Building Block Modularity Makes for an Unimaginable Diversity of Structures

Modular is a good word to describe the structure of organic molecules. The parts can be interchanged and put together in many different ways. The building blocks can be combined to construct functional groups. The functional groups, in turn, can be combined to construct molecules. Given the large number of building blocks and functional groups and their various combinations, it is no wonder that the "Universe of Organic Molecules" – the subset of molecules containing up to 30 C, N, O and S atoms – is estimated† to be something like $1x10^{60}$. That's a really big number! It should be obvious that if we are to make sense of this complexity, we need to develop good skills in recognizing the functional groups in organic molecules. With just a little practice you will be able to instantly look at a new molecule and see it for the functional groups that it contains.

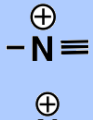
†Source: From Bohacek, R. S.; McMartin, C.; Guida, W. C. *Medicinal Research Reviews*, Vol. 16, No. 1 pp. 3-50 (1996).

Hydrogen & Carbon Connectedness

For the purpose of rapidly and accurately generating Lewis structures, it is helpful to reorganize the building blocks chart by connectedness rather than by EPDs. The reason for this reorganization is that bonding connectivity is usually known (and fixed) while the electron configuration around each atom is adjusted to match the connectivity. The chart below divides the building block into atom type, connectedness, and formal charge. A few examples may help to illustrate the utility of this organizational scheme.

charge	connectedness			
	1	2	3	4
hydrogen				
neutral	–H			
carbon				
neutral		–C≡ =C=		
+1				
-1				

Nitrogen, Oxygen and Fluorine Connectedness

charge	connectedness			
	1	2	3	4
nitrogen				
neutral				
+1				
-1				
oxygen				
neutral				
+1				
-1				
fluorine				
neutral				
+1