

## Background

### Wilson's Disease:

- The accumulation of copper in tissues of the body such as the liver, brain, and eyes
- Causes the copper transporting protein ATP7B to malfunction through a mutation resulting in the inability to properly eliminate copper
- The average cost for the 2 medicines currently on the market is about \$25,000 per month

### Proposed Solution:

- Alpha Lipoic Acid
- Used as a dietary supplement and has been found to aid in things like weight loss and memory retention and helps with conditions like diabetes and HIV
- Made of carbon, hydrogen, oxygen, and sulfur
- Copper binds well with sulfur

### Hypothesis:

We believe that alpha lipoic acid will be able to react with copper in different acidic conditions in order to make it insoluble in the body.

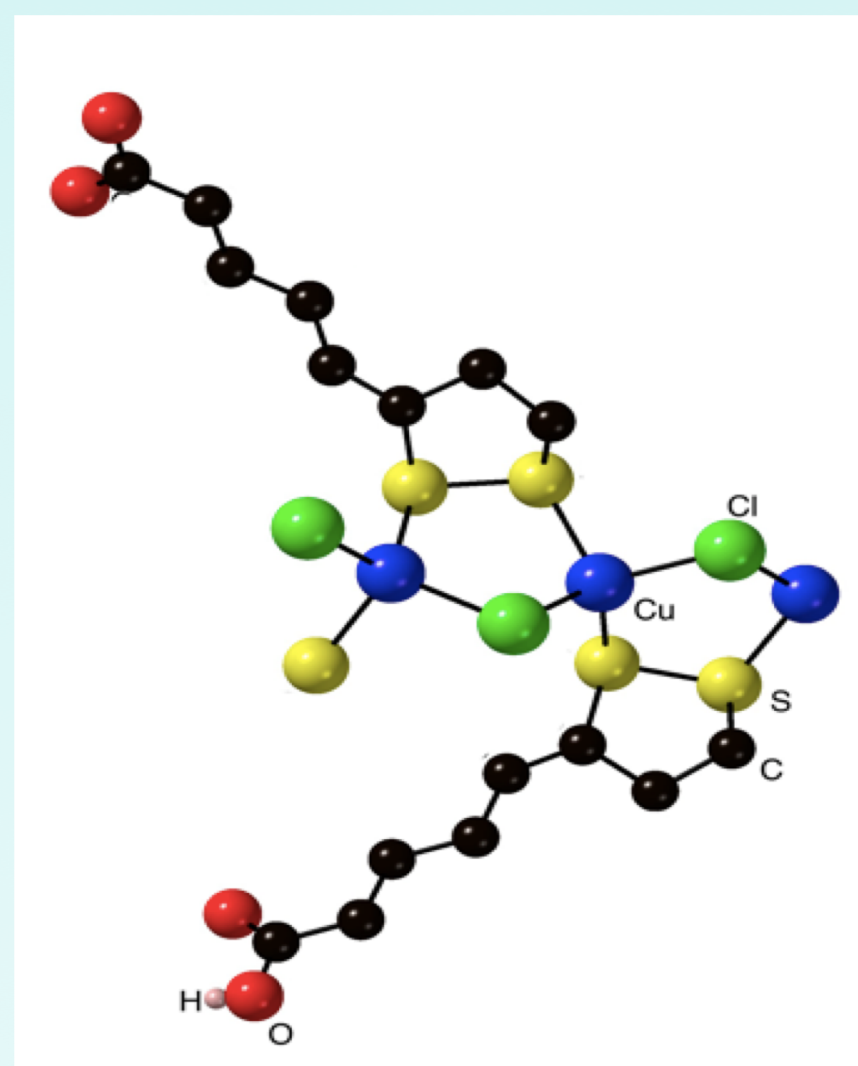


Figure 1: This molecule is Alpha Lipoic acid bonded with  $\text{CuCl}_2$  to show their attraction

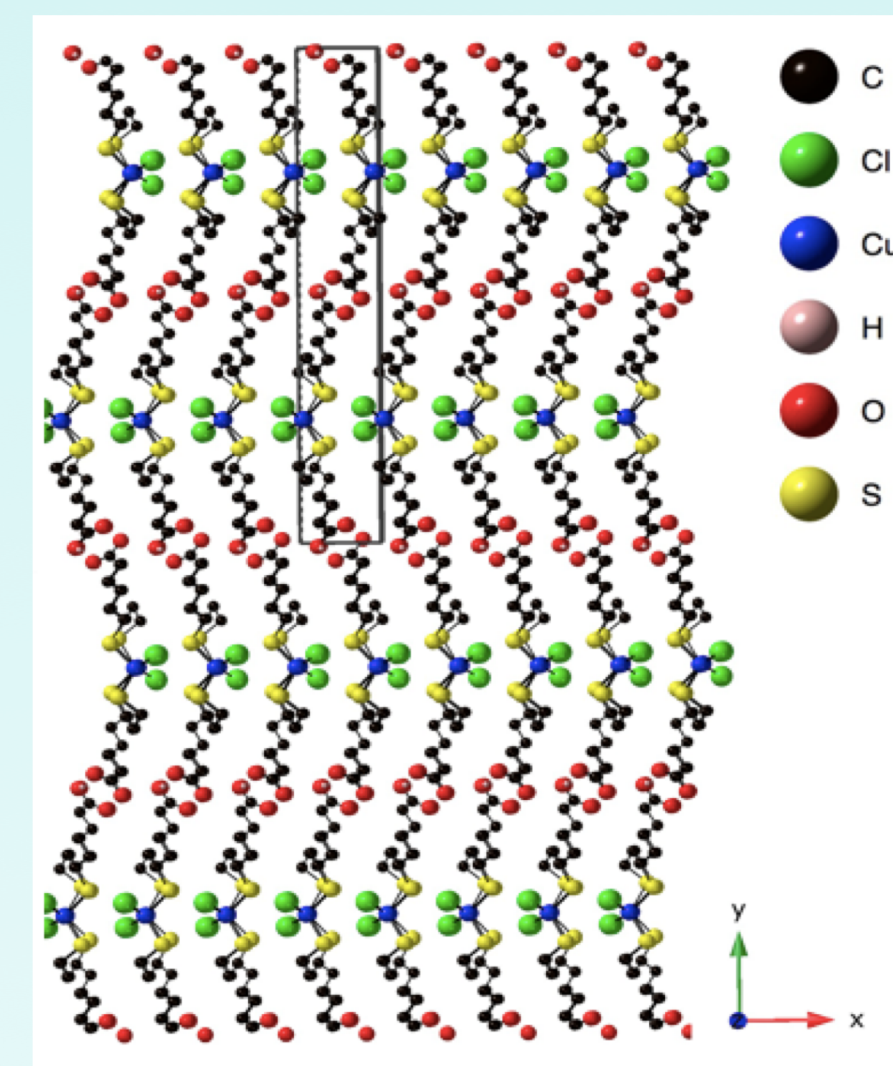


Figure 2: A chain of Alpha Lipoic Acid and  $\text{CuCl}_2$

## Methods

### Stock Solutions:

1. Obtained two 100 mL glass containers
2. Added approximately 8.5 grams of HCl in the first container and 91.5 grams of water to make a 1 M HCl solution
3. Finally 1 gram of  $\text{CuCl}_2$  was added to the 1 M HCl solution to make an acidic stock solution
4. Added approximately 100 grams of deionized water in the second container with 1 gram of  $\text{CuCl}_2$  to make a neutral stock solution

## Methods (continued)

### Lipoic Acid Reactions:

1. Added approximately 10 grams of each stock solution in separate 20mL vials
2. Broke open 1 pill of alpha lipoic acid in vial
3. Put vial on sample rotator
4. Centrifuged vial contents
5. Used a pipet to transfer to a clean vial
6. Repeated steps 2 through 5 for 2, 3, 4, and 5 pills for both solutions

### Copper (I) Vial:

1. Added approximately 15 grams of deionized water in a clean vial
2. Added 0.267 grams of copper (I) iodide
3. Added one pill of alpha lipoic acid

### Measurements:

- The UV-Visible Spectrophotometer was used to measure the absorbance to the solutions
- The MCP – AES was used to measure the concentration of copper in the solutions

## Results

### Lipoic Acid Reactions:

- Lipoic acid is capable of rendering copper (II) insoluble in neutral conditions
- Lipoic acid wasn't able to react with the copper (II) in acidic conditions
- As the amount of the lipoic acid increased, the amount of copper absorbed out of the solution increased

### Copper (I) Vial:

- Brown precipitate formed from the reaction of the lipoic acid,  $\text{CuCl}_2$  neutral stock solution, and sodium thiosulfate pentahydrate
- After adding 5 pills in the neutral solution, there was a 94.87% reduction in the concentration of copper



Figure 3: This is the copper (I) vial after the reaction between the compounds. This is the vial after the contents had not been touched for 24 hours.

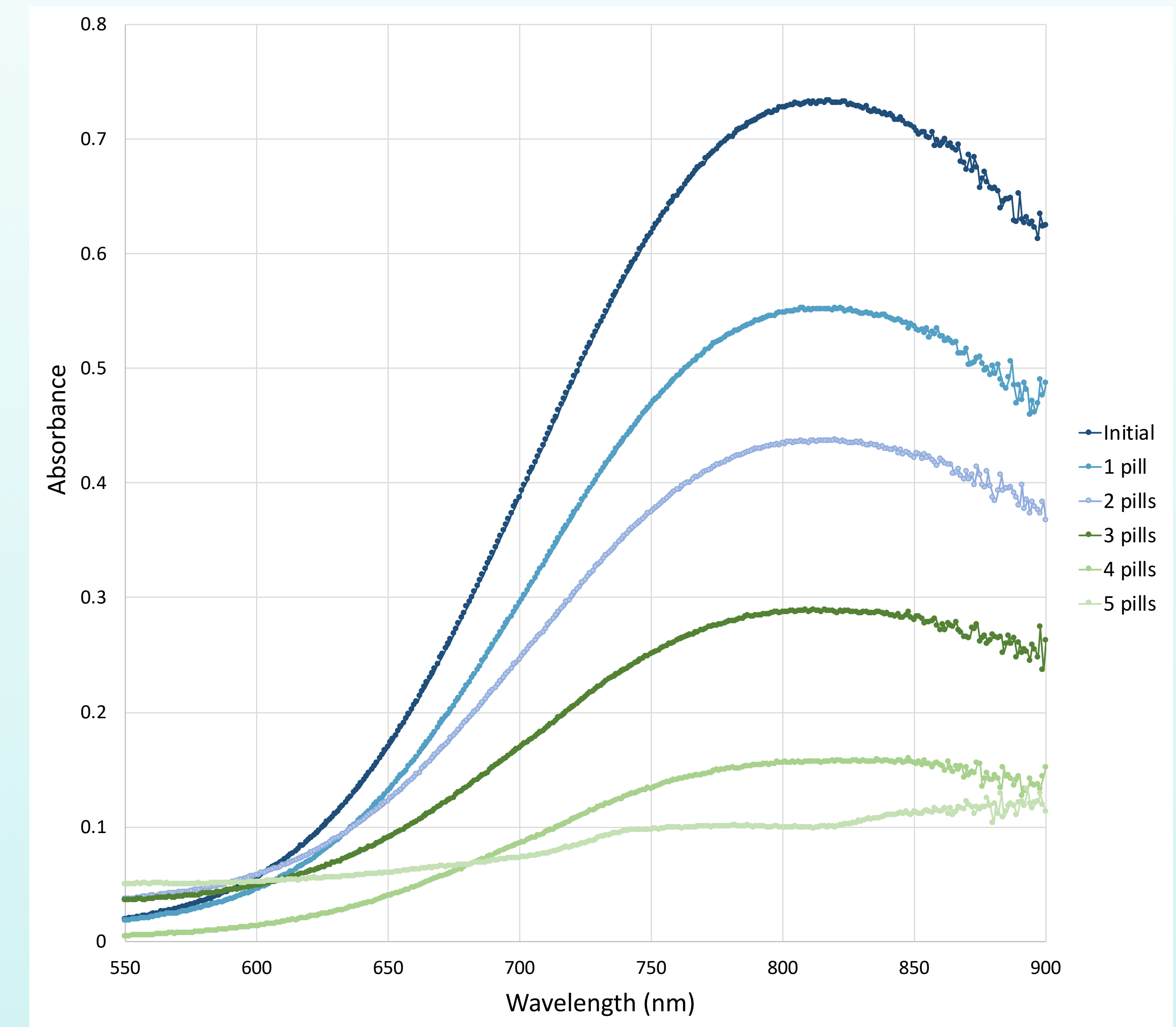


Figure 4: This is the scatterplot that was created by the reading from the UV-visible spectrophotometer of the lipoic acid reaction with the  $\text{CuCl}_2$  neutral stock solution for 0 to 5 pills

## Discussion

- Lipoic acid can remove copper from the liver through the hepatic portal
- Lipoic acid works best in neutral environments thus the most absorption would be in the small intestine
- Not only can lipoic acid prevent copper absorption from the body but it can also possibly clear any existing from the liver
- With future research, lipoic acid can be an excellent and inexpensive treatment for Wilson's disease

## Acknowledgements

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