

## Review Article

## Medicinal chemistry of benzimidazole, a versatile pharmacophore

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## ABSTRACT

Benzimidazole is a versatile moiety and has significant role in medicine and medicinal chemistry. The Benzimidazole moiety since discovered has been used in variety of medicine discovery in allopathic medicine. Some alkaloids used as alternative and complimentary medicines also contain benzimidazole. The pharmacophoric property of the moiety makes it versatile to be used as anti-ulcer, anti-helminthic, anti-bacterial, antiviral, and anti-histaminic agent. Here in this review the significant medicinal uses of benzimidazole moiety have been outlined.

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## 1. Introduction

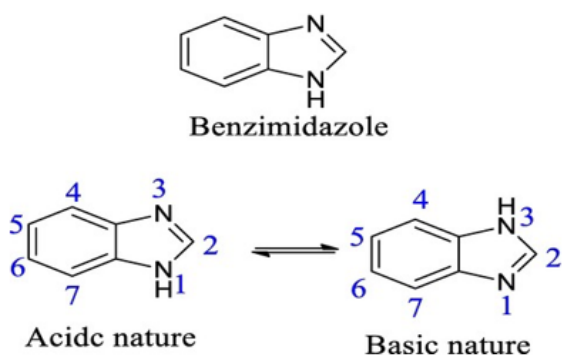


Figure 1:

Benzimidazole<sup>6</sup> shows in-imine tautomerism and has been used for in variety of the medicines as the active constituent. In this review article the Benzimidazole

and the marketed medicines have been illustrated and exemplified. A typical allopathic medicinal chemistry review of medicines containing Benzimidazole moiety. Benzimidazole is a heterocyclic aromatic organic compound. This bicyclic compound may be viewed as fused rings of the aromatic compounds benzene and imidazole. It is a white solid that appears in form of tabular crystals.<sup>1-5</sup>

IUPAC: 1H-1,3-Benzimidazole

The properties of Benzimidazole moiety can be studied by the following table.

Properties	
Chemical formula	C <sub>7</sub> H <sub>6</sub> N <sub>2</sub>
Molar mass	118.139 g·mol <sup>-1</sup>
Melting point	170 to 172 °C (338 to 342 °F; 443 to 445 K)
Acidity (pKa)	12.8 (for benzimidazole) and 5.6 (for the conjugate acid)

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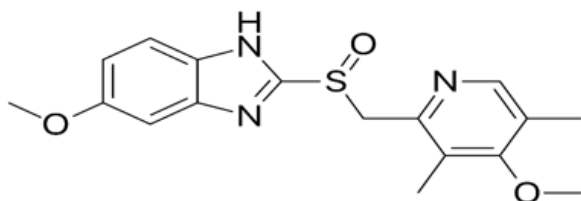
E-mail address: [abhishekvarpe003@gmail.com](mailto:abhishekvarpe003@gmail.com) (A. Varpe).

## 2. Review

Benzimidazole is a versatile moiety. In this review the marketed benzimidazoles are being discussed thus following classes of drugs have been exemplified. Drugs containing benzimidazole ring /derivatives are as follows and can be divided into following categories:

### 2.1. Anti ulcer

#### 2.1.1. Omeprazole<sup>6</sup>



It is proton pump inhibitor, used in ulcer, to reduce acidity.

IUPAC: (R)-omeprazole is a 5-methoxy-2-[[[4-methoxy-3,5-dimethylpyridin-2-yl)methyl]sulfinyl]-1H-benzimidazole that has R configuration at the sulfur atom.

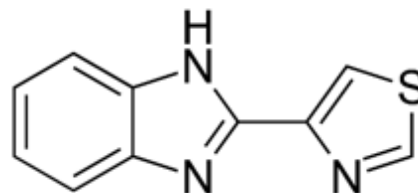
## 3. Marketed Preparation



Omeprazole inj: 40 mg & capsules are available.

### 3.1. Anti-helminthic

## 4. Thiabendazole<sup>7</sup>



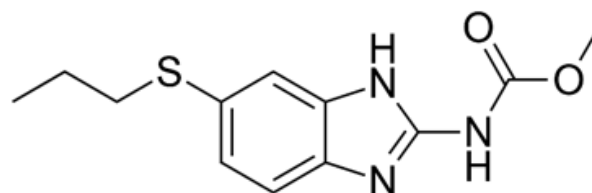
Thiabendazole is a member of the class of benzimidazoles carrying a 1,3-thiazol-4-yl substituent at position 2. It belongs to the anthelmintic class of drug.



In market thiabendazole ointment & tablets are available.

### 4.1. Anti bacterial

## 5. Albendazole<sup>8</sup>



It is a broad-spectrum anthelmintic and antiprotozoal agent of the benzimidazole type.<sup>3</sup> It is used for the treatment of a variety of intestinal parasite infections, including ascariasis, pinworm infection, hookworm infection,

trichuriasis, strongyloidiasis, taeniasis, clonorchiasis, opisthorchiasis, cutaneous larva migrans, giardiasis, and gnathostomiasis, among other diseases.

**IUPAC:** methyl-[5-(propylthio)-1H-benzimidazol-2-yl]carbamate (38.1.18), is also made by the heterocyclization of a derivative of phenylenediamine to a derivative of benzimidazole.

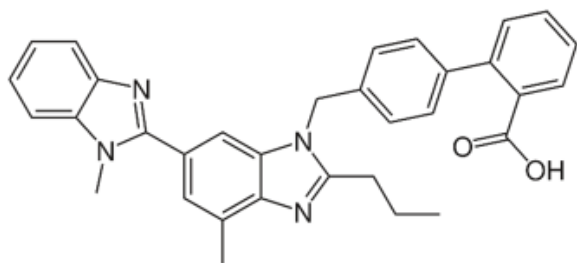
## 6. Marketed Preparation



Albendazole is available in chewable tab & suspension formulation.

### 6.1. Anti hypertensive

## 7. Telmisartan<sup>9</sup>



Telmisartan is used alone or together with other medicines to treat high blood pressure (hypertension).

**IUPAC :** 2-(4-[[4-methyl-6-(1-methyl-1H-1, 3-benzodiazol-2-yl)-2-propyl-1H-1, 3-benzodiazol-1-yl]methyl] phenyl) benzoic acid.

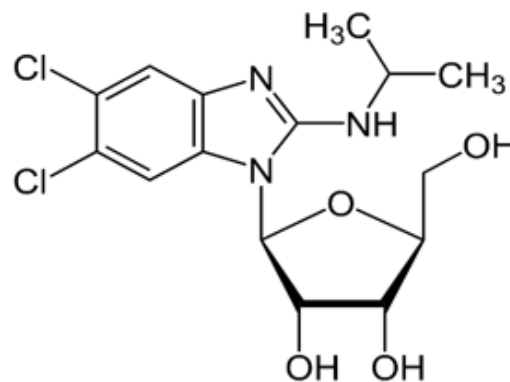
## 8. Marketed Preparation

Telmisartan is available in tablet form, individual or with combination of other drug.



### 8.1. Anti viral

#### 8.1.1. Maribavir<sup>10</sup>



Benzimidazole ring is present in modified form.

Maribavir, sold under the brand name Livtency, is an antiviral medication that is used to treat post-transplant cytomegalovirus. Maribavir is a cytomegalovirus pUL97 kinase inhibitor that works by preventing the activity of human cytomegalovirus enzyme pUL97, thus blocking virus replication.

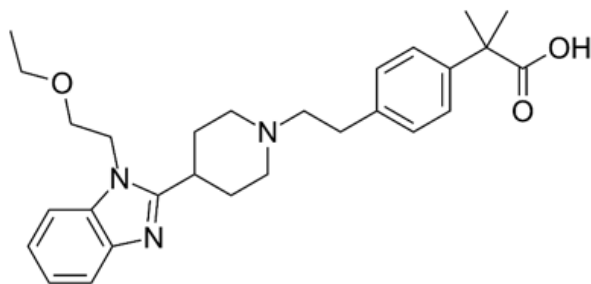
**IUPAC:** 1-ribofuranosyl benzimidazole (5,6-dichloro-2-isopropylamino-1-[β-1-ribofuranosyl]-1H-benzimidazole).

## 9. Marketed Preparation



### 9.1. Antihistaminic

### 9.2. Bilastine<sup>11</sup>



It is a second-generation antihistamine and takes effect by selectively inhibiting the histamine H<sub>1</sub> receptor, preventing these allergic reactions.

**IUPAC:** 2-[4-[2-[4-[1-(2-ethoxyethyl) benzimidazol-2-yl] piperidin-1-yl] ethyl] phenyl]-2- methylpropionic acid, is a novel molecule with a molecular weight of 463.6 daltons and a chemical structure similar to piperidiny- benzimidazole.

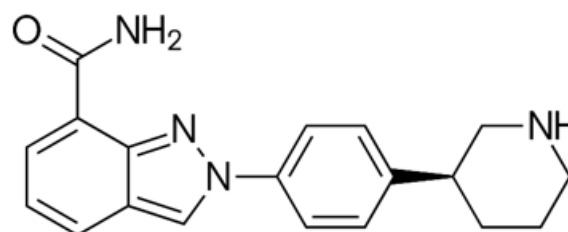
## 10. Marketed Preparation



Bilastine is available in tablet & oral solution formulation.

### 10.1. Anti cancer

### 10.1.1. Niraparib<sup>12</sup>



Niraparib, sold is an anti-cancer medication used for the treatment of epithelial ovarian, fallopian tube, or primary peritoneal cancer. It is taken by mouth. It is a PARP inhibitor.

**IUPAC:** 2-[4-(piperidin-3-yl)phenyl]-2H-indazole-7-carboxamide that has S-configuration.

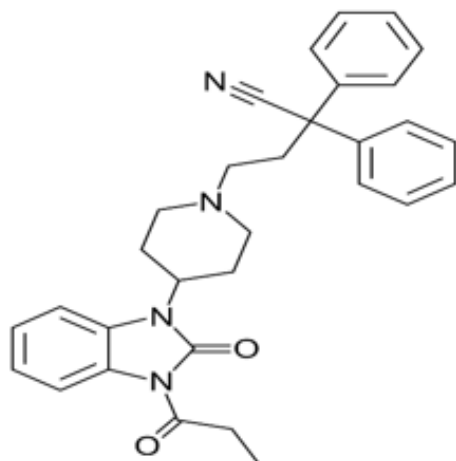
Its is approved as a first-line maintenance treatment for women with advanced ovarian cancer after responding to platinum-based chemotherapy.

## 11. Marketed Preparation



Available in capsule form.

### 11.1. Analgesic Benzitramide



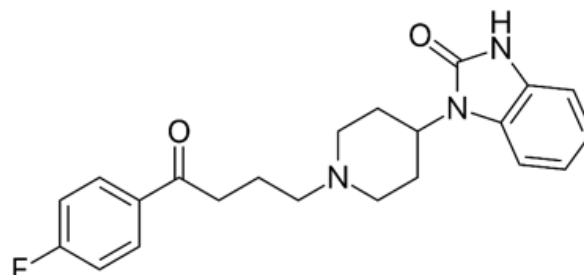
Bezitramide in 2004 the drug was withdrawn from the market. Bezitramide is a pro-drug which undergoes rapid hydrolysis of an appropriate group to form the major metabolite, R-4618. It was manufactured by Janssen (a subsidiary of Johnson & Johnson).

## 12. Marketed Preparation

### 12.1. Burgodin<sup>13</sup>

### 12.2. Anti-psychotic

## 13. Benperidol<sup>14</sup>



Benperidol is a first-generation antipsychotic. It is also known by the trade name Anquil.

It has a ketone modification in the benzimidazole ring structure.

## 14. Marketed Preparation



Benperidol-nuraxpharm tablet is available in 2, 4 & 10 mg preparations in the market.

## 15. Conclusion

Several marketed preparations containing benzimidazole functional groups have been reviewed in this paper. Some benzimidazole-containing drugs being discovered over a century ago and still widely used today. Also, its use is not limited to human allopathic medicine purposes only and some of them are also used in veterinary allopathic medicine. Thus, it is concluded that benzimidazole is a versatile moiety.

**16. Source of Funding**

None.

**17. Conflict of Interest**

None.

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