# List of Ph.D. Course work subjects that can be offered under Pharmacology Group from 2026

| Pharmacology | | | | | | | |
|---|---|---|---|---|---|---|---|
| Group I | | Group II | | Group III | | Group IV | |
| Subject Code | Name of the subject | Subject Code | Name of the subject | Subject Code | Name of the subject | Subject Code | Name of the subject |
| **PHPHC101** | Screening Methods in Animals (Reneal) | **PHPHC201** | Toxicity Studies | **PHPHC301** | Pakinson's Disease | **PHPHC401** | Hemi-Parkinsonism in Rat Model |
| **PHPHC102** | Inflammatory Bowel Disease (IBD) | **PHPHC202** | IBD and Colorectal Cancer | **PHPHC302** | Diabetes In Geriatrics | **PHPHC402** | Pharmacoeconomics |
| **PHPHC103** | Antiaging Drugs | **PHPHC203** | Metabolic Syndrome | **PHPHC303** | Stroke | **PHPHC403** | Neurological Disorders |

## PHPHC101 SCREENING METHODS IN ANIMALS (Reneal)

**UNIT I**

Care Handling and breeding techniques of laboratory animals, Regulations for laboratory animals, CPCSEA guidelines, alternatives to animal studies, Good laboratory Practices.

**UNIT II**

Bioassays: Basic principles of Biological standardization: Methods used in the bio-assay of Rabbis Vaccine, Oxytocin, Tetanus Antitoxin and Diphtheria Vaccine. Test for pyrogens.

**UNIT III**

Toxicity tests: OECD guidelines, determination of LD50, acute, sub-acute and chronic toxicity studies.

**UNIT IV**

Organization of screening for the Pharmacological activity of new substances with emphasis on the evaluation of cardiac and anti-diabetic activities.

**UNIT V**

Organization of screening for the Pharmacological activity of new substances with emphasis on the evaluation of psychopharmacological, anti-inflammatory and analgesic activities.

**TEXT BOOKS:**

- Screening methods in Pharmacology, Vol.-1&2 by Robert .A. Turner and Peter Hebborn.
- Drug discovery and evaluation by H. G. Vogel and W. H. Vogel, Springerverlag, Berlin Heideleberg.
- Handbook of experimental pharmacology by S. K. Kulkarni, Vallabh Prakashan, Delhi.

**REFERENCE BOOKS**:

- ICH of technical requirements for registration of pharmaceuticals for human use, ICH harmonized tripartite guidelines - Guidelines for good clinical practice, E6, May 1996.
- Good clinical practice - Guidelines for Clinical trials on pharmaceutical products in India, Central drug standard control organization, New Delhi, Minister of Health- 2001.

# PHPHC102: INFLAMMATORY BOWEL DISEASE (IBD)

## Unit 1: Introduction to Inflammatory Bowel Disease

- Definition and classification of IBD
- Epidemiology and disease burden
- Natural history of the disease

## Unit 2: Pathophysiology of IBD

- Intestinal epithelial barrier dysfunction
- Immune dysregulation and inflammation
- Role of cytokines and mediators

## Unit 3: Genetic and Environmental Factors

- Genetic susceptibility in IBD
- Environmental triggers and lifestyle factors
- Gene–environment interaction

## Unit 4: Nutrition, Diet, and Lifestyle in IBD

- Dietary patterns and inflammation
- Role of probiotics, prebiotics, and synbiotics
- Lifestyle interventions

## Unit 5: Immunological Mechanisms

- Innate and adaptive immune responses
- Role of T cells and macrophages
- Inflammatory signalling pathways

**Unit 6: Biomarkers and Diagnosis**

- Inflammatory and molecular biomarkers
- Endoscopic and histopathological evaluation
- Disease activity indices

**Unit 7: IBD in Special Populations**

- Pediatric and geriatric IBD
- Pregnancy and IBD
- Gender-specific considerations

**Unit 8: Pharmacological Management of IBD**

- Conventional drugs and immunomodulators
- Biologics and targeted therapies
- Drug resistance and adverse effects

**Unit 9: Role of Natural Products in IBD**

- Medicinal plants with anti-IBD activity
- Phytochemicals and mechanisms of action
- Preclinical and clinical evidence

**Unit 10: IBD Complications and Colorectal Cancer**

- Chronic inflammation and complications
- IBD-associated colorectal cancer
- Preventive and therapeutic approaches

# PHPHC103: ANTIAGING DRUGS

## Introduction to Aging

- Definition and concepts of aging
- Chronological aging vs biological aging
- Demographic trends and aging population
- Physiological changes during aging
- Cellular and molecular mechanisms of aging

## Theories of Aging

- Programmed theories of aging
- Damage or error theories
- Free radical theory of aging
- Mitochondrial theory of aging
- Telomere shortening and cellular senescence
- Genetic and epigenetic influences in aging

## Molecular Mechanisms of Aging

- Oxidative stress and aging
- Inflammation and aging (Inflammaging)
- Role of mitochondria in aging
- DNA damage and repair mechanisms
- Role of autophagy and apoptosis in aging

## Experimental Models of Aging

- Natural aging models
- Induced aging models
- D-Galactose induced aging model
- Animal models used in anti-aging research
- Biomarkers of aging

**Pharmacology of Anti-Aging Agents**

- Antioxidants in aging prevention
- Role of vitamins and micronutrients
- Polyphenols and natural compounds
- Caloric restriction mimetics

**Drugs studied in anti-aging research:**

- Metformin
- Telmisartan
- Quercetin
- Creatine
- Resveratrol
- Rapamycin

**Mechanisms of Anti-Aging Drugs**

- AMPK activation
- mTOR inhibition
- Sirtuin activation
- Reduction of oxidative stress
- Anti-inflammatory mechanisms

**Emerging Therapies in Anti-Aging**

- Senolytic drugs
- Senomorphic agents
- Nanotechnology in anti-aging therapy
- Anti-aging vaccines and future perspectives

# PHPHC201: TOXICITY STUDIES

**UNIT I**

Introduction to Toxicity Studies principles. Types of Toxicity Studies - Acute, Subacute and Chronic Toxicity Studies

**UNIT II**

Systemic toxicity studies

**UNIT III**

Genotoxicity and Carcinogenicity Studies

**UNIT IV**

Toxicity tests: OECD guidelines, determination of LD50, acute, sub-acute and chronic toxicity studies.

**UNIT V**

Ethical Considerations in Animal Toxicity Studies

**TEXT BOOKS:**


1. Fundamentals of experimental pharmacology by M. N. Ghosh, Hilton and company
2. Screening methods in Pharmacology, Vol.-1&2 by Robert A. Turner and Peter Hebborn.
3. Drug discovery and evaluation by H. G. Vogel and W. H. Vogel, Springer-Verlag, Berlin Heidelberg.
4. Handbook of experimental pharmacology by S. K. Kulkarni, Vallabh Prakashan, Delhi.


**REFERENCE GUIDELINES**:


1. New drugs and clinical trials rules, 2019
2. ICH of technical requirements for registration of pharmaceuticals for human use, ICH harmonized trip
3. Artite guidelines - Guidelines for good clinical practice, E6, May 1996.
4. Good clinical practice - Guidelines for Clinical trials on pharmaceutical products in India, Central drug standard control organization, New Delhi, Minister of Health- 2001.

# PHPHC202: IBD AND COLORECTAL CANCER

## Unit 1: Role of Experimental Models in GI Research

- Significance of animal and in vitro models
- Disease simulation and translational relevance
- Ethical guidelines and regulatory aspects

## Unit 2: Chemically Induced Models of IBD

- DSS-induced acute and chronic colitis
- TNBS and Oxazolone models
- Pathological and biochemical assessment

## Unit 3: Genetic and Transgenic Models of IBD

- IL-10 knockout and NOD2 mutant mice
- Autophagy-related gene models
- Advantages and limitations

## Unit 4: Immune-Mediated and Infectious Models of IBD

- T-cell transfer colitis model
- Bacteria-induced colitis
- Immune signalling pathways

## Unit 5: In Vitro and Ex Vivo Models of IBD

- Intestinal epithelial cell lines
- Organoid and co-culture models
- Applications in mechanistic studies

**Unit 6: Chemically Induced Models of Colorectal Cancer**

- Azoxymethane (AOM) model
- DMH-induced carcinogenesis
- Tumor initiation and progression

**Unit 7: Inflammation-Associated Colorectal Cancer Models**

- AOM/DSS combined model
- Chronic colitis-driven carcinogenesis
- Molecular pathways involved

**Unit 8: Genetic and Molecular Models of Colorectal Cancer**

- APCMin/+ mouse model
- KRAS, p53, and β-catenin mutations
- Tumor biology and progression

**Unit 9: Evaluation Parameters and Biomarkers**

- Clinical, histological, and biochemical endpoints
- Molecular markers (COX-2, TNF-α, BAX, BCL-2, p53)
- Data interpretation and scoring systems

**Unit 10: Application of Experimental Models in Drug Discovery**

- Screening of synthetic and natural compounds
- Mechanism-based evaluation
- Translational limitations and future perspectives

# PHPHC203: METABOLIC SYNDROME

## Unit 1: Introduction to Metabolic Syndrome

- Definition and diagnostic criteria
- Epidemiology and global burden
- Components of metabolic syndrome

## Unit 2: Pathophysiology of Metabolic Syndrome

- Insulin resistance
- Central obesity
- Dyslipidemia
- Hypertension
- Chronic inflammation

## Unit 3: Molecular Mechanisms

- Adipokines and cytokines
- Role of leptin and adiponectin
- Oxidative stress
- Endothelial dysfunction

## Unit 4: Clinical Manifestations and Diagnosis

- Diagnostic criteria (WHO, NCEP ATP III, IDF)
- Laboratory investigations
- Biomarkers of metabolic syndrome

**Unit 5: Pharmacological Management**

Drugs used in management:

**Antidiabetic drugs**

Metformin

Thiazolidinediones

GLP-1 agonists

SGLT-2 inhibitors

**Antihypertensives**

ACE inhibitors

ARBs (Telmisartan)

Calcium channel blockers

**Lipid-lowering drugs**

- Statins
- Fibrates
- Niacin

**Anti-obesity drugs**

- Orlistat
- GLP-1 analogues

**Unit 6: Complications of Metabolic Syndrome**

- Type 2 diabetes mellitus
- Cardiovascular disease
- Non-alcoholic fatty liver disease (NAFLD)
- Chronic kidney disease

**Unit 7: Emerging Therapies**

- Novel antidiabetic drugs
- Gut microbiota and metabolic syndrome
- Role of gene therapy
- Future pharmacological targets

# PHPHC301: PARKINSONS'S DISEASE

**UNIT- 1**

**Over view of Parkinson's disease**

Definition, histological background, prevalence and global impact

**UNIT-2**

**Pathophysiology of Parkinson's disease**

- Neurological basis, dopamine deficiency and Lewy bodies.
- Symptoms of Parkinson's Disease-Motor symptoms, bradykinesia, rigidity and postural instability
- Non-motor symptoms.

**UNIT- 3**

**Diagnosis of Parkinson's disease**

- Clinical diagnosis and Diagnosis
- Neuroimaging

**UNIT-4**

**Treatment and management**

- Pharmacological treatments – drugs used to treat Parkinson's disease, classification and mechanism of action.
- Life style changes

**UNIT-5**

**Current Research and advances**

- Gene Therapy, stem cell therapy and neuroprotective drugs.
- Parkinson's disease and gut health
- Parkinsons disease and inflammation

**UNIT-6**

**Challenges in Parkinson's disease management**

- Progressive nature of Parkinson's disease
- Side effects of Long-term medication
- Metal health

# PHPHC302: DIABETES IN GERIATRICS

**UNIT- 1**

**Over view of diabetes mellitus**

- Pathophysiology of diabetes mellitus type 1 and type 2.
- Epidemiology and risk factors in Geriatric populations.
- Diagnostic criteria and clinical presentation of type to Diabetes mellitus in older adults

**UNIT-2**

**Pharmacological management of Type-2 Diabetes**

- first line and second line drug therapies in diabetes (metformin, sulfonylureas. DPP-4 inhibitors, SGLT-2 inhibitors)
- Considerations for the geriatric population: renal function, polypharmacy, comorbidities.
- New and emerging drug therapies in type-2 Diabetes mellitus

**UNIT- 3**

**Challenges in Managing Geriatric diabetes**

- Comorbidities in elderly patients:
  cardiovascular diseases, renal dysfunction, cognitive decline.
- Polypharmacy and its implications on drug therapy in geriatrics.
- Managing Hypoglycemia risk and treatment adjustment.

**UNIT-4**

**Non-Pharmacological management of type-2 diabetes**

- Diet exercise and Lifestyle changes in older adults.
- Diabetes education and self-management in geriatrics.
- Psychosocial aspects of diabetes care in older adults.

**UNIT-5**

**Health outcomes and quality of life in geriatrics with T2DM**

- Assessing health-related quality of life in older adults with diabetes.
- The impact of diabetes on physical, cognitive and emotional well-being
- Health outcomes measurement in geriatric diabetes care

**UNIT-6**

**Pharmacoeconomic Evolutions of drug therapies in geriatric type-2 Diabetes**

- Evaluating the cost effectiveness of diabetes medications in elderly patients.
- Economic burden of type-2 diabetes mellitus in older adults
- Use of pharmacoeconomic data in health care policy for diabetes management

# PHPHC303: STROKE

**Introduction to Stroke**

- Definition and classification of stroke
- Epidemiology
- Cerebral circulation and regulation of cerebral blood flow
- Blood Brain Barrier and Neurovascular unit
- Ischemic and hemorrhagic stroke

**Pathophysiology of Cerebral Ischemia**

- Ischemic cascade
- Excitotoxicity and glutamate receptors
- Calcium overload and mitochondrial dysfunction
- Oxidative stress and free radical injury
- Neuroinflammation and cytokines

**Cell Death Mechanisms**

- Apoptosis, necrosis and autophagy
- Ferroptosis and its role in ischemic stroke
- Iron metabolism in the brain
- Role of ferritin, transferrin and hepcidin

**Pharmacological Management of Stroke**

- Thrombolytic therapy
- Antiplatelet and anticoagulant drugs
- Neuroprotective agents
- Management of cerebral edema
- Secondary prevention drugs (statins, antihypertensives)

**Non-Pharmacological Management of Stroke**

- Mechanical thrombectomy
- Neurocritical care and stroke units
- Physiotherapy and neurorehabilitation
- Nutritional support
- Lifestyle modification and secondary prevention
- Patient education and community-based stroke care

# PHPHC401: HEMI-PARKINSONISM IN RAT MODEL

**UNIT-1**

**Introduction to Parkinson's disease and hemi-Parkinson's disease**

- Overview of Parkinson's disease- Pathophysiology of PD and dopamine's role in motor function
- Hemi-parkinsonism as a model for Parkinson's disease
- Dopamine's effect on motor control

**UNIT-2**

**Experimental models of Parkinson's disease**

- Animal Models of Parkinson's Disease-Hemi-Parkinson's rat model (e.g. 6-OHDA, MPTP)
- Benefits and limitations of animal models in Parkinson's disease research.
- Behavioral implications of the hemi-parkinsonism model

**UNIT-3**

**Behavioural Assessment of Motor Function in Parkinson's disease model**

- Behavioral tests for Parkinson's disease symptoms- Rotarod test, cylinder test, open-field test and foot-fault test
- Assessing dopamine deficits: relation between behavioural deficits and striatal dopamine depletion

**UNIT-4**

**Striatal dopamine measurement**

- Techniques to measure dopamine levels: Microdialysis and HPLC
- Dopaminergic system alterations in Hemi-parkinsonism-effects of dopamine depletion on striatal function

**UNIT-5**

**Pharmacological interventions and their effect on behavior**

- Drugs for Parkinson's Disease: mechanism of action – Levodopa, dopamine agonists and MAO-inhibitors
- Pharmacological effects on behavior and dopamine: assessing drug-induced changes in behavioural patterns

# PHPHC402: PHARMACOECONOMICS

**UNIT-1**

**Introduction to Pharmacoeconomics**

- Overview of Pharmacoeconomics and its role in healthcare.
- Key concepts: cost effectiveness, cost utility, cost benefit and cost minimization analysis
- The role of Pharmacoeconomics in Healthcare decision making.
- Health care systems and their economic constraints

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**UNIT-2**

**Methods of economic evaluation**

- Method of data collection and analysis in the Pharmacoeconomics
- Direct indirect and intangible cost in Health care
- Incremental cost effectiveness ratio (I C E R )
- Quality-Adjusted life years (Q A L Y) and Disability- Adjusted life years (D A L Y)

**UNIT-3**

**Economic Models**

- Decision analysis models: Markov models and co-hort models
- Simulation techniques in Pharmacoeconomics
- Sensitivity analysis in economic Evolutions.

**UNIT-4**

**Pharmacoeconomics of drug Therapies**

- Pharmacoeconomic evaluation of Pharmaceutical treatments for chronic diseases.
- The role of Pharmacoeconomics in evaluating diabetes treatment
- Real- world evidence and cost effectiveness studies of diabetes therapies.

**UNIT-5**

**Special topics in Pharmacoeconomics**

- Comparative effectiveness research in Pharmacoeconomics
- Ethical considerations in Pharmacoeconomics evaluations.

# PHPHC403: NEUROLOGICAL DISORDERS

**Introduction to Computational Drug Discovery**

- Principles of in-silico drug design
- Target identification and validation
- Databases: PDB, PubChem, DrugBank

**Molecular Docking and Virtual Screening**

- Ligand and protein preparation
- Docking algorithms
- Scoring functions
- Binding affinity and interaction analysis

**Screening of Drug Candidates for Pharmacokinetic Suitability and Blood Brain Barrier Permeability**

- Pharmacokinetic modelling
- Absorption, distribution, metabolism, excretion and toxicity
- Blood Brain Barrier Permeability Prediction
- CNS drug likeness

**Molecular Dynamics (MD) Simulation**

- Principles of Molecular Dynamics (MD)
- Protein-ligand stability

**Network Pharmacology**

- Drug target pathway interaction
- Disease network analysis
- Application in neurological disorders

**Animal Models of Neurological Disorders**

- Ethical guidelines and animal handling
- Ischemic stroke models (MCAO, global ischemia)
- Hemorrhagic stroke models

**Behavioral and Functional Assessment in Animal Models**

- Neurological deficit scoring
- Motor coordination tests
- Learning and memory tests

**Biochemical and Oxidative Stress Markers**

- Estimation of brain iron
- Estimation of Lipid peroxidation
- Antioxidant enzymes
- Inflammatory mediators

**Histopathological Techniques**

- Infarct size determination
- H&E staining
- Nissl staining
- Iron staining techniques

**Molecular Techniques**

- RT-qPCR
- Western blotting
- Protein and gene expression in stroke