Novel Chemical Compounds Support Excess Copper Removal in Biological Systems

A preorganized phosphine sulfide-stabilized phosphine (PSP) framework that displays unique capabilities for binding with copper (Cu) and shows high potential for drug candidacy

Researchers at Georgia Tech have developed a new family of chelating agents—chemical compounds that bind with metals to help metabolize them out of the body—as a potential pharmaceutical treatment for the accumulation of excess copper, like in Wilson's disease. In creating these chemical ligands, researchers established several synthetic methods for the reagents' synthesis and also characterized their structure and copper affinity through multiple techniques, including ultraviolet (UV) imaging, X-rays, and crystallography.

The two primary characteristics that make these PSP chelating agents unique are (1) their use of auxiliary phosphine sulfide groups and (2) the geometric pre-organization of the molecules. Because of these distinctive qualities, the novel PSP reagents possess a robust coordinating ability for Cu(I)—the +1 oxidation state of copper—as well as a high level of specificity that keeps them unaffected by other essential metals in the body.

Summary Bullets

- **Powerful**: Displays an affinity for copper that is unprecedented among synthetic ligands, with a complex stability constant of logK = 20.0
- **Specific**: Functions without interference by other metals in the body
- **Effective**: Possesses a strong copper coordinating ability, even in the complex chemical environments of different biological systems

Solution Advantages

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Potential Commercial Applications

- Pharmaceuticals

- Metallomics

Background and More Information

Copper has a small but important presence in the human body, supporting the production of red blood cells as well as maintaining nerve cells and the immune system. Too little or too much copper, however, could be highly detrimental for an individual’s health. In Wilson’s disease, an accumulation of copper in the liver, brain, and other vital organs can lead to complications like liver failure. Treatments using chelating agents can remove excess copper from the body and then also maintain healthy copper levels throughout an individual’s life. In comparison to other chelating agents currently in use to treat Wilson’s disease, this PSP family developed at Georgia Tech displays an exceptional level of specificity and high degrees of affinity.

Inventors

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IP Status

: US20220169669A1

Publications

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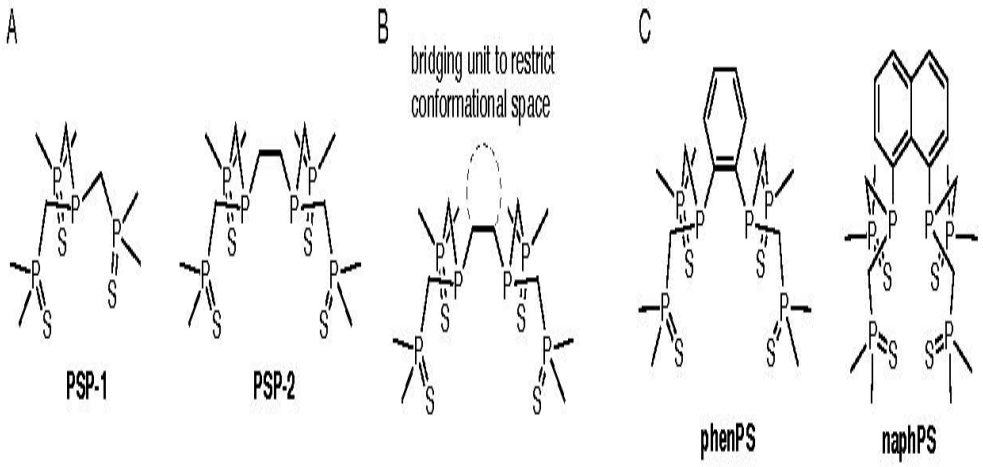
Images



The organization of two novel PSP prototypes – phenPS and naphPS

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