

4. Purine and Pyrimidine Bases

Purines: adenine, guanine.

Pyrimidines: cytosine, thymine, uracil.

Table of the Biological Role of Nitrogenous Bases

Base	Type of Heterocycle	Biological Function
Adenine	Purine	Component of ATP and DNA
Guanine	Purine	Transmission of genetic information
Cytosine	Pyrimidine	Structure of DNA and RNA
Thymine	Pyrimidine	DNA stabilization

5. Heterocyclic Compounds as Medicinal Agents

5.1. Importance in Pharmaceuticals

Heterocyclic systems are widely used in the development of:

- antibiotics;
- antiviral drugs;
- antifungal agents;
- antitumor drugs;
- psychotropic substances.

5.2. Major Pharmacological Groups

Class of Compounds	Representatives	Pharmacological Action
β -Lactams	Penicillin	Antibacterial
Imidazoles	Ketoconazole	Antifungal
Triazoles	Fluconazole	Antimycotic
Purine Analogues	Acyclovir	Antiviral
Indole Derivatives	Indomethacin	Anti-inflammatory
Benzodiazepines	Diazepam	Sedative

6. Neurotransmitters Containing Heterocyclic Fragments

6.1 Serotonin

Serotonin is an indole derivative synthesized from tryptophan.

6.2 Histamine

Histamine contains an imidazole ring and participates in allergic reactions, inflammation, gastric juice secretion, and nerve impulse transmission.

6.3 Melatonin

Melatonin is an indole derivative regulating circadian rhythms, the sleep–wake cycle, and antioxidant protection.



7. Biological Activity of Heterocyclic Compounds

Biological activity is determined by electronic density, aromaticity, lipophilicity, spatial structure, and the ability to form hydrogen bonds.

Results and Discussion

The analysis shows that heterocyclic compounds occupy a central place among biologically active substances of natural and synthetic origin.

Conclusion

Heterocyclic compounds represent one of the most important classes of biologically active substances. Most modern medicinal preparations are based on heterocyclic structures because of their high biological activity and selectivity of action.

References

1. Joule J.A., Mills K. Heterocyclic Chemistry. Oxford: Wiley, 2013.
2. Katritzky A.R. Handbook of Heterocyclic Chemistry. Elsevier, 2010.
3. Lehninger A. Principles of Biochemistry. New York, 2017.
4. Voet D., Voet J. Biochemistry. Wiley, 2016.
5. Patrick G. An Introduction to Medicinal Chemistry. Oxford University Press, 2018.
6. Silverman R.B. The Organic Chemistry of Drug Design and Drug Action. Academic Press, 2014.
7. Scientific articles on bioorganic chemistry, pharmacology, and medicinal chemistry.

