

**Central University of Haryana
School of Interdisciplinary and Applied Sciences
Department of Nutrition Biology**

SCHEME AND CURRICULUM

Ph.D. Nutrition Biology

(w.e.f. 2021)



**Department of Nutrition Biology
CENTRAL UNIVERSITY OF HARYANA,
MAHENDERGARH, HARYANA**

SCHEME AND CURRICULUM

Semester	Core /Elective	Paper Code	Title of the Paper	Credit L-T-P
I	CC	SIAS NB 02 01 01 C 4004	Research Methodology	4+0+0
	CC	SIAS NB 02 01 02 C 4004	Advanced Analytical Techniques	4+0+0
	CC	SIAS NB 02 01 03 C 2002	Research and Publication Ethics (RPE)	2+0+0
	DCEC	SIAS NB 02 01 01 DCEC 4004	Advances in Nutritional Genomics and Metabolomics	4+0+0
		SIAS NB 02 01 02 DCEC 4004	Food and Nutrition Toxicology	4+0+0
	Total			14

Course: Research Methodology

Course code: SIAS NB 02 01 01 C 4004

Credit: 4

Lectures: 60

Course objective: To provide knowledge about tools and techniques related with scientific communication, research methodology and biosafety in biological experiments.

Learning outcomes:

- Understanding the existence of scientific knowledge
- Acquiring the skills of scientific reading, writing and presentations
- Appreciating the scientific ethics through case studies
- Understand the importance and level of biosafety at laboratory and industrial levels

Unit 1. Identification and defining of the Research Problem:

Familiarization of research areas; Review of literature using appropriate resources – reviews, research papers, books and patents; Use of tools for searching literature through electronic databases; Defining a research problem.

Unit 2. Experimental Approaches and Methodology

Experimental designs to address the research problem; Pros and cons of different experimental strategies; Finalization of experimental design; Tools and techniques to execute experiments; Means to validate and analyze data; Use of statistical tools for analyzing the significance and interpretation of the data; Methods of recording observations and documentation

Unit 3. Ethics and Safety in Biological Research

Guidelines for Biosafety and Bioethics; Institutional Biosafety Committee – Handling of Genetically modified organisms, Institutional Human and Animal Ethics Committee - compliance, concerns and approval; Safety practices and disposal of Bio-waste in the laboratory; Radioactivity and safety precautions; Handling and disposal of flammable and hazardous chemicals.

Unit 4. Presentation, Publication and Protection of Research Data.

Skills for scientific writing and research presentation – Term paper, Research project, Research report, Thesis, Research article and Review; Organization of the research document in to different sections (Introduction, Methodology, Results, Discussion, and Summary and Conclusions, Bibliography); Use of electronic tools for bibliographic

formatting and checking Plagiarism; Oral presentation skills; Patents and Intellectual property rights

Students are expected to undertake the following assignments, exercises for evaluation.

1. Identification and selection of the broad area of research
2. Review of literature, formulation of research plan and submission of term paper along with references
3. Oral presentation of research plan and experimental design

Evaluation will be based on term paper and oral presentation

SUGGESTED READINGS

1. Beauchamp T.L., Walters L., Kahn J.P. & Anna C. *Contemporary issues in Bioethics*. Wardsworth Publishers. Co. 2013. Print
2. Cross C.L. and Wayne W.D. *Biostatistics: Basic Concepts and Methodology for the Health Sciences*. 10th edition, Wiley. 2014. Print
3. Davis, G.B. and Straub D.W. *Writing the doctoral dissertation*. 3rd edition. Barron's Educational series. 2012. Print
4. Deepa Goel. *IPR, Biosafety and Bioethics*. 1st edition. Pearson Education. 2013. Print
5. Kothari C.K. *Research Methodology: Methods and Techniques*. 3rd edition. New Age International. 2013. Print
6. Krishnaswamy, K.N., Mathiranjani M., and Sivakumar, A.I. *Management Research Methodology; Integration of Principles, Methods and Techniques*. Pearson Education. 2011. Print
7. Kumar R. *Research Methodology: A Step-by-Step Guide for Beginners*. 2nd edition, Pearson Education. 2005. Print
8. Montgomery, Douglas C. *Design and Analysis of Experiments*. 8th edition. Wiley. 2013. Print
9. Rao S and Richard J. *Introduction to Biostatistics and Research Methods*. 5th edition. Prentice Hall India Learning Private Limited. 2012. Print
10. Gastel, Barbara, and Robert A. Day. *How to write and publish a scientific paper*. ABC-CLIO, 2016.

Course: Advanced Analytical Techniques

Course code: SIAS NB 02 01 02 C 4004

Credit: 4

Lectures: 60

Course objective: To provide an advanced understanding of the core principles of various techniques used in biological experiments.

Learning outcomes:

- Demonstrate principles of various basic and advanced techniques used in biological experiments
- Critically analyze and interpret the results obtained from biological experiments

Unit 1. Recombinant DNA techniques and Genomics

Use of Restriction and modification enzymes in cloning; Plasmid vector; Transformation and Plasmid isolation; PCR; DNA sequencing methods (Sanger's chain termination method, and automated DNA sequencing); Next generation sequencing (NGS); Global expression profiling; Whole genome analysis of mRNA and protein expression; Real time PCR and Microarrays and their applications

Unit 2. Proteomics

UV and fluorescence spectroscopy; Circular Dichroism; Mass spectrometry - Principles and their applications; Protein separation techniques and instrumentation (Gel filtration, Ion exchange and Affinity chromatography, 1D and 2D Polyacrylamide gel electrophoresis); Immunochemical detection of proteins

Unit 3. Microbial and Cellular Techniques

Microscopic techniques; Microbial growth and kinetics (synchronous culture, continuous and batch and fed-batch cultures, chemostat and turbidostat); Methods for identifying microbes (polyphasic approach); Cell disruption and fractionation of organelles; Isolation and purification of membrane proteins; Various methods to study cell-cell and cell-virus fusion;

Flow cytometry techniques; Confocal and Atomic Force Microscopy; Types of Biosafety cabinets

Unit 4. Animal Models in Biology

Handling and maintenance of animals, Ventilated cages, Different routes of injections and collection of various biological components, Formulation of feed and design of experiment

Recap Unit

Preparation of solutions; Concepts of solution strength (concentration); Sterilization of solutions; Preparation of Buffers - Concept of pKa and Henderson-Hasselbach equation; Concept of conjugate acid and base

SUGGESTED READINGS

1. Ausubel FW. *Current Protocols in Molecular Biology*. Wiley-Blackwell. 2011. Print
2. Burgess R. and Deutcher MP. *Guide to Protein Purification*. Academic Press, San Diego, USA. 2009. Print
3. Butler, M. *Animal Cell Culture & Technology*. 1st edition. Tailor & Francis Publishers (UK). 2004. Print
4. Freshney, R.I. *Culture of Animal cells: A Manual of Basic Technique and specialized applications*. 7th edition. Wiley-Blackwell. 2016. Print
5. Green M.R. and Sambrook J. *Molecular Cloning: A Laboratory Manual. Vol. I, II, III*. 4th edition. Cold spring harbor laboratory press. 2013. Print
6. Owen J.A., Punt J., Stranford S.A. *Kuby: Immunology*. 7th edition. W.H. Freeman Publishers. 2013. Print
7. Plummer D.T. *An Introduction to Practical Biochemistry*. 3rd edition. McGraw Hill Higher Education. 2001. Print
8. Razdan, M. K. *Introduction to Plant Tissue Culture*. 2nd Edition. Oxford & IBH. 2008. Print

9. Sheehan, David. *Physical Biochemistry: Principles and Applications*. 2nd edition. Wiley. 2009. Print
10. Wilson K. and Walker J. *Principles and Techniques of Biochemistry and Molecular Biology*. 7th edition. Cambridge University Press India Pvt. Ltd. 2010. Print

Course title: Research and Publication Ethics

Credit: 2

Course code: SIAS NB 02 01 03 C 2002

Lectures: 30

Course objective: To learn philosophy of science, research misconduct and integrity, publication plagiarism and ethics.

Learning Outcomes:

- Learn to identify the FFP in research and ethics of publication.
- Hands on session help to find research misconduct, predatory publication, publications metrics and plagiarism.
- To learn database citation and indexing of publication.

Part A: THEORY

Unit1 Philosophy & ethics

Introduction of Philosophy; definition, nature and scope, concept, branches. Ethics; definition, moral philosophy, nature of moral judgments and reactions.

Unit II Scientific conduct

Ethics with respect to science and research, Intellectual honesty and research integrity, Scientific Misconduct; falsification, fabrication and Plagiarism (FFP), Redundant publications; duplicate and overlapping publications, salami slicing.

Unit III Publication ethics

Publication ethics; definition, introduction and importance. Best Practices/ standards setting initiatives and guidelines: COPE, WAME etc., Conflict of Interest, Publication misconduct: definition, concept, problems lead to unethical behavior and vice-versa, types, Violation of publication ethics, authorship and contributor-ship, Identification of publication misconduct, complaint and appeals, Predatory publications and journals.

Part B: PRACTICE

Unit IV Open access publishing

Open access publications and initiatives, SHERPA/RoMEO online resource to check publisher copyright and self-achieving policies, Software tools to identify predatory publications developed by SPPU, Journal finder Journal suggestion tools vis. JANE, Elsevier journal finder, Springer journal suggested etc.

Unit V Publication misconduct

Group discussion; Subject specific ethical issues, FFP, Authorship, Conflict of interest, Complaint and appeals; example and fraud from India and abroad. Software tools; turnitin, urkund and other open source plagiarism tools.

Unit VI Database and research metrics

Database: Indexing citation database; Web of Science and Scopus etc., Research metrics; Impact factor of journal as per journal citation report, SNIP, SJR, IPP, Cite score, Metrics; h index, g index, i10, altmetrics.

Suggested readings

1. Bird A. Philosophy of science. Routledge. 2006. ISBN 9781138705579.
2. MacIntyre A. A short history of ethics: A history of moral philosophy from the homeric age to the twentieth century. London. 1967. ISBN: 9780268161286.
3. Chaddhah P. Ethics in competitive research, do not get scooped; do not get plagiarized. 2018. ISBN-10: 9387480860
4. On being a scientist, a guide to responsible conduct in research. National Academy of Science, National Academy of Engineering and Institute of Medicine. 2009. ISBN-10: 0309119707
5. Muralidhar K. Ghosh A. Singhvi A. Ethics in science education, research and governance. Indian National Science Academy. 2019. ISBN: 9788193948217

Course: Advances in Nutritional Genomics and Metabolomics

Course code: SIAS NB 02 01 01 DCEC 4004

Credit: 4

Lectures: 60

Course objective: To understand the concept of genomics and metabolomics in nutrition research

Learning Outcome

- Understanding of principles of nutritional genomics and metabolomics
- Understanding the significance and applications of nutritional genomics and metabolomics along with its resources and analysis

Unit 1

Nutritional Genomics: Genome & genomics, nutritionally important genes, gene regulation by lipids and carbohydrates, metabolic control analysis, transcriptomics, proteomics and metabolomics, nutrient-gene interaction and expression, genetic control of metabolic pathways, Nutri-Epigonomics and Nutri-Epigenetics.

Unit 2

Metabolomics: Overview of primary metabolism, Integration of Metabolism, The Metabolome – Metabolic flux, Metabolic flux analysis, metabolic engineering, metabolic phenotypes. Nutri-metabolomics, Molecular nutrition: basic understanding of the digestion, absorption, and metabolism of nutrients. Nutritional genomics and metabolomics in obesity and type 2 diabetes.

Unit 3

Nutrition genomics and metabolomics: Biological networks and their significance – at the level of genome, transcriptome, proteome, metabolome and fluxome. Applications and its role in systems biology. Food metabolome, Dietary metabolites and cellular metabolism, Analytical methods for detecting and quantifying metabolites. Metabolomics in nutrition research, Dietary lipids and lipidomics, Microflora and Regional metabolic phenotypes.

Unit 4

Metabolomics resources and analysis: tools, software, libraries, databases, experiment repositories, and meta-data storage. Nutri-miRomics, metabolomics in practice and case study from literature. Opportunities and challenges in nutritional genomics and metabolomics.

SUGGESTED READINGS

1. Lynnette R. Ferguson, *Nutrigenomics and Nutrigenetics in Functional Foods and Personalized*, CRC Press, ISBN 9781439876800 - CAT# K13569 Year 2013.
2. Afman L, Müller M. *Nutrigenomics: from molecular nutrition to prevention of disease*. J Am Diet Assoc. 106: 569-576, Year 2006
3. Corthésy-Theulaz I, den Dunnen JT, Ferré P, Geurts JMW, Müller M, van Belzen N, van Ommen B. *Nutrigenomics: the impact of biomics technology on nutrition research*. Ann Nutr Metab. 49: 355-265, Year 2005
4. Hirsch J.B., Evans D. *The state of nutrigenomics. Evaluating nutrition, biomarkers and genetics – you are what you eat*. Nutraceuticals World, September. 56-59, Year 2005.
5. *Metabolomics – A powerful Tool in Systems Biology*, Edited by J.Nielsen and M.C. Jewett, Springer Publishers, Year 2007
6. D'Auria J.C., Gershenzon J. *The secondary metabolism of Arabidopsis thaliana: Growing like a weed*. Curr. Opin. Plant Biol. 8: 308–316, Year 2005.
7. Fernie A.R. *The future of metabolic phytochemistry: Large numbers or metabolites, higher resolution, greater understanding*. Phytochemistry 68: 2861–2880, Year 2007.
8. <https://www.ebi.ac.uk/training/online/course/introduction-metabolomics/designing-metabolomics-study/key-stages-metabolomics-study>
9. https://link.springer.com/chapter/10.1007/978-3-319-43027-0_6 (Nutritional Genomics: The Wave of the Future for Nutrition and Dietetics, 2016)
10. The Human Metabolome Database (<http://www.hmdb.ca/>).
11. Sales N.M.R., Pelegrini P.B., and Goersch M.C. *Nutrigenomics: Definitions and Advances of This New Science*. J Nutr Metabol. 2014:1-6, Year 2014
12. Paik J.K. *Application of Nutrigenomics in Diabetes*. J Korean Diabetes. 17(4):266-270, Year 2016

Course: Food and Nutrition Toxicology

Course code: SIAS NB 02 01 02 DCEC 4004

Credit: 4

Lectures: 60

Course objectives: Understanding of the basic principles of food and nutritional toxicology and risk assessment.

Learning outcomes:

- Understanding of the various toxicants and their interaction with nutrients
- Understanding of the methods of safety evaluation and risk assessment

Unit 1

Food toxicology: significance and mechanism manifestation of toxic effects; classification of food toxicants; factors affecting toxicity of compounds; methods used in safety evaluation-risk assessments. Nutrient-toxicant interaction, Principles of toxicology: adsorption, distribution, metabolism and excretion (ADME) of xenobiotics; toxicokinetics; system toxicity; organ toxicity.

Unit 2

Nutritional toxicology: safety assessment on dietary components; case studies on the toxic (or detoxification) events associated with food intake and environmental exposure; *in-vivo* and *in-vitro* techniques for toxicological research. Toxicants and allergens in foods derived from plants, animals, marine, algae & mushroom; Food Poisoning.

Unit 3

Microbial toxins and food intoxications: source of contamination, effect on health, preventive measures, methods of inactivation/destruction. Naturally occurring toxicants, Food contaminants, Chemical toxins: pesticides, insecticides, metallic and others, residual effects, preventive measures, methods of removal. Derived Food toxicants- Processing & Packaging; Toxicants generated during food processing such as nitrosamines, acrylamide, benzene, dioxins and furans; persistent organic pollutants.

Unit 4

Toxicology & food additives; Toxicological aspects of nutrient supplements; toxicological aspects of fumigants, chlorinated solvents, autoxidation products, carcinogens in smoked

foods and pyrolysis, agrochemicals; heavy metals; intentional and unintentional additives. Food packaging material, potential contaminants from food packaging material, Permissible limits in food.

SUGGESTED READINGS

1. Fernando P. Carvalho. *Pesticides, environment, and food safety*, Food and Energy Security 6(2), Year 2017.(<http://onlinelibrary.wiley.com/doi/10.1002/fes3.108/pdf>)
2. Dellafiora L. and Dall'Asta C. *Forthcoming Challenges in Mycotoxins Toxicology Research for Safer Food—A Need for Multi-Omics Approach*. Toxins Year 2017, 9, 18; doi:10.3390/toxins9010018 (file:///C:/Users/dell/Downloads/toxins-09-00018.pdf)
3. Branen A. L, Davidson P. M and Salminen S. *Food Additives*. Marcel Dekker. Condon JM. Year 1990.
4. Marcel Dekker. *Food Toxicology - Principles & Concepts*. Hathcock JN. (Ed.). Year 1982.
5. Rechcigl M Jr. *Nutritional Toxicology*. Vol. I. Academic Press. Year 1983.
6. Shabbir S. *Handbook of Naturally Occurring Food Toxicants*. CRC Press. Year 2007.
7. Tweedy B. G. *Food Toxicology: A Perspective on Relative Risks*, Year 1991.