



Research Plan of Department of Biochemistry (2021-2025)

The Department of Biochemistry offers a dynamic environment comprising a wide spectrum of basic and applied research interests. The department identifies chemical biology and the development of novel research tools, laboratory analysis and therapeutic agents as important areas for future development.

It comprises the following research areas:

- **Pathogenesis and pathophysiology**
- **Mode of action of drugs**
- **Autophagy and senescence**
- **Long non-coding RNAs as diagnostic/prognostic markers**
- **Stem cells and immunotherapy**
- **Natural products as adjuvant/alternative therapy**
- **Prevention and treatment of cancer**
- **Repurposing of drugs with broad safety margin**
- **New biomarkers for early detection of diseases**
- **Genomics and metabolomics**

Pathogenesis and pathophysiology

Pathogenesis of disease describes the mechanisms by which it develops, progresses and either persists or is resolved. The study of disease pathogenesis usually focuses on the factors that lead to the initial origin of the disease. There are many different types of disease pathogenesis including invasion of the body by viruses or bacteria, inflammation as a response to chemicals, physical trauma, the presence of cancerous cells and many different types of genetic disorders. While pathophysiology of diseases focuses on the disordered or disrupted physiological processes that could lead to developing diseases. Understanding pathogenesis and pathophysiology of a disease at the cellular and molecular levels is critical for discovering, developing and implementing methods to prevent the disease and to improve patient outcomes after treatment.



Mode of action of drugs

Discovering new mechanisms of action of currently used drugs, studying adverse effects of drugs, studying the biological effects of newly synthesized chemicals and possible therapeutic use.

Autophagy and senescence

Studying the underlying mechanisms of autophagy dysregulation in development of diseases such as diabetes, neurodegenerative diseases, heart diseases, infections and cancer, identifying autophagy biomarkers for use in patients, exploring autophagy-based therapies, studying the mechanisms that activate senescence in age-related diseases.

Long non-coding RNAs as diagnostic/prognostic markers

Studying the roles of long non-coding RNAs (lncRNAs) as biomarkers for diagnosis and prognosis of different human diseases such as virus infection, cancer, and neurodegenerative disorders and investigating the diagnostic utility of the combined use of lncRNAs with the traditional markers.

Stem cells and immunotherapy

Cancer stem cells (CSCs) are responsible for drug resistance to most chemotherapeutic agents and also for tumor cell heterogeneity. Targeting CSCs is essential to achieve complete regression of tumors. Immune markers expressed by CSCs exhibit specific immune characteristics in various cancers, which can be used in immunotherapies to target CSCs in the tumor microenvironment. Developing dendritic cell-based vaccine is one of the potent immunotherapies used to eradicate tumors.

Natural products as adjuvant/alternative therapy

Assessing the biological activities and studying the mechanism of action of natural products in different diseases, testing their safety in clinical use, comparing their effectiveness with that of the existing drugs and examining the utility of natural products as adjuvant therapy in improving disease management.



Prevention and treatment of cancer

Studying the mechanisms of cancer stem cells in initiation and progression of cancer, studying the epigenetic and metabolic changes driving cancer, exploring novel diagnostic and prognostic methods for cancer patients, developing new therapeutic approaches for killing cancerous cells and targeting epigenetic regulators, exploring the role of immune modulation in cancer treatment as well as investigating the protective role of dietary agents in cancer.

Repurposing of drugs with broad safety margin

Discovering new therapeutic indications of existing drugs, comparing their efficacy with the standard therapies, and investigating drug combination therapy with different mechanisms of action as one of drug repurposing tools.

New biomarkers for early detection of diseases

Developing novel biomarkers for detecting diseases at early stages, such as cancer, neurodegenerative diseases and kidney diseases and investigating the use of multimarker panel in improving early diagnosis of diseases.

Genomics and metabolomics

Employing tools of genomics to discover new targets for treating diseases, study drug resistance, monitor treatment response, predict disease outcome, and identify genetic variants associated with susceptibility to diseases. Also, using metabolomics technologies to identify new disease indicators.

Sources of funding

- Research fund provided by the university
- Students fees
- Participation in competitive projects



Research Directions	Output 2021	Output 2022	Output 2023	Output 2024	Output 2025	Budget Required
Pathogenesis and pathophysiology	Publication M.Sc.	Publication M.Sc.	M.Sc.		Publication M.Sc.	120.000
Mode of action of drugs			Publication	M.Sc.		45.000
Autophagy and senescence		2 Publications		Publication	2 Publications 2 Ph.D.	115.000
Long non-coding RNAs as diagnostic/prognostic markers	Publication	M.Sc. Publication		Publication		80.000
Stem cells and immunotherapy		Publication	Ph.D.			70.000
Natural products as adjuvant/alternative therapy			Publication	Publication	M.Sc. Ph.D.	90.000
Prevention and treatment of cancer	Publication	Publication Ph.D.			Publication	85.000
Repurposing of drugs with broad safety margin				Publication		40.000
New biomarkers for early detection of diseases		Publication		Publication		60.000
Genomics and metabolomics				Publication		45.000