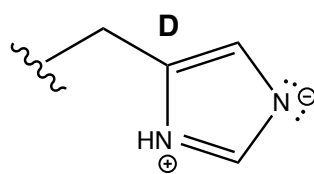
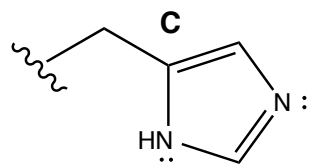


## Exploring Amino Acid Side Chains

1. Draw the complete side chain of trp, including any H's on heteroatoms, formal charges and lone pairs.
2. Draw the complete side chain of arg with the guanidine group unprotonated. Draw two important resonance forms. Be sure that all hydrogens on N are shown, as are proper formal charges and lone pairs.
3. Draw the complete side chain of arg with the guanidine group protonated. Draw two important resonance forms. Be sure that all hydrogens on N are shown, as are proper formal charges and lone pairs.
4. The side chain of ser is a simple alcohol with a  $pK_a$  of about 16, about that of water.
  - (a) Why is this value not given in Table 3-1?
  - (b) Look at the structure of tyr. Tyr also has an alcohol in its side chain. Why is its  $pK_a$  about 10, namely,  $10^6$  or a million times stronger than ser?
  - (c) Regardless of whether or not you can explain the difference, draw an energy diagram that reflects the difference in  $pK_a$ .

5. What is the difference between these two structures? What word or phrase best describes them? What is this?



6. What is the difference between these two structures? What word or phrase best describes them? What is this?

