

# Bioinorganic Chemistry: Role of Metals in Biology

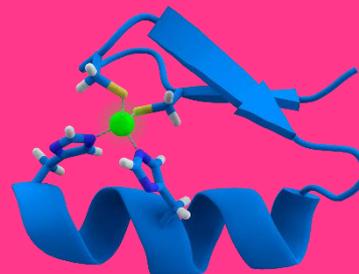
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99% C, H, N, O, P

I ♥ the 1%

# Metallobiome



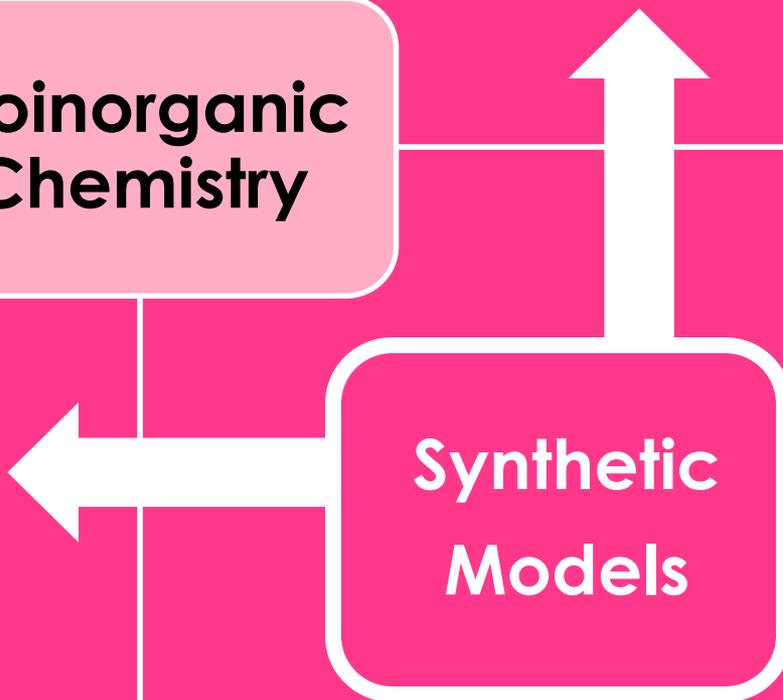
Structure  
vs.  
Function

**Bioinorganic  
Chemistry**



**Toxicology**

**Synthetic  
Models**



# IIB ...or not IIB

Zn

0.003 mass %; Essential to all known life forms  
...LD<sub>50</sub> (ZnCl<sub>2</sub>) 350 mg/kg, rat (oral)

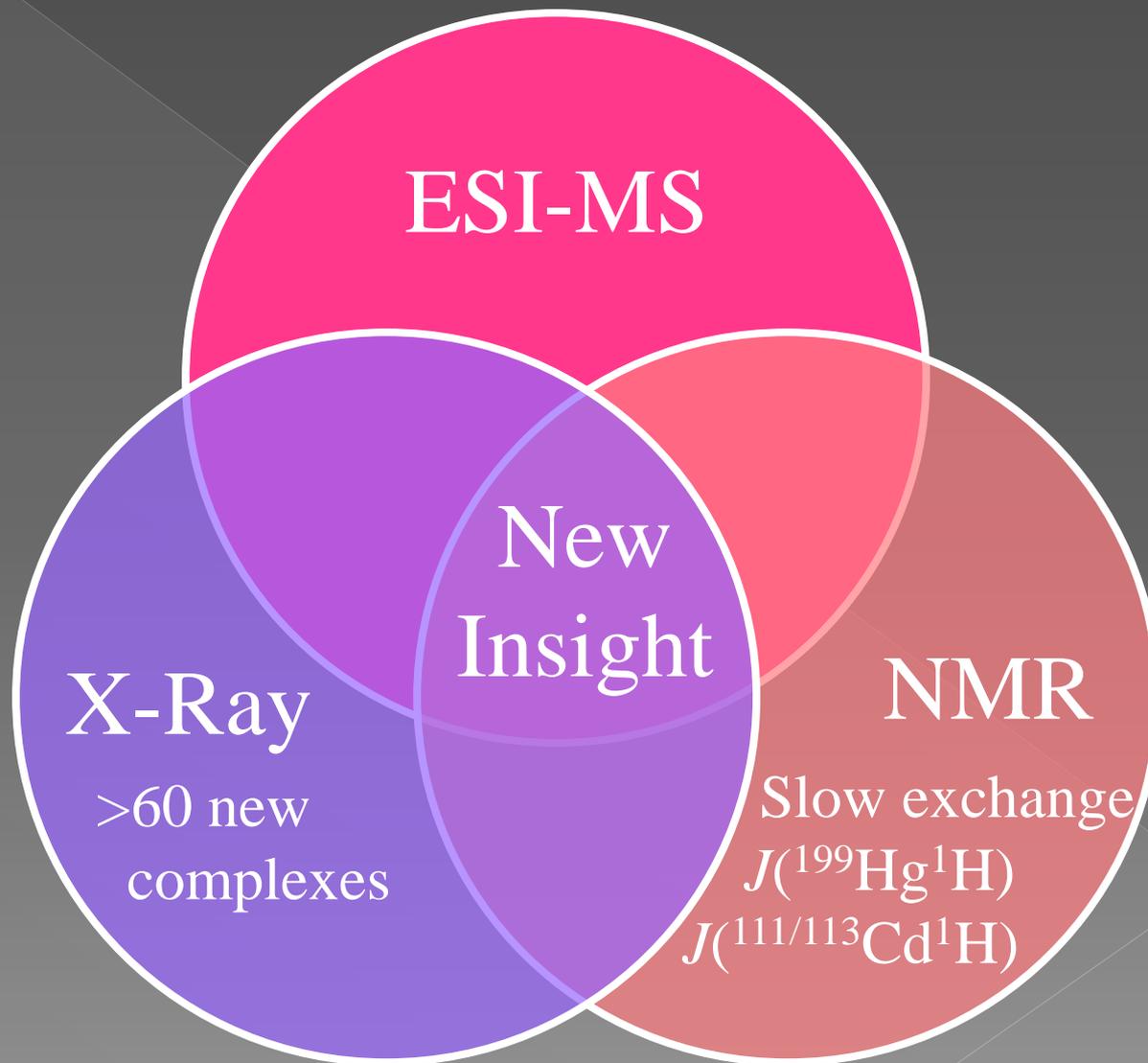
Cd

*Thalassiosira weissflogii* produces Cd(II)-dependent carbonic anhydrase in Zn(II) limiting conditions  
...but generally considered toxic to all known life forms

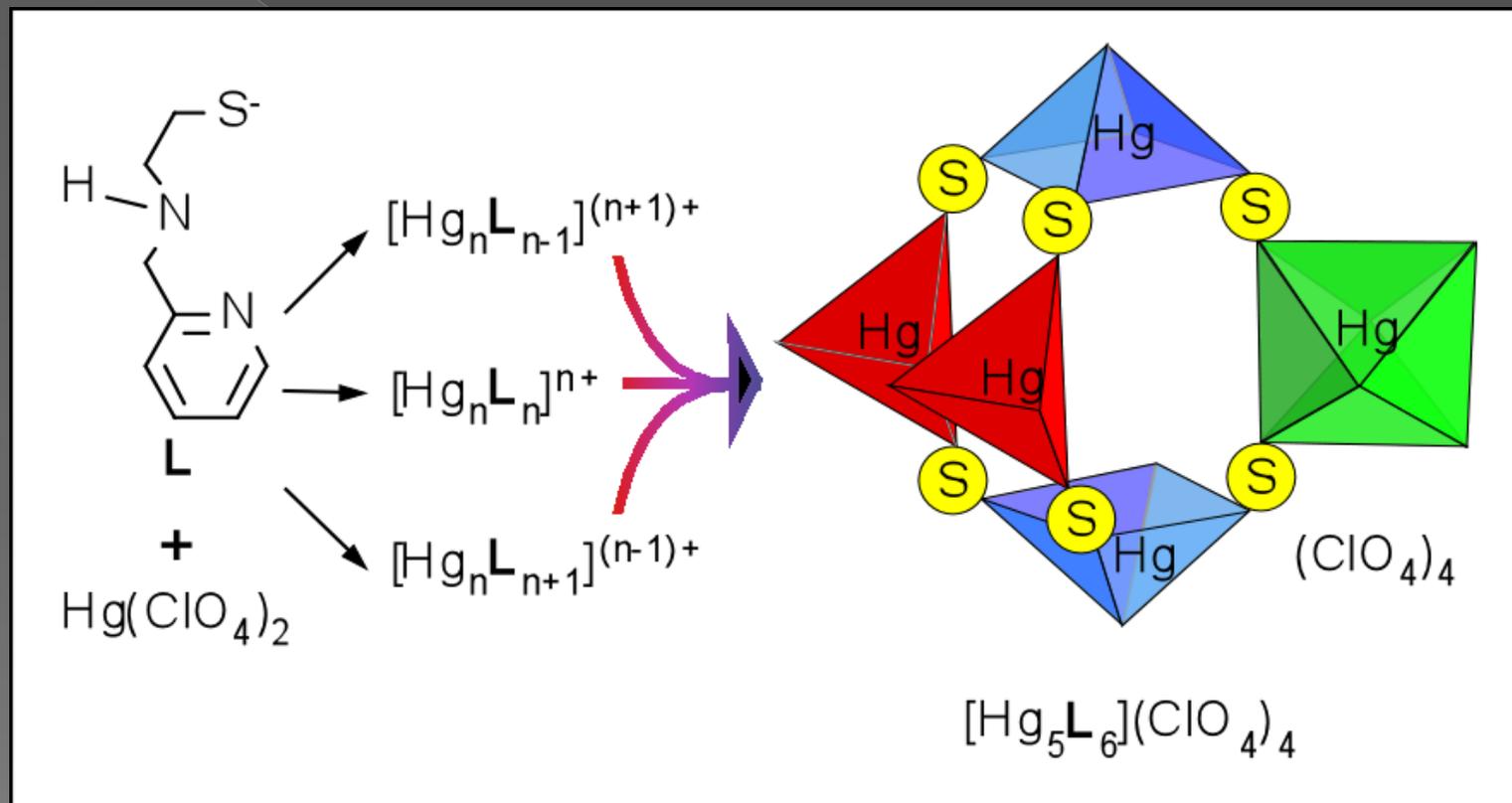
Hg

Broad toxicity of Hg(II) likely precludes any physiologically beneficial role

# Multi-faceted Approach

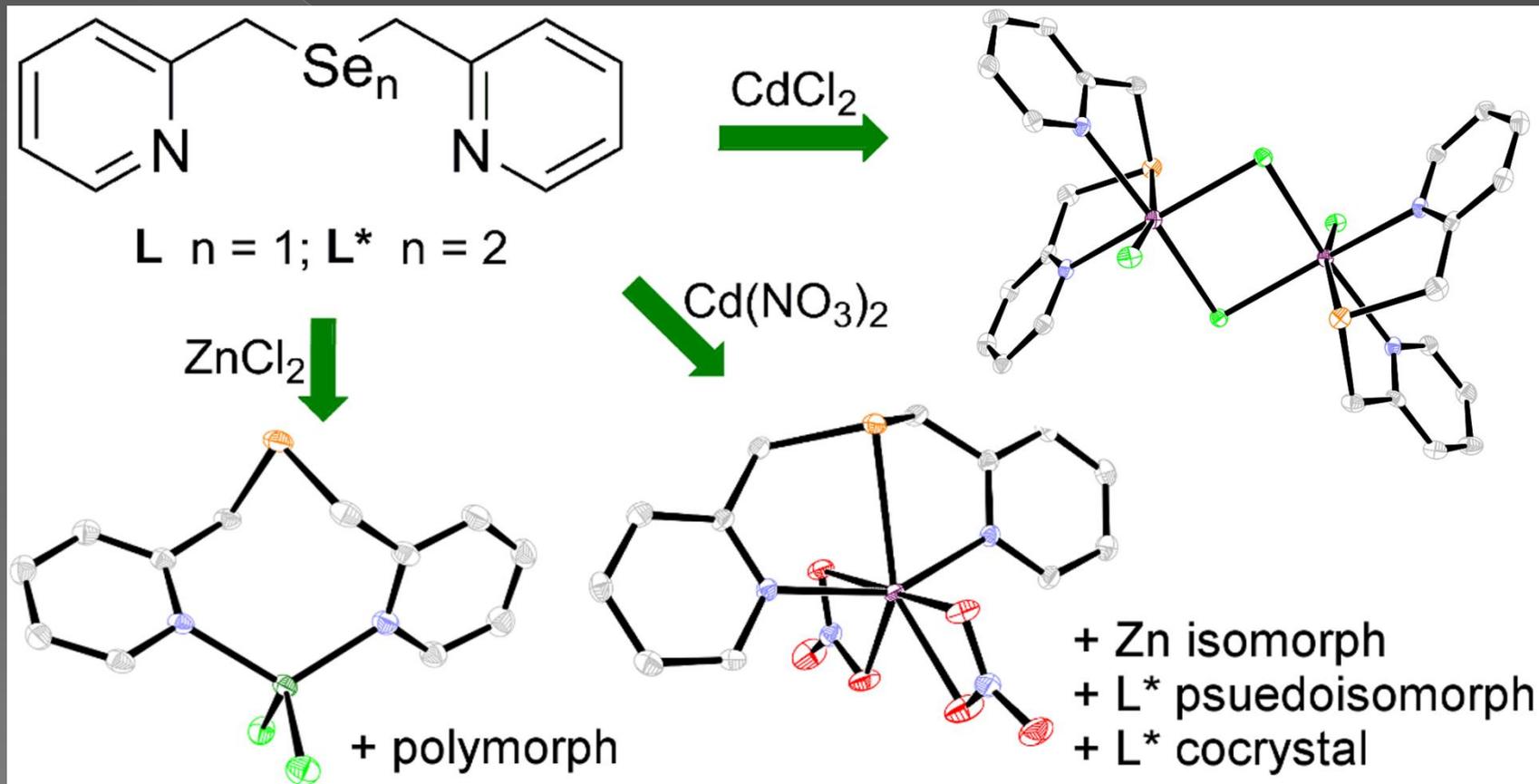


# Metallothionein Model



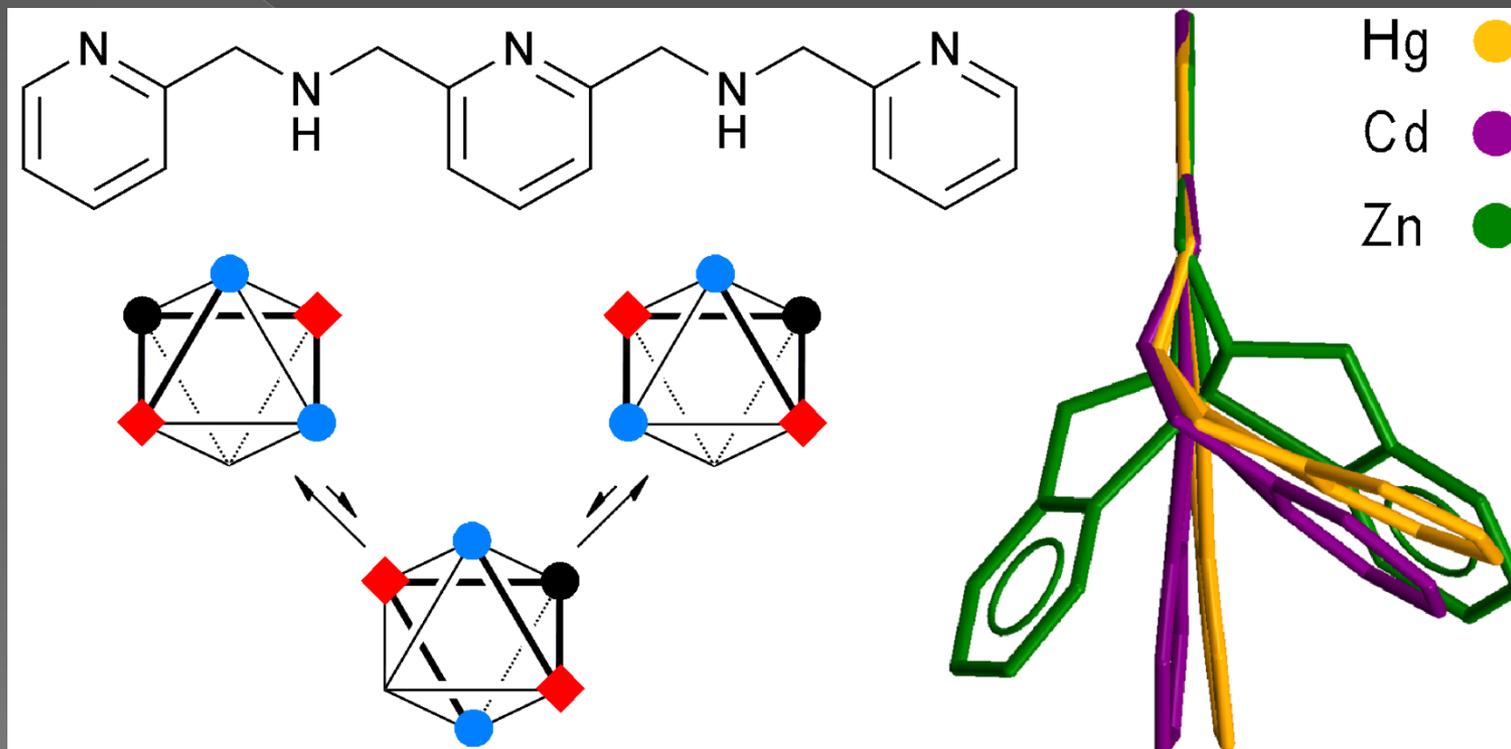
Julie A. Viehweg, Sarah M. Stamps, Jennifer J. Dertinger, Robert L. Green, Katherine E. Harris,  
Raymond J. Butcher,<sup>‡</sup> Erica J. Andriole, J.C. Poutsma, Steven M. Berry, Deborah C. Bebout\*  
“A Synthetic Model of Hg(II) Sequestration” *Dalton Transactions* 2010, 39, 3174.

# New M-Se Bonds



Malia S. Hain, Yoko Fukuda, Carolina Rojas Ramírez, Benjamin Y. Winer, Stephanie E. Winslow, Robert D. Pike, and Deborah C. Bebout\* "Staging Bonding between Group 12 Metal Ions and Neutral Selenium Donors: Intermolecular Interactions of Mixed N,Se Donor Ligands and Anions" *Crystal Growth & Design* 2014, 14, 6497–6507.

# Conformational Trapping

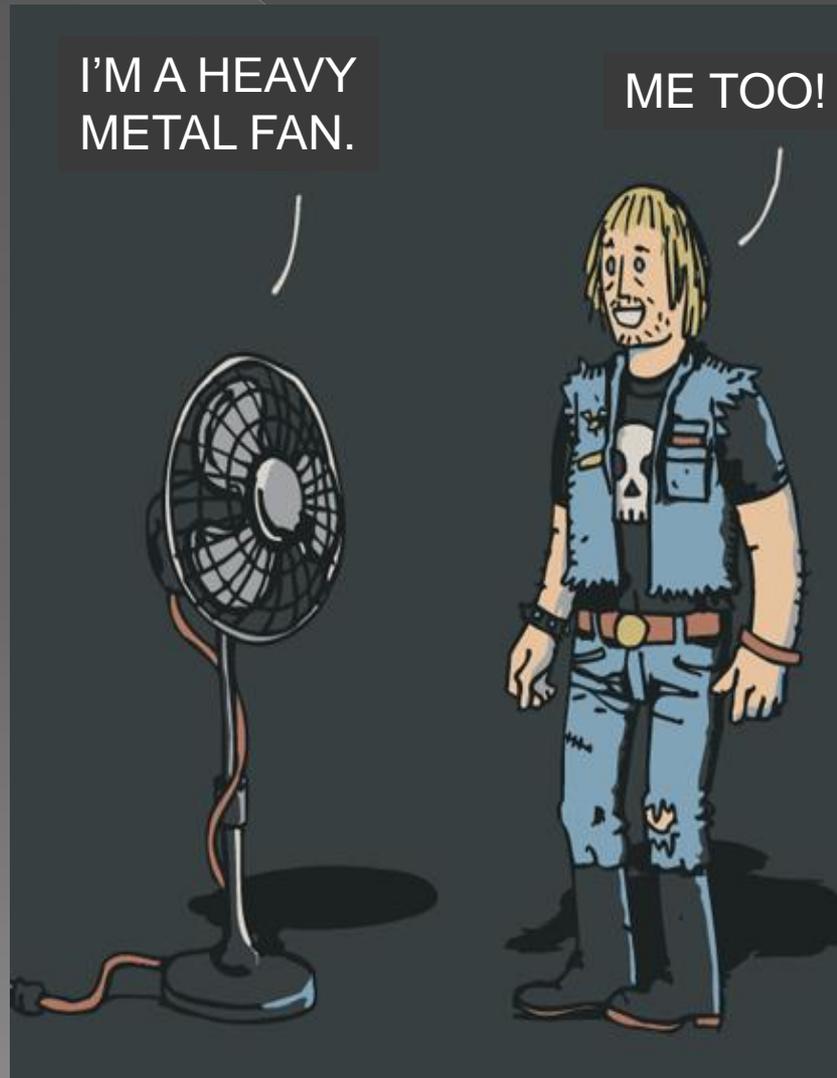


Edith V. Bowers, Geoffrey S. Murphy, Stephanie N. Till, Christopher J. VandenBussche, Melissa M. Yaroschak, Robert D. Pike, Raymond J. Butcher<sup>‡</sup> and Deborah C. Bebout\* “Bis-tetradentate Complexes of Cd(II) and Hg(II) with  $\text{N}_8$  Coordination: Structural and NMR Comparisons of Tripodal Amine Ligands with Pyridyl and Imidazolyl Groups” *Dalton Trans.* **2014**, 43, 16475–16485.

# Student Involvement

- Organic synthesis
- Purification
- Coordination Chem
- Routine NMR
- IR, UV/Vis, etc.
- Multinuclear NMR
- ESI-MS
- X-ray Crystallography
- Scientific writing
- Scientific presentations

# Are you a heavy metal fan?



I'M A HEAVY  
METAL FAN.

ME TOO!

- ★ Three juniors now;  
prefer sophomores  
& freshman
- ★ Please come talk  
to me if interested!
- ★ [dcbebo@wm.edu](mailto:dcbebo@wm.edu)  
ISC 2039 & 2028