## Exploring Nucleotides

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**Lesson Overview**:

This lesson reviews nucleotides (the building blocks of nucleic acids) and their components.

**ASBMB Learning Objectives**

(<https://www.asbmb.org/education/core-concept-teaching-strategies/foundational-concepts/structure-function>)

2. Structure is determined by several factors

* Students should be able to **recognize the repeating units in biological macromolecules** and be able to discuss the structural impacts of the covalent and noncovalent interactions involved *(Introductory)*.

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1. Explore the molecule [ATP](https://www.rcsb.org/ligand/ATP) and answer the following questions:
   1. What is the complete chemical name of this molecule?

* 1. What are the three parts of this molecule?

* 1. What are two general cellular processes that this molecule is used for?

* 1. Is this molecule used as a drug or supplement? How did you figure this out?

1. Explore the [ligands in the Chemical Component Dictionary related to ATP](https://www.rcsb.org/search?request=%7B%22query%22%3A%7B%22type%22%3A%22group%22%2C%22nodes%22%3A%5B%7B%22service%22%3A%22chemical%22%2C%22parameters%22%3A%7B%22type%22%3A%22descriptor%22%2C%22descriptor_type%22%3A%22SMILES%22%2C%22value%22%3A%22c1nc(c2c(n1)n(cn2)%5BC%40H%5D3%5BC%40%40H%5D(%5BC%40%40H%5D(%5BC%40H%5D(O3)CO%5BP%40%40%5D(%3DO)(O)O%5BP%40%5D(%3DO)(O)OP(%3DO)(O)O)O)O)N%22%2C%22match_type%22%3A%22sub-struct-graph-relaxed%22%7D%2C%22label%22%3A%22chemical%22%2C%22type%22%3A%22terminal%22%7D%5D%2C%22logical_operator%22%3A%22and%22%7D%2C%22return_type%22%3A%22mol_definition%22%2C%22request_options%22%3A%7B%22paginate%22%3A%7B%22start%22%3A0%2C%22rows%22%3A25%7D%2C%22scoring_strategy%22%3A%22combined%22%2C%22sort%22%3A%5B%7B%22sort_by%22%3A%22score%22%2C%22direction%22%3A%22desc%22%7D%5D%7D%2C%22request_info%22%3A%7B%22query_id%22%3A%220c06cac375f0f2229baa935eba8bb584%22%7D%7D) and answer the following questions:
   1. Select any one ligand from this list of molecules and write its identifier and its complete chemical name.
   2. List at least one way in which this molecule is similar to ATP and one way it is different from ATP. *Hint - you may find it useful to support your written explanation by including an annotated diagram of the molecules you are comparing.*
2. Explore the following molecules in PDB’s Chemical Component Dictionary by clicking on the link included. Complete the following table by:
   1. Indicating the “Molecule Type” by selecting from the words - **Base, Sugar, Nucleoside, Nucleotide.**
   2. Filling in the “Reason” and “Evidence” columns to include the reason for your classification in words and in a figure respectively. Follow the example shown for AMP.
   3. Examine the ligand summary pages and note, using Y for yes and N for no, if the molecule is an **approved drug or nutraceutical**.

| Ligand ID | Chemical structure | Molecule Type | Evidence | Reason | Drug |
| --- | --- | --- | --- | --- | --- |
| [AMP](https://www.rcsb.org/ligand/AMP) |  | nucleotide |  | Has base, sugar, and phosphate | Y |
| [ADN](https://www.rcsb.org/ligand/ADN) |  |  |  |  |  |
| [SGV](https://www.rcsb.org/ligand/SGV) |  |  |  |  |  |
| [9DA](https://www.rcsb.org/ligand/9DA) |  |  |  |  |  |
| [BDR](https://www.rcsb.org/ligand/BDR) |  |  |  |  |  |
| [CMP](https://www.rcsb.org/ligand/cmp) |  |  |  |  |  |
| [ID2](https://www.rcsb.org/ligand/ID2) |  |  |  |  |  |