

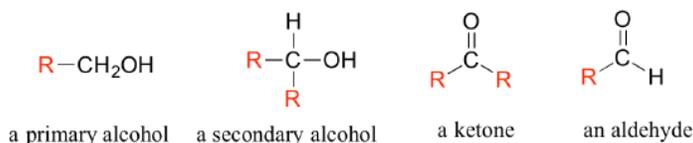
3.1: GENERIC (ABBREVIATED) STRUCTURES (AKA R GROUPS)

learning objective

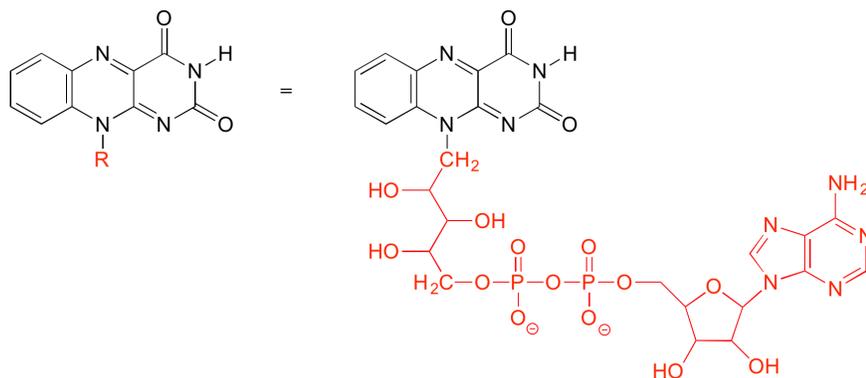
- use R groups to draw generic functional groups - refer to section 3.1

Drawing Generic (abbreviated) Organic Structures

In chapter 2, we learned to recognize and distinguish between organic functional groups. Often when drawing organic structures, chemists find it convenient to use the letter 'R' to designate part of a molecule outside of the region of interest. "R" represents the "Rest of the Molecule". If we just want to refer in general to a functional group without drawing a specific molecule, for example, we can use 'R groups' to focus attention on the group of interest:

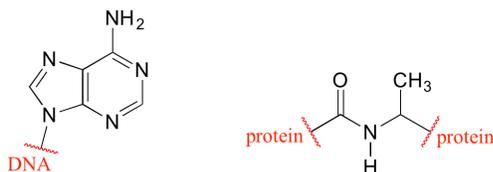


The 'R' group is a convenient way to abbreviate the structures of large biological molecules, especially when we are interested in something that is occurring specifically at one location on the molecule. For example, in chapter 15 when we look at biochemical oxidation-reduction reactions involving the flavin molecule, we will abbreviate a large part of the flavin structure which does not change at all in the reactions of interest:



flavin adenine dinucleotide (FAD)

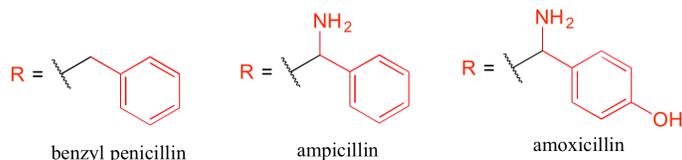
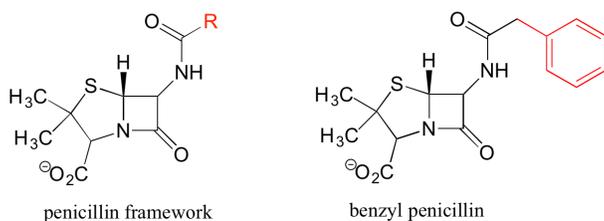
As an alternative, we can use a 'break' symbol to indicate that we are looking at a small piece or section of a larger molecule. This is used commonly in the context of drawing groups on large polymers such as proteins or DNA.



an adenine base in DNA

a small section of a protein

Finally, 'R' groups can be used to concisely illustrate a series of related compounds, such as the family of penicillin-based antibiotics.

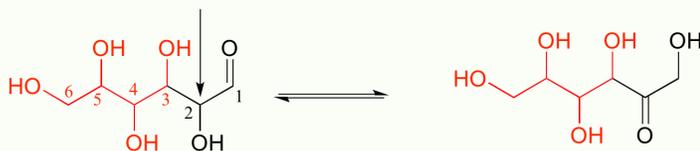


Using abbreviations appropriately is a very important skill to develop when studying organic chemistry in a biological context, because although many biomolecules are very large and complex (and take forever to draw!), usually we are focusing on just one small part of the molecule where a change is taking place.

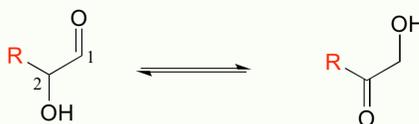
As a rule, you should never abbreviate any atom involved in a bond-breaking or bond-forming event that is being illustrated: only abbreviate that part of the molecule which is not involved in the reaction of interest.

For example, carbon #2 in the reactant/product below most definitely is involved in bonding changes, and therefore should not be included in the 'R' group.

Carbon #2 is involved in reaction events - do not include in abbreviation!



appropriate abbreviation:



inappropriate abbreviation:

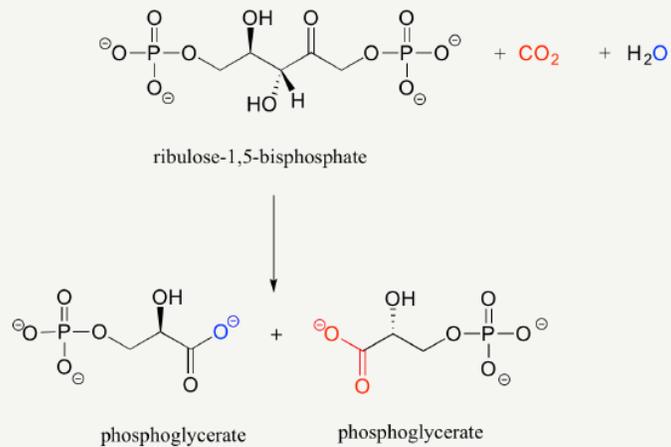


If you are unsure whether to draw out part of a structure or abbreviate it, the safest thing to do is to draw it out.

1. a) If you intend to draw out the chemical details of a reaction in which the methyl ester functional group of cocaine (see earlier figure) was converted to a carboxylate plus methanol, what would be an appropriate abbreviation to use for the cocaine structure (assuming that you *only* wanted to discuss the chemistry specifically occurring at the ester group)?

b) Below is the (somewhat complicated) reaction catalyzed by an enzyme known as 'Rubisco', by which plants 'fix' carbon dioxide. Carbon dioxide and the oxygen of water are

colored red and blue respectively to help you see where those atoms are incorporated into the products. Propose an appropriate abbreviation for the starting compound (ribulose 1,5-bisphosphate), using two different 'R' groups, R_1 and R_2 .



[Solutions to exercises](#)

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