

## Chapter 5

### Chemical Bonding I: Drawing Lewis Structures and Determining Molecular Shapes



Morphinan (a morphine analog) binding to an opiod receptor (based on research done by Brian Kobilka (1955–) and coworkers at Stanford University). Morphine is derived from the sap of the opium poppy.

"A geometrical and mechanical basis of the physical science cannot be constructed until we know the forms, sizes, and positions of the molecules of substances."

—George Gore (1826–1908)

## Learning Outcomes

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- 5.1 Morphine: A Molecular Impostor
- 5.2 Electronegativity and Bond Polarity
- 5.3 Writing Lewis Structures for Molecular Compounds and Polyatomic Ions
- 5.4 Resonance and Formal Charge
- 5.5 Exceptions to the Octet Rule: Odd-Electron Species, Incomplete Octets, and Expanded Octets
- 5.6 Bond Energies and Bond Lengths
- 5.7 VSEPR Theory: The Five Basic Shapes
- 5.8 VSEPR Theory: The Effect of Lone Pairs
- 5.9 VSEPR Theory: Predicting Molecular Geometries
- 5.10 Molecular Shape and Polarity

### Key Learning Outcomes

**CHEMICAL BONDING IS AT THE HEART** of chemistry. In this book, we examine three different theories for chemical bonding. Recall from [Section 4.4](#) that bonding theories explain why atoms bond together to form molecules and predict many of the properties (such as the shapes) of molecules. Therefore, bonding theories play an important role in helping us to see the relationship between the structure of a molecule and its properties. The first and simplest bonding theory is the Lewis model, which we introduced in [Chapter 4](#) and expand upon in this chapter. With just a few dots, dashes, and chemical symbols, the Lewis model helps us to understand and predict a myriad of chemical observations. The Lewis model, combined with a theory called *valence shell electron pair repulsion theory* (VSEPR), allows us to predict the shapes of molecules. The other two bonding theories are valence bond theory and molecular orbital theory, which we will cover in [Chapter 6](#).

Not for Distribution