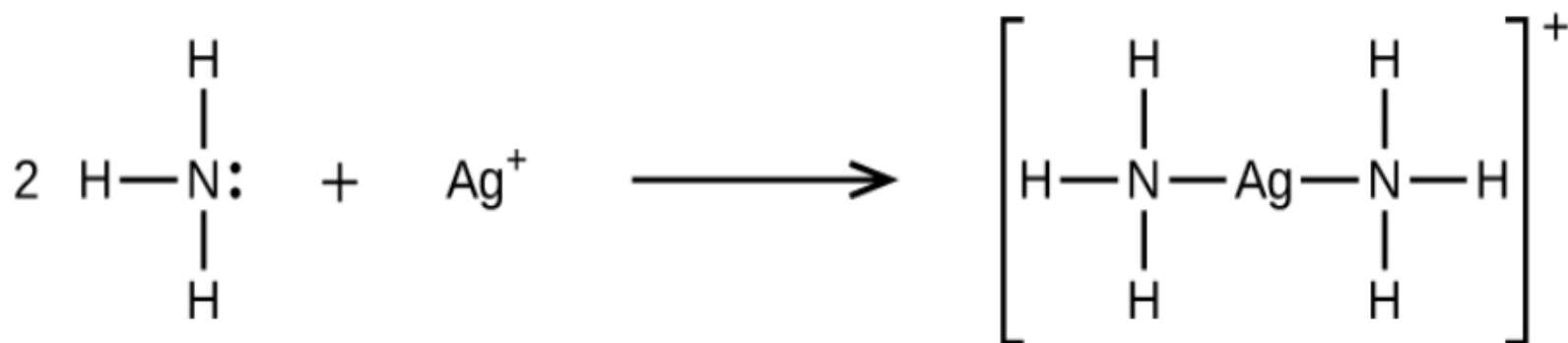


# Week 5: Synthesis of Amino Acid Complexes

Dr. Turner

# Complex ions

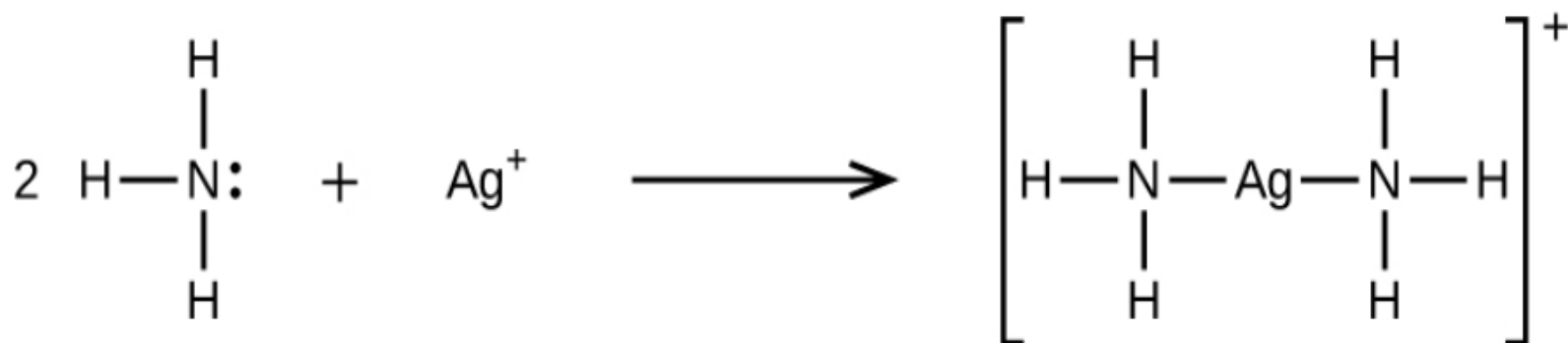
- A complex ion is formed when the lone pair electrons in substances known as ligands are attracted to the positive charge of a metal ion.
- In Figure 1 below silver is the positively charged metal cation and ammonia is the ligand.



**Figure 1** Two ammonia ligands complexing a silver(I) ion<sup>1</sup>

# Complex ions

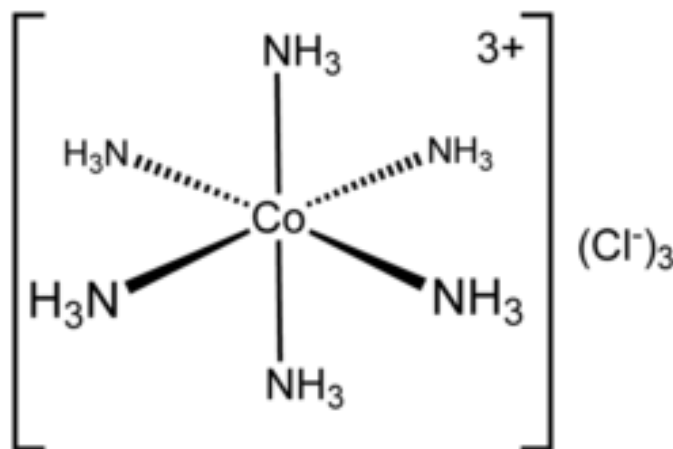
- Each of the two  $\text{NH}_3$  molecules use their lone pair electrons to form a bond to the positively charged  $\text{Ag}^+$ .
- Since the two ammonia are neutral and the silver has a +1 charge, the complex formed from their combination also has a +1 charge and is thus written in brackets.



**Figure 1** Two ammonia ligands complexing a silver(I) ion<sup>1</sup>

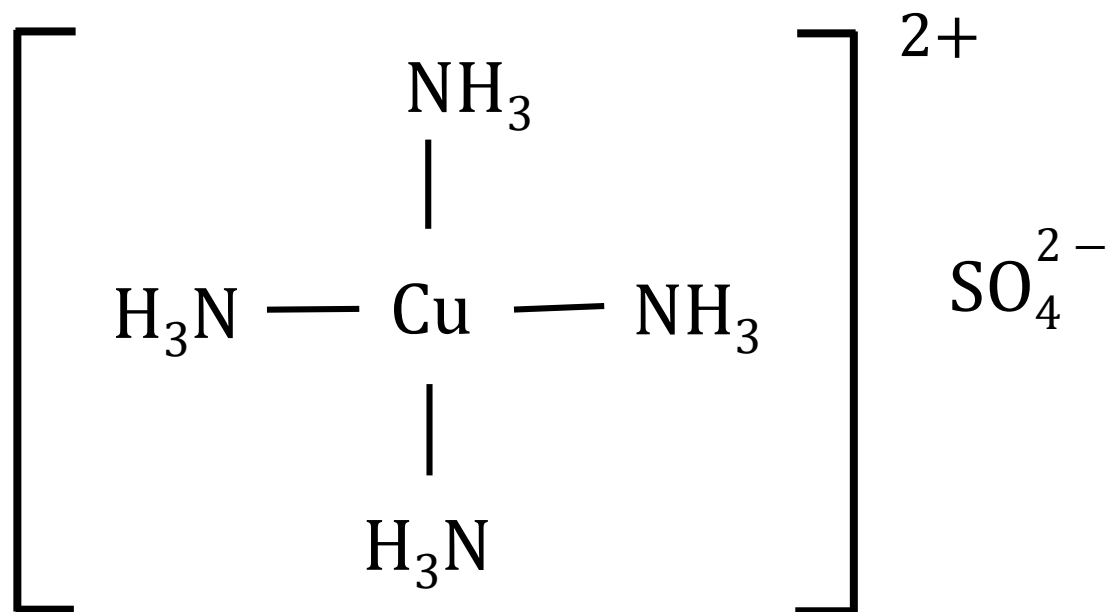
# Counter ions

- Since complex ions are charged, they generally form ionic compounds with negatively charged anions.
- These anions are called counterions since they are added to counteract the positively charged complex ion. An example of this is shown below in **Figure 2**.



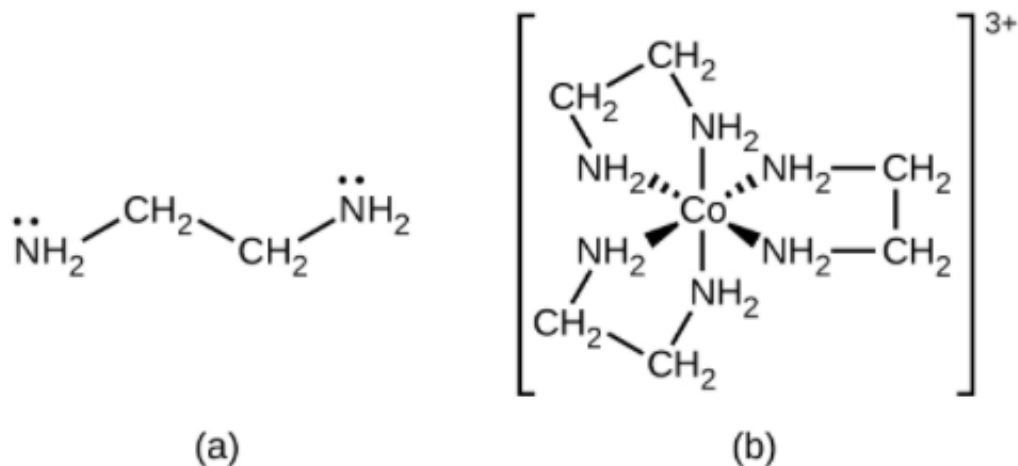
**Figure 2** Six ammonia ligands complexing a cobalt(III) ion with three chloride ions acting as counterions<sup>1</sup>

# The model compound as a counter ion



# Chelation sites

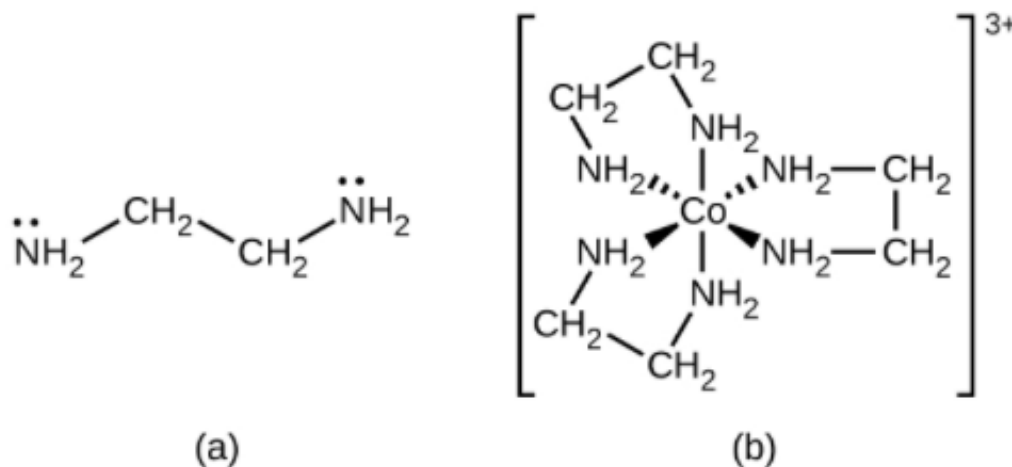
- Different metal cations are generally able to complex different numbers of ligands around them.
- These locations of ligand attachment are called chelation sites. Additionally, some ligands occupy multiple chelation sites.
- A ligand that occupies one chelation site is known as a monodentate ligand, and a ligand which occupies two chelation sites is called a bidentate ligand.



**Figure 3** (a) the ethylenediamine ligand contains two atoms with lone pairs that can bond with the metal center. (b) The cobalt(III) complex contains three of these ligands, each forming two bonds to the cobalt ion.<sup>1</sup>

# Chelation sites

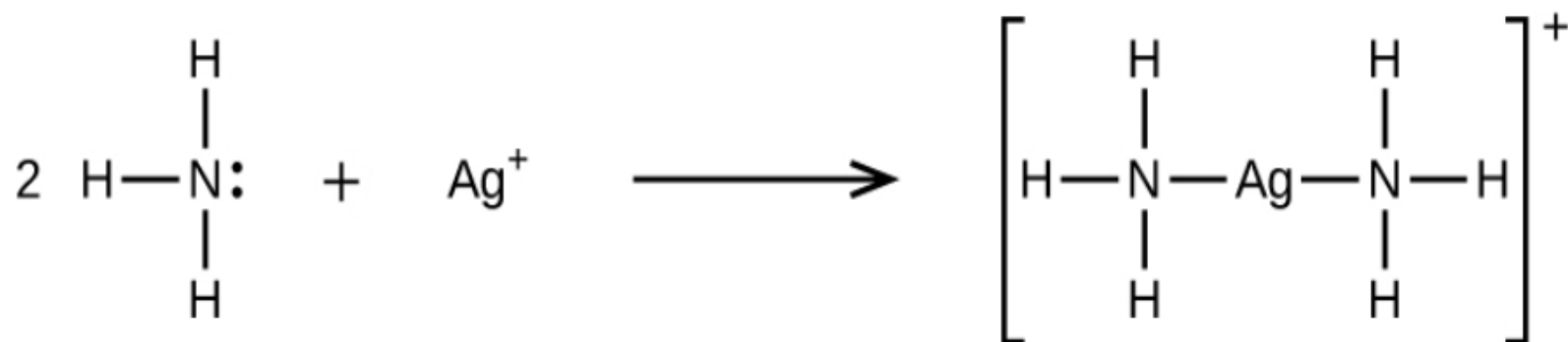
- A ligand that occupies one chelation site is known as a monodentate ligand, and a ligand which occupies two chelation sites is called a bidentate ligand.
- For example, the cobalt ion in **Figure 3** below has six chelation sites and three bidentate ethylenediamines complexed to it.



**Figure 3** (a) the ethylenediamine ligand contains two atoms with lone pairs that can bond with the metal center. (b) The cobalt(III) complex contains three of these ligands, each forming two bonds to the cobalt ion.<sup>1</sup>

# Chelation sites

- The silver ion in **Figure 1** has two chelation sites and has two monodentate ammonias complexed to it.



**Figure 1** Two ammonia ligands complexing a silver(I) ion<sup>1</sup>



# Today's goal

- Today we are synthesizing a complex ion of copper with the amino acid alanine.
- Note that everywhere in your lab notebook where amino acid is mentioned, the amino acid is alanine.

## Alanine ( $\text{C}_3\text{H}_7\text{NO}_2$ )

