Thymine

By: **BD Editors** Reviewed by: **BD Editors**

Last Updated: **April 28, 2017**

Thymine Definition

Thymine is one of the four nitrogenous *nucleobases* that form the basic building blocks of *deoxyribonucleic acid* (DNA).

Also known as *5-methyluracil*, thymine (T)

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Thymine is one of the four nitrogenous *nucleobases* that form the basic building blocks of *deoxyribonucleic acid* (DNA).

Also known as *5-methyluracil*, thymine (T) is a *pyrimidine* nucleobase, which pairs with adenine (A), a *purine* nucleobase. They are joined together as a *base pair* by two hydrogen bonds, which stabilize the nucleic acid structures in DNA. When stacked with the other base pair, *guanine* (G) and *cytosine* (C), the helical structure of DNA (or RNA) is formed.

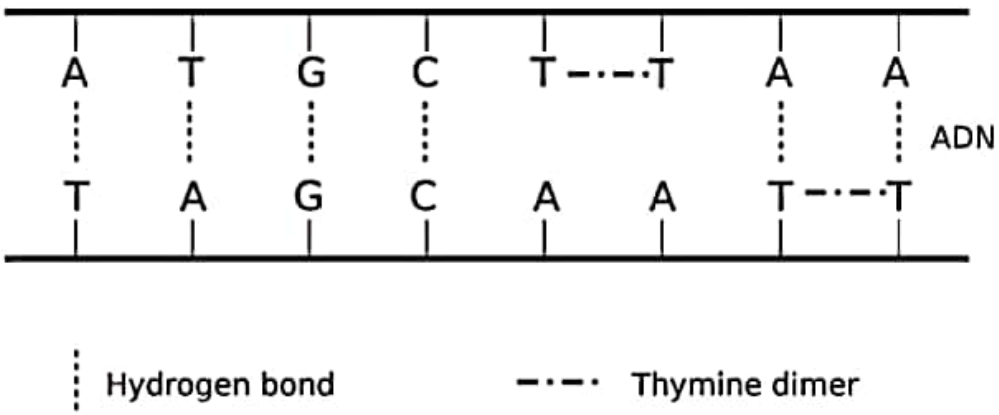
In the structure of *RNA*, thymine is replaced by the *uracil* nucleobase. As suggested by its alternative name (5-methyluracil), thymine can be derived by *methylation* of uracil at the 5th carbon (a methyl branch $-CH_3$ is added to the pyrimidine ring).

The combination of thymine, with the *pentose sugar*, *deoxyribose*, forms the *nucleoside*, deoxythymidine (alternatively named *'thymidine'*). A nucleoside is a *nucleotide* without a *phosphate group*.

Mutation and Cancer

When exposed to *ultraviolet radiation* such as sunlight, *covalent bonds* are formed between adjacent thymine molecules on the same strand of DNA, creating *thymine dimers*. This process causes damage, by

causing the DNA to form 'kinks'. This inhibits the normal function of the DNA, which cannot then be replicated or *transcribed*.



Thymine Dimers

Fortunately, most cells are able to repair damaged DNA. This can be achieved in two ways: repair enzymes called *photolyase* can break the covalent bond, using light as an energy-source for bond *cleavage*. This process is called *photoreactivation* and is possible in most organisms, although not in *placental mammals*.

Thymine Structure

The formula of thymine is $C_5H_6N_2O_2$.

Properties

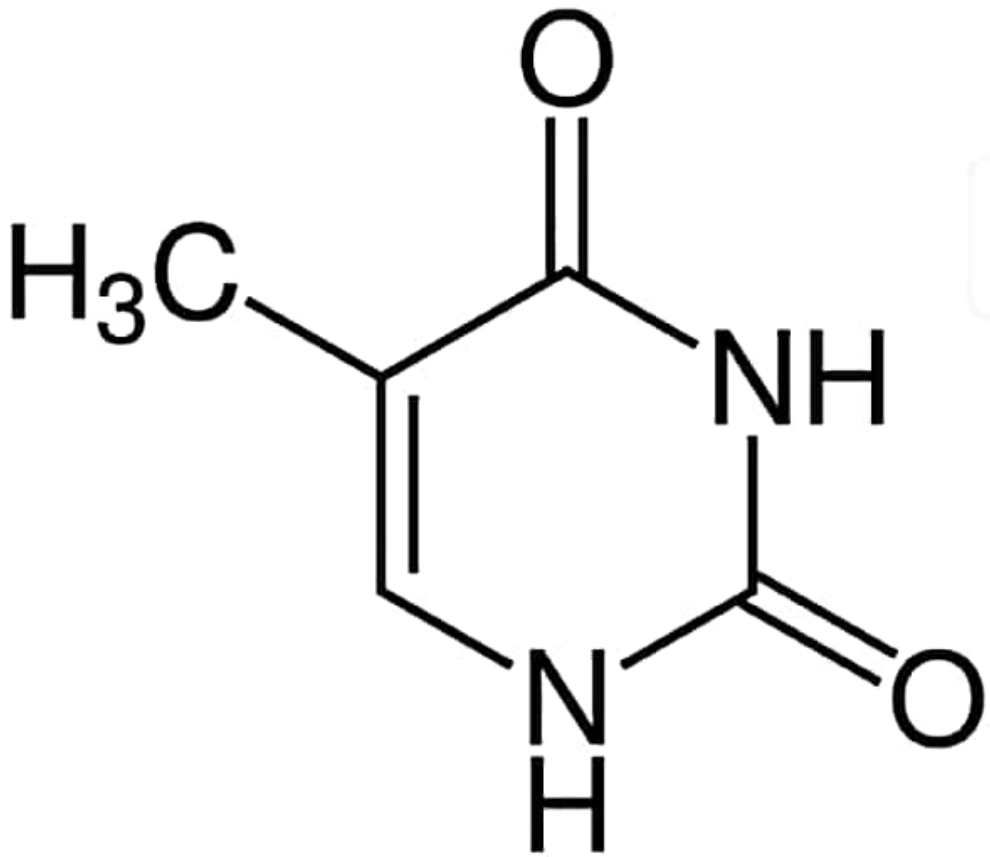
It is a heterocyclic, aromatic, organic compound.

Heterocyclic compounds or 'ring structures' are *cyclic compounds* (the atoms in the compound are connected to form a ring), that have atoms of at least two different elements.

An 'organic' compound contains carbon, so a heterocyclic organic compound contains atoms of carbon and one or more additional elements such as sulphur, nitrogen or oxygen.

The term *aromatic* describes a molecule which is cyclic and planar (flat), with a ring of *resonance bonds*, which give the molecule added stability. This means that it does not break apart or react with other substances easily.

Atomic Structure



Thymin structure

In the same way as the other pyrimidines, cytosine and uracil, thymine has nitrogen (N) at the 1' and 3'; each one is bonded to hydrogen (H). The N molecule at the 3' prime forms the *glycosidic bond* – the covalent bond which joins to the deoxyribose sugar to form the nucleoside, thymidine.

At the 2' and 6' positions are *carbonyl groups* and at the left hand side is a *double bond*.

Thymine has a methyl group at the 5' position, distinguishing it from uracil, which has hydrogen at that position.

Related Biology Terms

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Related Biology Terms

- **Adenine** – The purine nucleobase that bonds with thymine in DNA and with uracil in RNA.
- **Guanine** – The purine nucelobase, which bonds with cytosine in DNA and RNA.
- **Cytosine** – The pyrimidine nucelobase, which bonds with guanine in DNA and RNA.
- **DNA** – The self-replicating, main component of chromosomes, which carries genetic information Deoxyribonucleic acid.

NAME OF THE TEACHER	SUBJECT	CLASS	TOPIC
BALBHADRA PRASAD SINGH	CHEMISTRY	U.G. SEM–V	THYMINE

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