those people could develop PTSD. Our vision is for the brain to stop triggering and recalling traumatizing memories.

II. Description

1. Present Technology:

Most people with PTSD go to therapy. Most treatments deal with confronting the person's traumatic memory. Some common treatments for PTSD are cognitive processing therapy, prolonged exposure therapy, eye movement desensitization and reprocessing, and stress inoculation training. Another limitation is that the cures are not immediate, so if the person has depression because of PTSD, then he might commit suicide before therapy ends. The patient could also for some reason be scared of the place where the therapy is going on. They might refuse to take the treatment or attempt to do what their therapist might want them to do. There is a reason so many people have PTSD, because the treatments have so many limitations. Our future technology will be using nanotechnology, robotics, and optogenetics to provide a better solution.

2. History:

Robotics

During the 18th century automatons were a common toy. They could move like humans or animals. In 1942, Isaac Asimov made the "Three Laws of Robotics." WAP-1, the first biped robot, was made by Ichiro Kato in 1969. In 2005, the Korean Institute of Science and

Technology created Hubo, which was connected to a computer, which made it one of the smartest robots around. In 2017, a robot named Sophie was granted Saudi Arabian citizenship.

Nanotechnology

The first known use of nanotechnology was carbon nanotubes and cementite nanowires in wootz steel from India at about 600 BCE. In 1959, Richard Feynman thought of the idea of nanotechnology in a talk, which inspired many other scientists. Norio Taniguchi came up with and used the word nanotechnology for the first time in 1974. In 1986, Eric Drexler made a book called *Engines of creation: The Coming Era of Nanotechnology*, which was about the idea of a nanobot that could replicate itself. Gerd Binnig and Heinrich Rohrer won a Nobel prize for making the scanning tunneling microscope in 1986 too. During the early 2000's, the government started sponsoring nanotechnology research. In 2010, IBM made a silicon tip to create a map that was one thousandth the size of a grain of salt.

Optogenetics

Optogenetics started in 1999, by Francis Crick. He thought of the idea of possibly having the brain being controlled by light (optogenetics). A previous way for using light to control neurons was carried out by Richard Fork. He used laser activation of neurons within intact tissue, although not in a genetically-targeted way. The earliest genetically targeted method that used light to control rhodopsin-sensitized neurons was reported in January 2002, by Boris Zemelman and Gero Miesenböck. In 2003, Zemelman and Miesenböck developed another method for light-dependent activation of neurons.

3. Future Technology

Our future technology will use a nanorobots to help you with PTSD with just a beam of light. The nanorobots will use artificial intelligence to map the neurons related to certain memories. Once the nanorobots understands which neurons are related to specific memories we can target them to prevent them from being retriggered. Nanorobots will find the neuron/neurons and use optogenetics which can use light to impact the specific neurons associated. If the memory can't be remembered, there won't be any more PTSD.

Nanotechnology allows us to manipulate inside an atom. Nanorobots can go into places very small places. Our nanorobots will travel through blood vessel and enter the brain. Going through the blood vessel would be more efficient because we would not have to drill through the skull or damage anything to enter the brain or find a passage. Since there are blood vessels leading through the brain, it would be easier to travel through the brain that way. It would be the fastest way to get to the brain. In figure A, you can see nanobots holding on to the blood cells to travel. For our nanobot, it will have fins to propel it through the veins.

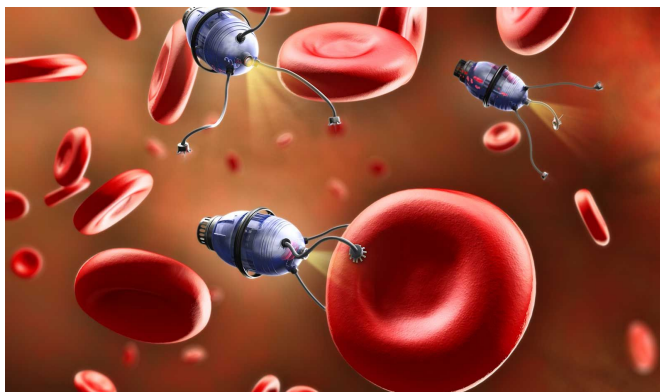


Figure A

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It is important to know the brain because then we need understand the neurons and how they work with memories. “Your brain contains billions of nerve cells arranged in patterns that coordinate thought, emotion, behavior, movement and sensation. While all the parts of your brain work together, each part is responsible for a specific function — controlling everything from your heart rate to your mood.”¹ In Figure C, it shows nerve cells and neurons working together. One interesting fact is that neurons don’t actually touch, but at their synapses the electrical signals turn into chemical signals to communicate.

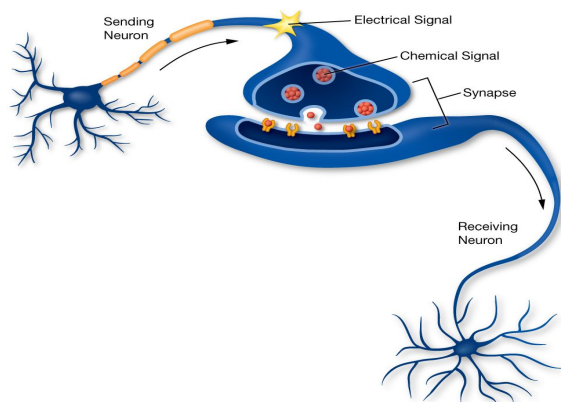


Figure B:

In Figure D below, you can see that we have four lobes that make up our brain. First there’s the frontal lobe. The frontal lobe is used for controlling thinking, planning, organizing, problem solving, short term memory and movement. Second, we have the parietal lobe it is used for interpreting sensory information such as taste, temperature and touch. Third, the occipital lobe that is used for processing images from your eyes and link that information with

¹ “Slide Show: How Your Brain Works.” *Mayo Clinic*, Mayo Foundation for Medical Education and Research, 20 Apr. 2016, www.mayoclinic.org/brain/sls-20077047.”

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images stored in your memory. Last but not least the fourth lobe. The temporal lobe, helps by processing information from your senses of smell, taste and sound. The difficult part of our future vision is that memories aren't stored in one part of the brain but depending on the type are stored across different, interconnected regions of the brain.

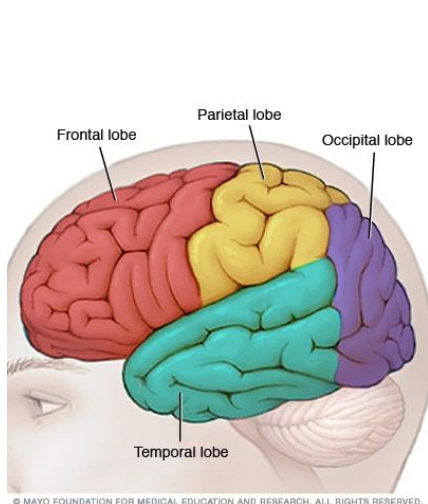


Figure C

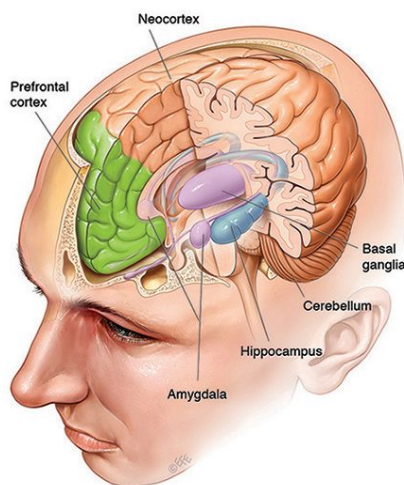


Figure D

PTSD memories would be explicit memories which are about events that happened to a person. The nanorobots will need to coordinate around the following three areas of the brain: the hippocampus, the neocortex and the amygdala, as shown in Figure E. The design of the nanorobot is critical so it won't damage any vessels or brain. Since the robot would go through the blood vessel, it would be designed for swimming to maneuver in blood fluid in our vessels instead of to swim through the blood vessels. We are thinking about having fins to control the nanorobot while it would go through the blood vessels up to the brain. The fins would hover and somewhat be almost like a fish. It would be in a swimming motion which would make a

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constant forward thrust with no drag. We're thinking about conducting polymer. Polymer is a thing that has a molecular structure. It could possibly eliminate the use of electric motors.

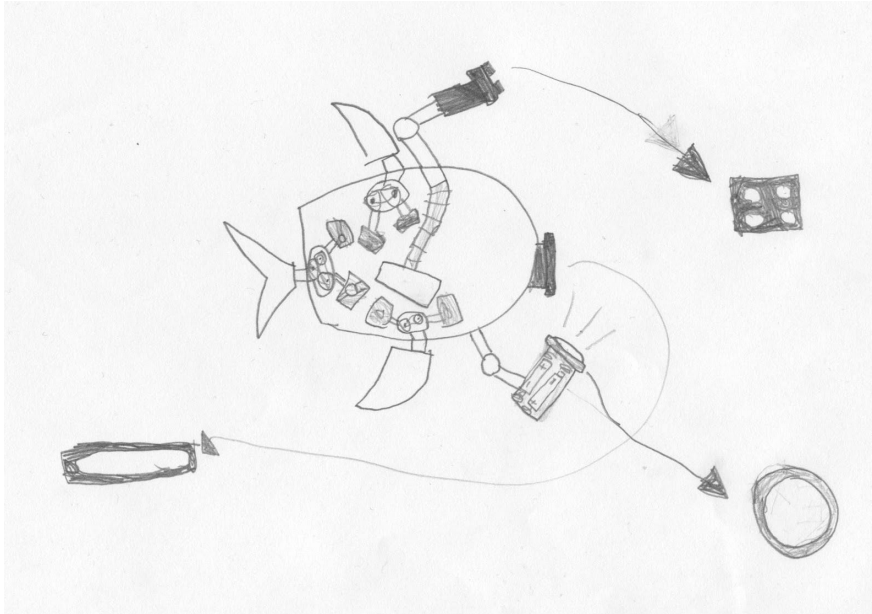


Figure: E

The brain of the nanorobots will include Artificial Intelligence technology. Artificial Intelligence will allow us to gain knowledge and learn about neurons and how we can map them.

Optogenetics is a very important breakthrough technology. There is an algae called, *Chlamydomonas Reinhardtii*. It can sense where light is coming from and can move to a better position to get the most light. Then, scientists can put the DNA of the algae on the neurons using genetic engineering, which gives the neurons the trait of the algae to be activated by light. Now people can shine blue light on the neurons and they will fire

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We want to cause the neuron to turn “off.” Scientists found a single cell organism called Archaea, which has a protein called halorhodopsin. Halorhodopsin has negatively charged ions. When the gene is genetically engineered into the neuron, scientists must use a yellow light to turn it off, not a blue light. Figure F illustrates how optogenetics works using the protein “opsin” and the difference between using channelrhodopsin and halorhodopsin.

How does optogenetics work?

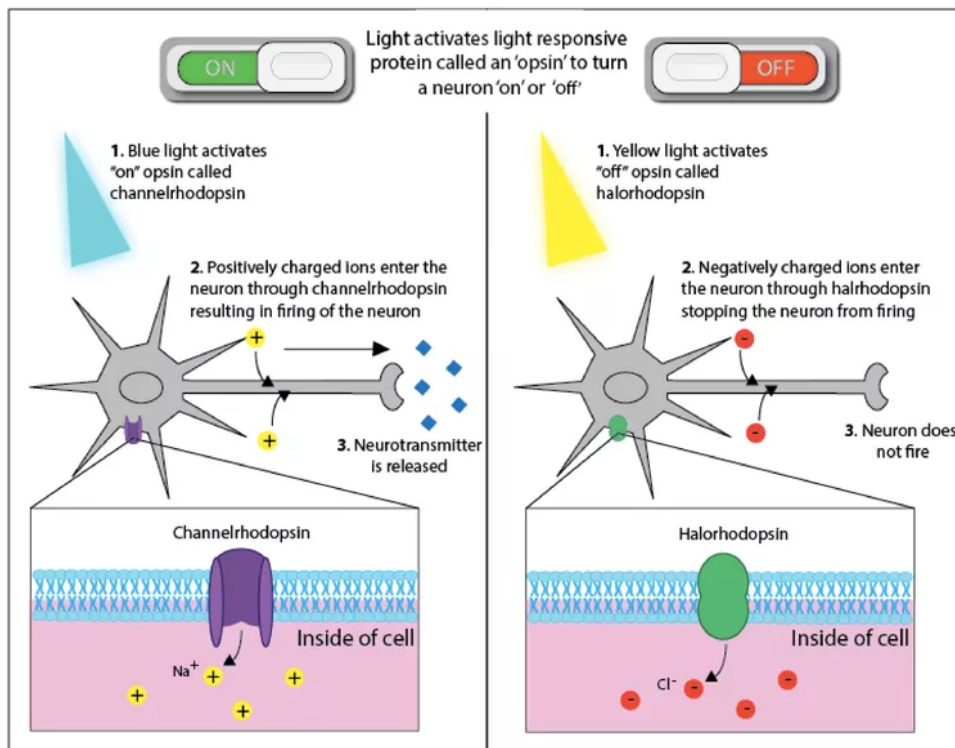


Figure F

4. Design Process:

Our team wanted to focus on forgetting memories because it can put you in a bad mood if you regret doing something or sad and traumatizing to remember something scary. We also

did not like having something like a movie or book get spoiled before we see it. We initially thought about hypnotism or cutting off neurons. We thought about those before we learned about optogenetics and because cutting off the neurons would be permanent, because it would be hard to repair the neurons after if there was a mistake. We were also going to use the algae protein Chlamydomonas Reinhardtii. We then realized that we would have to use the single cell organism Archaea, because we had to shut down the neurons, not cause them to fire. We debated the design of our nanobot for a while, too. We decided on using fins on the nanobot instead of a propeller. We chose fins because it allows more maneuverability and a propeller could damage the blood veins, cells, or parts of the brain.

5. Breakthroughs:

We will need breakthrough advancements in nanotechnology and nanobots which can be designed with all the technology required such as AI, optogenetic protein and light triggering capabilities. These are emerging technologies still need advancements in precision and size.

An important study to do would be to make sure that the nanobot only triggers neurons with traumatic memories. The study would map a brain and its neurons and watch as multiple nanobots come in and do their job. The observers could then use the scientific method to fix them and then redo the study. They could also see how the rest of the brain reacts to the neurons with those memories shutting down. Another study could be how the robot works in the body. The nanorobot will use artificial intelligence so it can navigate. We would perform tests to ensure the nanorobot could be able to navigate to the brain and not harm anything in its path.

6. Consequences

Depression is a very common mental sickness in the U.S and many other countries. PTSD usually leads to depression, so when PTSD is stopped, then depression rates will go down. If depression is less prominent, than the world might become a more happy place.

It could be possible that there could be a mistake if the nanobots place the algae gene on the wrong neuron. It might make them forget one of their friends who they met during the war or during the time they had their traumatic event or events. It would probably be very simple to turn the neurons back on though. Also, if the wrong person got their hands on it, it could be very disastrous. People could brainwash someone, and since there are nanobots, they could just inject the nanobots in with a program and the victim would not even know. You could erase their memories of what they believe in, or they could make them forget who they were going to vote for, and then convince them to vote for someone else. On the positive side, there are also many other mental diseases or disorders that are caused by neurons not firing properly, like Alzheimer and Parkinson disease, that could be cured by optogenetics.

III. Bibliography

Figures

Figure A

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Figure B <https://learn.genetics.utah.edu/content/neuroscience/neurons/>

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Figure D - <https://qbi.uq.edu.au/brain-basics/memory/where-are-memories-stored>

Figure E - Created by Team

Figure F -

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IV. Web design

Page 1


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Home

Our vision is to cure PTSD (Post Traumatic Stress Disorder) with nanotechnology, specifically using artificial intelligent nanorobots to target specific neurons associated with the memory. We plan to also use light to control the neurons in the brain to prevent tragic memories from being painfully recalled using optogenetics.



When you click on the play button our team will explain our vision in a video.



What is PTSD? PTSD is when a person who has experienced a traumatic event experiences anxiety and depression as they recall or have flashbacks to those memories.

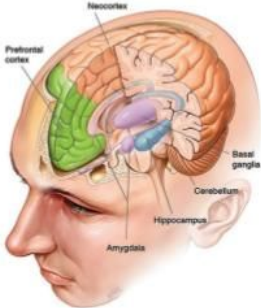
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When you click on any of the boxes with a black background, it will take you to the web page, except for sources, which will have a pop up which will include all sources including images. When you click on the play button it will explain our vision in a video.

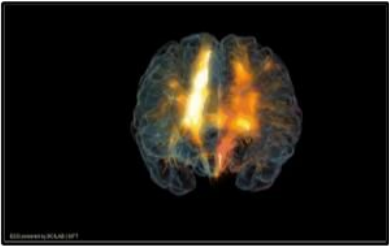
Sample Web Page # 1 of 5 (must include 5 forms)

HOMEUnderstanding The brainFuture TechnologyBreakthroughsConsequencesSources

Understanding The Brain



Memories aren't stored in one part of the brain but depending on the type are stored across different, interconnected regions of the brain. Click on the image to learn more about the brain.



Your brain contains billions of nervous cells called neurons that work together to coordinate thought, emotion, behavior, movement and sensation. Click on the image to learn more about neurons.

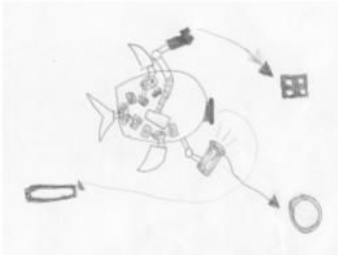
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Sample Web Page # 2 of 5 (must include 5 forms)

When you click on any of the boxes with a black background, it will take you to the web page, except for sources, which will have a pop up which will include all sources including images. When you click on the brain image on the right, it will have a pop up window explaining the different parts of the brain. On the left, a pop up will explain where memories are stored along with how neurons works.

HOME Understanding The brain Future Technology Breakthroughs Consequences Sources

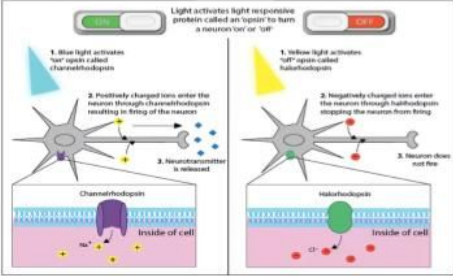
Future Technology - Nanotechnology and Optogenetics



Our nanorobot has a protein to apply to neurons and a light to control neurons. In addition, AI technology will understand and map specific neurons to memories.

[Click here to learn about nanotechnology and its history.](#)

How does optogenetics work?



This picture shows how scientists can turn neurons on or off using light and a protein.

[Click here to learn about optogenetics and its history .](#)

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Sample Web Page # 3 of 5 (must include 5 forms)

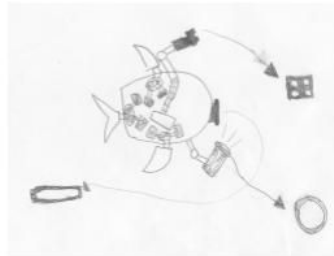
When you click on any of the boxes with a black background, it will take you to the web page, except for sources, which will have a pop up which will include all sources including images. When you move your mouse/pointer over the drawing of our nanobot, it will cause the image to become animated in 3D and slowly rotate around. If you put your mouse over the optogenetics picture, it will enlarge.

- HOME
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- Sources

Breakthroughs

We will need breakthrough advancements in nanotechnology and nanobots which can be designed with all the technology required such as AI, optogenetic protein and light triggering capabilities.

Click here to see the nanorobot providing the protein and light to a neuron.



In the space below, please describe any special effects that might be applied to your web page.
Sample Web Page # 5 of 5 (must include 5 forms)

When you click on any of the boxes with a black background, it will take you to the web page, except for sources, which will have a pop up which will include all sources including images.

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Consequences

ALL CREATIONS HAVE POSITIVE AND NEGATIVE OUTCOMES

Positive	Negative
Our nano and optogenetics could cure PTSD and make a difference. There many other mental diseases or disorders that are caused by neurons not firing properly, like Alzheimer and Parkinson disease, that could be cured by optogenetics.	It could be possible that there could be a mistake if the nanobots place the algae gene on the wrong neuron. It might make them forget different important memories. Also, if the wrong person got their hands on it, it could be very disastrous. People could brainwash someone, and since there are nanobots, they could just inject the nanobots in with a program and the victim would not even know.

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