

Thesis Statement:

Till Human Voices Wake Us

4/26/17

Jennifer Cantley

I seek to understand and find some form of control over the inevitabilities of life, disease, death, and decay. Anxiety. Depression. Helplessness. My art explores the emotions elicited by the frailty and impending mortality of my loved ones and me by envisioning the underlying chemical and macromolecular mechanisms of these mental and physical processes. To face death is to be in a position of discomfort, but I believe that through my work, I will be able to soothe the associated anxiety and can be empowered to recognize my part in life's eternal cycle.

Life is unpredictable. Life is messy. We as humans, at times wield science in our attempt to understand and control this chaos. In doing so, we can see how life is forever locked in a continual process where we decay to the soil and our carbonaceous building blocks are recycled to form a new living being which itself returns to the soil. The cycle repeats, endlessly reimagining the macroscopic projection of those same building blocks. Yet, each living thing traverses through its own peculiar trail of tiny tragedies that all work to drive it back into the earth.

I make reference to biology and molecular biology. I create using knowledge I have collected through studying certain diseases, microscopic organisms, human anatomy, and protein structures. By using this imagery, I am able to construct complex forms that represent specific fields of scientific study while imagining abstract forms and concepts. My art is a vehicle of exploration to understand the complicated journey life goes through.

Molecular Structures

Through my investigations, I have noticed a fragility common to every living thing. The tiny microscopic parts that make up our enormous living bodies have cellular maintenance systems that constantly work to repair any damages acquired, whether big or small, major or minor. This persistent maintenance keeps neurons firing so that fingers can wiggle, brains can carry out complex

thoughts, lungs can breathe, and hearts can beat.¹ As living things age, eventually the breakdown of their bodies happens faster than the microscopic parts can repair and they succumb to the inevitability of death and decay. In many cases, disease or trauma accelerate this breakdown.

My knowledge of science was severely stunted early on in my education. Not until my 20s did I find an insatiable desire to understand how the world around me functions. I began teaching myself and having friends teach me the basics of biology, genetics, and chemistry. Starting with little prior knowledge of how the universe works and suddenly wanting to know everything possible requires a reference point, a place to start my exploration of the universe. In my early studies, I quickly began to fixate on a specific macromolecule, a protein called rhodopsin. Proteins are large molecules that serve a purpose for a cell or for the body as a whole.² Rhodopsin is found in the retina of a sighted creature and is what causes the eye to see value; light and dark.³ Rhodopsin literally sheds light on our worlds or occludes them in darkness. I consider this a metaphor for the constant struggle I have between the known and the unknown, control and lack of control. To me, as a visual artist who relies on light to see and create, darkness represents things that I do not understand and cannot grasp. I began to compulsively draw this structure from many different angles as a way to better understand the protein physically. I was able to visualize this structure using the Pymol molecular graphics system and protein crystal data from the protein data bank.⁴ With the protein, the more I drew the complex, interweaving line structures, it was easier to comprehend the dense, scientific literature describing the function of this protein. I felt like I understood the intricate structure the way one feels acquainted with a face after having a person sit for a portrait. Since I could not talk to this protein, my way of building a familiarity with it was to recreate it with my own

¹ Guillery, R.W. "Observations of Synaptic Structures: Origins of the Neuron Doctrine and its Current Status". *Philosophical Transactions of the Royal Society B: Biological Science* Volume 360 (June, 29 2005).

² Lesk, Arthur M. *Introduction to Protein Architecture*. Oxford University Press; 1st edition. 2001.

³ Hargrave, P.A., J.H. McDowell. "Rhodopsin and phototransduction: a model system of G Protein-linked receptors." *Federation of America Societies for Experimental Biology* Volume 6 (March 1992).

⁴ The PyMOL Molecular Graphics System 1.7.4.5 Edu (Schrödinger).

hand over and over again. Rhodopsin became an obsession. It was the foundation of my study of science and, in a way, the foundation to my current body of work (Figure 1).



Figure 1. *Rhodopsin (Vibrations)* detail. Charcoal & Ink on paper

As I continued to explore protein structures, I discovered an artist by the name of Irving Geis. This artist illustrated protein structures in great detail before technology, such as computers and computer programs, made it easy for molecular life to be visualized.⁵ In fact, the representations of protein structures that technology now gives us are based on his drawings. His work inspired me, in part, to use microscopic structures as a design element. There is an entire subatomic world that can only be seen through an instrumental interface or with the assistance of artists. Geis was interested in molecular forms, drawing the molecular structures accurately, and showing the way they moved and their function with stark value and saturated colors. Irving Geis helped shed light

⁵ “Molecular Artistry: Science Illustrator Irving Geis Shed Light on an Unseen World.” *Georgia Tech Parker H. Petit Institute for Bioengineering and Bioscience* (Nov. 16, 2014).

on an unknown world and created a visual record of the microscopic realm that we still use to this day and that I use in my work.

As I branched out from rhodopsin, I found a new protein that resonated with me. The protein SERT, also known as serotonin transporter, is a protein structure that aids in transporting serotonin through the brain, hence the name. Many people without a proper distribution of serotonin suffer from anxiety disorders and depression which in many cases is the result of defective serotonin transport.⁶ SERT is the molecular manifestation of the disquieted feelings I am burdened with when pondering the cellular decay of myself and my loved ones. My portrayal of SERT began to become fragmented. With rhodopsin I would meticulously draw out every line and bend of the structure but SERT was more chaotic and less controlled (Figure). I was less concerned with making an accurate portrayal of SERT and more focused on the disjointed quality. Using handmade paper, I would methodically cut out the image of SERT as a way for me to express my anxieties but also, the monotony of cutting out protein structures became a therapeutic motion that helped calm me and momentarily pacifies my ever present anxieties.

Genetic Experimentation

I draw inspiration from studying the molecular world. After pouring over biochemistry, molecular biology, and human anatomy textbooks, articles published in scientific journals, and speaking directly with scientists, my knowledge of microscopic and molecular subjects has considerably increased. Through every iteration of my art, I am constantly grappling with how I can use knowledge of science to find my own form of control over the chaos of the natural world. In my studies, I have expanded my interest into the realm of genetics. Many diseases, or predispositions to certain illnesses are written directly into a person's genetic code. It's almost as if there is a death

⁶ Tuma, Rabiya S. "Controlling Emotional Feedback Is Key to Depression." *DNA Learning Center* (July 1, 2005).

sentence engraved into the Adenine, Cytosine, Guanine, and Thymine bases of our DNA. If that death sentence could be located, maybe humans could fix the faulty genes in their bodies that cause their demise. This is something I ponder often being in a family with a long lineage of individuals suffering from neurodegenerative diseases. The practice of genetic engineering has since caught my attention as a potential method of governance over the turmoil of life.

In 2012, Jennifer Doudna's lab at UC Berkeley successfully repurposed a set of molecular tools known as the CRISPR/Cas9 system that made gene editing easier than ever before. CRISPR is part of a molecular system that essentially allows for the editing of genes in living organisms.⁷ CRISPR/Cas9 has successfully fixed faulty, disease causing genes inside of a body. CRISPR is still quite new and, as far as we know, no one has used it on a viable human specimen. I began thinking about what these genetic experiments might look like if they were allowed to be carried out on humans. I started sketching out loose illustrations of what I imagine it would be like to do these first human genetic experiments in a laboratory. Genetic manipulation is especially complicated for higher organisms like eukarya, multiple celled organisms. Any genetic experiment like CRISPR has the potential of creating a genetically modified human that is technically human but is physically deformed beyond recognition.⁸ There are so many factors that go into genetic engineering that changing a gene in order to cure someone of the genetic disease Cystic Fibrosis, could theoretically cause an individual to develop without a vital organ. Meaning, CRISPR could edit genes but since we do not completely understand how the many genes are expressed and regulated over the course of development, it could mess with a gene that tells a human embryo to grow a hand or an eye. This idea of science gone wrong fascinated me. With all we as humans know, we cannot fix every

7 Jakociuna, Tadas, Michael K. Jensen, Jay D. Keasling. "CRISPR/Cas9 Advances Engineering of Microbial Cell Factories." *Metabolic Engineering* Volume 34 (September, 23 2015): 44-59.

8 Baltimore, David, et al. "Prudent Path Forward for Genomic Engineering and Germline Gene Modifications." *Science*. (February, 2016). <http://science.sciencemag.org/content/348/6230/36>.

defective cell in a human body. As much as we wield science to save human lives, the chaos of disease and death still prevails.

I created colored pencil drawings of what I thought these experiments would look like. I exaggerated and distorted the shape and color of the lab-like specimens. This mirrors the distorted view of my imagination. Some of the color was super saturated and referenced the bright colors of anatomy textbooks that I constantly pour over in my research (Figure 2).



Figure 2. *Untitled 1*. Colored Pencil on paper

The drawings led to my sketches to evolve into 3-D mock experiments with the use of biodegradable plastic and paper forms to create sculptures (Figure 3). The sculptures, to me, became a manifestation of the diseases that many humans will one day succumb to. By making continuous iterations of these sculptural renditions of genetic experiments, I am trying to show the frivolous attempts people make to combat their inevitable demise and gain control over their lives by the use of scientific research. Many believe that through such genetic engineering, a level of perfection can

be achieved but this may not come before many unsuccessful experiments are performed and profound failure happens.

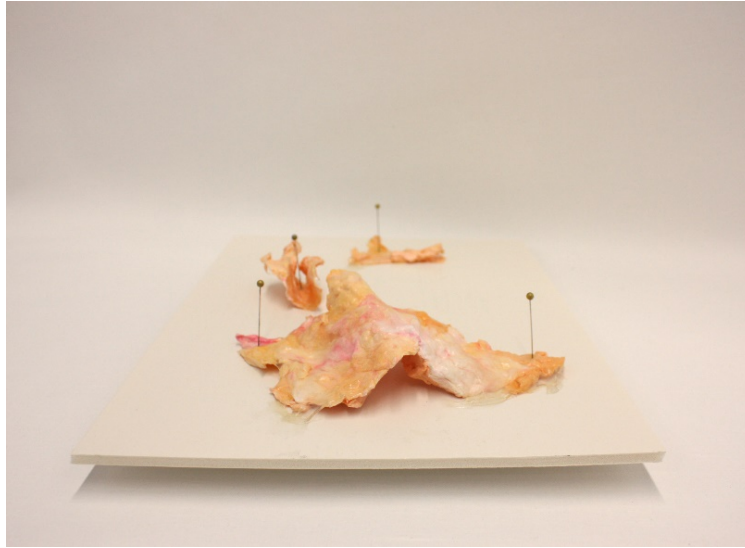


Figure 3. *Experiment #4*. Cotton paper and bioplastic.

At first I started to display these experiments on pedestals to elevate them as an art object. Later, I began placing them in vitrines to create a distance between them and the viewer. By having the diseased and malformed sculptures pinned down or encased in a vitrine, it was an attempt to show how frail life can be and that small genetic modifications can lead to large scale system failure. As I continued, I wanted to give life to these experiments because that is what I was trying to replicate, experiments on living things. I began attaching tubing to them that would pump fluid through their bodies and create the illusion of life. One of the criterion for life is a system in which energy and matter flow through an organism, the energy and matter are used by the organism, and is then excreted as a transformed energy or matter. This system of flowing energy as a way of replicating life was a tool I used for my sculptures (Figure 4).



Figure 4. *Psuedoscience: An Exploration of the Frivolous* Performance

Science Persona

As I continued to create and experiment, I realized in some ways, I take on the persona of a scientist; I create many iterations of experiments in order to understand the world around me. This is much like scientists do when they repeat experiments, each time with a single variable altered so as to see the outcome and infer a cause. The scientific method is quite similar to art making: observation, measurement, experimentation, testing, modification and then the end result.⁹ The process of making my work is also reminiscent of research in a lab, especially during the practice of making bioplastics. I must don my gloves, goggles, and protective equipment, as well as precisely measure material and closely chart my procedures and outcomes, much like scientists do. From this sprung the idea for the performance *Psuedoscience: An Exploration of the Frivolous*, where I carried out frivolous experiments on one of my paper and bioplastic sculptures in an attempt to express the helplessness I feel when faced with the deteriorating state of the people I care about.

⁹ Andersen, Hanne, et al. "Scientific Method." *Stanford Encyclopedia of Philosophy* (Nov 13, 2015).

Varied Materials

In many drawings, I use charcoal and graphite. Both these materials are carbon based, the very element that life's building blocks are built around. The use of carbon is a constant reminder of the origins of life and the inevitable journey life takes to eventual death. Carbon is found across the universe but all living things as we know them are intimately connected to the element. Charcoal is inherently black and its working in gray scale even reflects the properties the protein rhodopsin, which itself is the reason people see value.

Ink lines and washes are applied to many of my drawings. Ink is an old substance used for storytelling and record keeping. Most importantly, ink is a medium I am comfortable with. After years of experimentation, I have developed my own way of layering ink and then using it subtractively. This technique, at times, ignores the flowing, liquid quality of ink and can give the drawing the appearance of a drier pigment. Although it is an unruly material, as it runs, blotches, and stains, I understand how it will react when I put it on a surface. I know and anticipate the chaotic, unforgiving quality. Other times, human error, like drips and splashes, require me to problem solve. There is an anxiety with using such a staining medium but with ink alone, I have overcome that anxiety and do not feel uncomfortable or afraid when using it.

Not only does my choice of imagery reflect my scientific influences but also my use of materials. Some of my materials like bioplastic and paper are created from scratch with basic elements. Many of my materials do not always carry the longevity of more traditional art supplies such as oil paint or stone. I use substances that are made to one day fail and lose integrity as a physical object. Deterioration is the natural course for biomaterials which reflects my portrayal of living things that are also depreciating.

A mixture of starch, glycerin, water and a few other ingredients makes a substance that is biodegradable. This biodegradable plastic will eventually breakdown and decay. Bioplastic will not pollute the earth like conventional plastics but will instead be absorbed into the dust and dirt much

like living things are absorbed back into the earth. When the ingredients are mixed and heated, the substance starts out translucent but as it cools and dries it becomes cloudy yet flexible and durable. I use this material in many of my paper sculptures. It gives the paper an organic, skin-like or bodily fluid quality that I look for in representing genetic experiments. The biodegradability of the plastic mimics the deterioration of living organisms by the way it discolors, becomes brittle and weak, and eventually turns into dirt. The aging bioplastic is an allusion to the human body's journey toward death.

I also use fragile handmade cotton paper as a substrate. Cotton is a natural material. For me, cotton paper is closely associated with stark, white cotton bandages and gauze. Cotton paper reminds me of the steps humans take to heal disease and cleanse the body. At times I saturate the paper with pigment so it looks more flesh-like or I add dark colors that are generally associated with necrotic, rotting flesh. Even ever ubiquitous paper, will disintegrate if left to the elements. It is fragile, like the human body and can easily be scarred and torn if it is not treated delicately.

As mentioned earlier, I also use cutting materials as a medium for creation. Cutting out protein structures portrays the folds and bends of the linear, yet three-dimensional structures I represent. Also, cutting is a way of scaring and diminishing the paper and bioplastic, again, demonstrating the way living organisms diminish. I utilize the shadows to create copies of the image that are skewed and distorted. My art is a representation of the data I have collected in my studies and a way to portray and archive that information in a textbook of visual language of sorts. My use of media is broad and diverse, much like the scientific concepts I study.

Till Human Voices Wake Us

While many of my previous pieces took a more broad perspective on decay, science, and human emotion, *Till Human Voices Wake Us* is closely centered on my personal experience with life, disease, and death. Each column of paper, and each box and pedestal represents a story of an

individual. It signifies the journey from life to death and what it feels like to see the ones you love leave you. People are very aware of their own mortality- we are aware that when we die, our consciousness will cease. Science explains so much but it has yet to tell us what happens to our consciousness when our body stops sending signals to our brain and stops pumping blood through our veins. The perception of this passage toward the unknown void is what *Till human voices wake us* attempts to explore.



Figure 5. This image is for reference. Due to the time sensitive nature of bioplastic, the piece is not complete in this image. The piece will be completed on May 2nd, 2017.

The use of three columns represents three steps in the journey of many living organisms: life, disease, and inevitable death. The long columns were created with different techniques for each of the three pieces. The paper columns are representative of specific emotions associated with a

narrative. Those emotions are distinctive to me and my journey. The continuously shorter columns represent the deterioration of a human body but also the passage through time and the unknown span of time we have left before our demise. Pink, handmade cotton paper was gradually introduced into the columns to represent the sporadic onset of disease and inevitable decay (Figure 5).

The proteins in the drawings signify the ever present themes of molecular breakdown, anxiety, and darkness and light. Not only are the drawings made with ink but the protein structures are drawn with charcoal, again referencing carbon as an essential part of life. I use both rhodopsin and SERT interchangeably and fragmented. I am interested in the fragile forms the proteins create as they are cut out and the paper deteriorates to nothing. To me, the cut paper not only expresses the wear of time on living things but the constant motion and work microscopic parts put into keeping a larger living organism alive. Shadows are intentionally cast on the ground and the wall. Each protein casts multiple oddly overlaying shadows that have varying levels of shadow intensity owing to the lighting, which is meant to express the vibrational movement and breakdown of the proteins.

Each paper column coincides with a pedestal. They embody an abstract narrative of a person's struggle with disease and deterioration. The gradients of the pedestals and drawings are important to me as they express the journey from life and light, or things that can be seen and known, to darkness and death, things that are mysterious and undefinable. Using grayscale for the drawings and pedestals shows, to me, the constant voyage human being take towards death as well as the ever present yearning to understand life.

The viewer's interaction or lack of interaction with this piece is a vital part of the installation. They must make a conscious decision to interact with each box. The viewer then becomes a part of the exhibit as they explore and touch the pieces, which accelerates the breakdown of some of the work. The hope is that they reflect on what is inside each box, putting themselves in the position that I have invited them into in order to contemplate and meditate on the pieces and what they

mean to them. The first box is intended to be procedural yet intimate. White gloves are presented to the viewer. Donning the gloves simulates the first steps of a medical or laboratory procedure. In the boxes are delicate, imperfect, handmade pieces of paper. Each piece of paper holds a screenprint in graphite of an MRI scan of a brain. These MRI scans are precious to me. They are of someone I love. As the viewer goes through the paper, the unfixed graphite begins to fall off of the paper, the gloves become dirty, and eventually the prints become nothing but cloudy smudges on the paper. My hope is for the viewer to witness the helpless feeling of someone else's brain deteriorating before their eyes as they physically ruin the prints by viewing them.

The second box holds a vitrine of a bioplastic form that I often use to represent disease. The form has a flesh-like, tumor quality and, for me, embodies the incurable or unknown diseases that plague the people I care for. The plexiglass is scratched from the inside, requiring the viewer to again, take the invitation to lean close and investigate if they truly want to know what is inside. The vitrine and its scratched surface creates a barrier between the viewer and the diseased interior.

Water is often used to represent death in many works of literature. Water is mutable, fluctuating, and sustains us but is immensely destructive. Water has been used throughout literature as a symbol for cleansing, representing the unknown, and the great abyss of death. Water is not just a symbol for cleansing but is actually physically cleansing. Many people see the abundance of life and fertility in large bodies of water, yet when I find myself in the deep, I discover the fear of the unknown. As I tread water in the ocean, there is an entire world beneath me that I cannot see but I know it is there. The clear water gives way to the deep, black of lightless void. Water, to me, is a metaphor for the unknown. Authors Joseph Conrad and T.S. Eliot make references to death and water quite often in their literature. In the book *The Heart to Darkness*, Joseph Conrad speaks of watery deaths but also the "brain's inability to comprehend beyond death."¹⁰ The most poignant

¹⁰ Conrad, Joseph. *Heart of Darkness*. Dover Publication Inc. 1990.

example of death and water for me occurs within the T.S. Eliot poem *The Love Song of J. Alfred Prufrock*.¹¹ In the poem, Eliot is describing, in a way, the monotony of living and in his final passage, Eliot wrote, “Till human voices wake us, and we drown.”¹² This idea of water being our final resting place resonated with me and inspired the darkest valued segment of this installation- the third pedestal.

The last box, in the simplest language, represents the dark abyss of death. As much as humans try to pry at the idea of death and understand what happens to us postmortem from a metaphysical standpoint, there are no definitive answers. For this piece, I took away the viewer’s ability to see clearly but if they take the time to listen, they will hear the gentle melody of dripping water that leads into the dark of the unknown and a seemingly endless void. Although there is darkness, the sound of the water is tranquil. Although the unknown is often terrifying and our consciousness will one day slip into the unknown, part of us, our physical matter continues.

I am, through my art, gaining control and understanding over my own mortality and the mortality of those I love. As I compare and contrast larger biological structures with microbiology and represent the fragile condition of all life, I explore the complicated emotions that trouble my mind. Experimenting and creating is my way of comprehending the complexities of life’s cycle. By trying to understand what is happening to life at a cellular and molecular level and by studying and creating, I believe that I will one day find solace in the cycle of life and death because no matter what I do, one day I will die and return to the dirt from which all living things came.

¹¹ Eliot, T.S. “The Love Song for J Alfred Prufrock”. *Collected Poems 1909-1962*. (1963).

¹² Ibid

BIBLIOGRAPHY

- Andersen, Hanne, Brain Hepburn. "Scientific Method." *Stanford Encyclopedia of Philosophy* (Nov 13, 2015).
- Baltimore, David, et al. "Prudent Path Forward for Genomic Engineering and Germline Gene Modifications." *Science*. (February, 2016). <http://science.sciencemag.org/content/348/6230/36>.
- Conrad, Joseph. *Heart of Darkness*. Dover Publication Inc. 1990.
- Doudna, Jennifer. "Genome-editing Revolution". *Nature*. (February, 2016). <http://www.nature.com/news/genome-editing-revolution-my-whirlwind-year-with-crispr-1.19063#bacteria>.
- Eliot, T.S. "The Love Song for J Alfred Prufrock". *Collected Poems 1909-1962*. (1963).
- Guillery, R.W. "Observations of Synaptic Structures: Origins of the Neuron Doctrine and its Current Status". *Philosophical Transactions of the Royal Society B: Biological Science* Volume 360 (June, 29 2005).
- Hargrave, P.A., J.H. McDowell. "Rhodopsin and phototransduction: a model system of G Protein-linked receptors." *Federation of America Societies for Experimental Biology* Volume 6 (March 1992).
- Jakociuna, Tadas, Michael K. Jensen, Jay D. Keasling. "CRISPC/Cas9 Advances Engineering of Microbial Cell Factories." *Metabolic Engineering* Volume 34 (September, 23 2015): 44-59.
- Levine, Carol. *Taking Sides: Clashing Views on Controversial Bio-Ethics*. Mcgraw-Hill College; 9th edition. December 2000.
- Lesk, Arthur M. *Introduction to Protein Architecture*. Oxford University Press; 1st edition. 2001.
- "Molecular Artistry: Science Illustrator Irving Geis Shed Light on an Unseen World." *Georgia Tech Parker H. Petit Institute for Bioengineering and Bioscience* (Nov. 16, 2014).
- Reedy, Michael. *Michael Reedy Gallery*. (Aug, 2014). <http://www.michaelreedy.gallery/galleries>.
- The PyMOL Molecular Graphics System 1.7.4.5 Edu (Schrödinger).
- Tuma, Rabiya S. "Controlling Emotional Feedback Is Key to Depression." *DNA Learning Center* (July 1, 2005).

Image List

1. *Pseudoscience: An Exploration of the Frivolous*, Performance
Materials: Mixed Media
2. *Till Human Voices Wake Us*, Installation
Materials: Mixed Media
3. *Till Human Voices Wake Us*, Installation Detail
Materials: Mixed Media
4. *Till Human Voices Wake Us*, Installation Detail
Materials: Mixed Media
5. *Till Human Voices Wake Us*, Installation Detail
Materials: Mixed Media
6. *Till Human Voices Wake Us*, Installation Detail
Materials: Mixed Media
7. *Till Human Voices Wake Us*, Installation Detail
Materials: Mixed Media
8. *Till Human Voices Wake Us*, Installation Detail
Materials: Mixed Media
9. *Till Human Voices Wake Us*, Installation Detail
Materials: Mixed Media
10. *Pseudoscience: An Exploration of the Frivolous*, Performance Detail
Materials: Mixed Media



















