Centre for Animal Sciences

School of Basic and Applied Sciences
Central University of Punjab

Ph.D. Program in Animal Sciences

(2015-16)

Semester – I

Course Code	Course Title	L (hr)	P (hr)	Cr
LAS.701	Research Methodology & Biostatistics	4		4
LAS.702	DNA Damage & Repair in Human Health	4		4
LAS.703	Advances in Molecular Cell Biology	4		4
LAS.704	Neuroendocrinology	4		4
LAS.705	Parasites & Vectors	4		4
	Total Credits			20

L: Lectures; P: Practical; Cr: Credits

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LAS.701: Research Methodology & Biostatistics **4 credits**

Unit	Syllabus	Lectures
1.	**General Principles of Research & Statistics:** Meaning and importance of research, Critical thinking, Formulating hypothesis and development of research plan, Review of literature, Interpretation of results and discussion. Technical writing: Scientific writing, Writing synopsis, Research paper, Poster preparation, oral presentations and Dissertations, Difference between parametric and non-parametric statistics, Univariant and multivariant analysis, Confidence interval, Errors, Levels of significance, Hypothesis testing. Measures of central tendency and dispersal, Histograms, Probability distributions (Binomial, Poisson and Normal), Sampling distribution, Kurtosis and skewness.	18
2.	**Comparative Statistics:** Comparing means of two or more groups: Studentôs t-test, Paired t-test, Mann-Whitney U-test, Wilcoxon signed-rank, One-way and two-way analysis of variance (ANOVA), Critical difference (CD), Fisherôs LSD (Least significant difference), Kruskal-Wallis one-way ANOVA by ranks, Friedman two-way ANOVA by ranks and Chi-square test.	16
3.	**Regression and Correlation:** Standard errors of regression coefficients, Comparing two regression lines, Pearson Product - Moment Correlation Coefficient, Spearman Rank correlation coefficient, Power and sampling size in correlation and regression.	16
4.	**Introduction and Principles of Good Lab Practice:** Good laboratory practices, Biosafety for human health and environment. Biosafety issues for using cloned genes in medicine, agriculture, industry, and ecoprotection, Biological containment and physical containment, CDC Biosafety levels, Biosafety in Clinical laboratories and biohazard management, Physical, Chemical & Biological hazards, **Research ethics:** Ethical theories, Ethical considerations during research, data manipulations, subject consent, Animal testing. Animal rights, Perspectives and methodology & Ethical issues of the human genome project, Plagiarism	18

Suggested Reading:

1. Gupta, S. (2008). Research methodology and statistical techniques. Deep & Deep Publications (P) Limited, New Delhi.
2. Kothari, C. R. (2014). Research methodology (s). New Age International (p) Limited. New Delhi.
3. Sahay, Vinaya and Pradumna Singh (2009). Encyclopedia of Research Methodology in life sciences. Anmol Publications. New Delhi.
4. Kauda J. (2012). Research Methodology: A Project Guide for University Students. Samfunds literature Publications.
5. Dharmapalan B. (2012). Scientific Research Methodology. Narosa Publishing House ISBN: 978-81-8487-180-7.

6. Norman, G. and Streiner, D. (2008). Biostatistics: The Bare Essentials.3/e (with SPSS). Decker Inc. USA.
7. Rao, P. P., S. Sundar and Richard, J. (2009). Introduction to Biostatistics and Research Methods. PHI learning.
8. Christensen, L. (2007). Experimental Methodology. Boston: Allyn & Bacon.
9. Fleming, D. O. and Hunt, D.L. (2006). *Biological Safety: Principles and Practices*. American Society for Microbiology, USA.
10. Rockman, H. B. (2004). *Intellectual Property Law for Engineers and Scientists*. Wiley-IEEE Press, USA.
11. Shannon, T. A. (2009). *An Introduction to Bioethics*. Paulist Press, USA.
12. Vaughn, L. (2009). *Bioethics: Principles, Issues, and Cases.* Oxford University Press, UK.
13. WHO (2005). *Laboratory Biosafety Manual*. World Health Organization.

LAS.702: DNA Damage & Repair in Human Health **4 credits**

Unit	Syllabus	Lectures
1.	**Oxidative stress**: Chemical and biological effects, production and consumption of oxidants, antioxidants as supplements, metal catalysts and non-metal redox catalysts, and redox biology (response of various transcription factors (TFs) e.g., p53, NF-kB, AP-1, STAT3, HIF1Ŭ and Pax6/8).	18
2.	**Oxidative stress and diseases**: Contribution of oxidative stress towards development and progression of neurodegenerative diseases (Alzheimerôs, Parkinsonôs, and Huntingtonôs disease), cardiovascular diseases (Ischemia) and cancer (Lung and Pancreatic cancer).	18
3.	**DNA damage**: Sources of DNA damage (endogenous and exogenous), types of DNA damage: [i) oxidation of bases, ii) alkylation of bases, iii) hydrolysis of bases, iv) bulky adduct formation, and v) mismatch of bases].	18
4.	**DNA repair**: DNA damage-repair signalling mechanisms (role of PARP-1, XRCC1, BRCA1, p53, and DNA-PK). **Single-strand break repair (SSBR)**: emphasis on base excision repair (BER) pathway. **Double-strand break repair (DSBR)**: emphasis on non-homologous end joining (NHEJ) pathway. **DNA damage and human genetic diseases**: Comparisons between nuclear vs. mitochondrial DNA damage and repair, and pathological effects of poor nuclear DNA repair and mitochondrial DNA repair. **DNA repair modulation**: Effect of herbals on DNA repair, small molecules for cancer therapeutics, and caloric restriction for DNA repair.	18

Suggested Reading:

1. Lodish, H., Berk, A., Zipursky, SL., Matsudaira, P., Baltimore, D., Darnell, J. (2008), Molecular Cell Biology. Freeman, HW.
2. Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K. and Walter, P. (2007), Molecular

biology of the cell. Garland publishing.
3. Watson, J. D., Baker, TA., Bell, SP., Gann, A., Levine, M., Losick, R. (2008), Molecular Biology of the Gene. CSHL Press.
4. DNA Repair and Human Health. (2011), Edited by Sonya Vengrova, ISBN 978-953-307-612- InTech.
5. Heydari, AR., Unnikrishnan, A., Lucente, LV., Richardson, A. (2007), Caloric restriction and genomic stability. *Nucleic Acid Research*.
6. Hegde, ML., Mantha, AK., Hazra, TK., Bhakat, KK., Mitra, S., Szczesny, B. (2012), Oxidative genome damage and its repair: Implications in aging and neurodegenerative diseases. *Mech Ageing Dev*. 133(4):157-168.
7. Helleday, T., Petermann, E., Lundin, C., Hodgson, B., Sharma, RA. (2008), DNA repair pathways as targets for cancer therapy. *Nature Reviews Cancer* **8**, 193-204.

LAS.703: Advances in Molecular Cell Biology **4 credits**

Unit	Syllabus	Lectures
1.	**DNA Biology:** DNA topology and chromatin structure which affects the processes of DNA replication, repair, and transcription. Alternative DNA structures; Triplex-, G-quadruplex, cruciform-DNA,how these DNA structures induces DNA damage, repair, and genetic instability and various diseases.The molecular mechanisms by which protein complexes repair different forms of DNA damage.	18
2.	**RNA Biology:** Types of RNAs and Non-coding RNA; miRNA, piRNA, long non-coding RNA, etc.Biological roles of non-coding RNAsand regulation of gene expression by non-coding RNA in cancer and other diseases.RNA binding proteins in cancer, Epigenetic mechanisms and how they affect gene expression which leads to disease conditions.	18
3.	**Cancer & Signalling Pathways**: Cancer associated Signalling pathways; Akt Signaling, MAP kinase Signaling, PARP, apoptosis, p53 signaling, Caspase Signaling, NF-kB Signaling, JAK, STAT3 pathways, PTEN, mTOR signaling pathway, Wnt signaling pathways,VEGF signaling pathway,Toll-like receptor signaling pathway.	18
4.	**Advanced molecular cell biology techniques:** Chromatin-immunoprecipiation assays, DNA-footprinting, gel-shifts assays, Southern blotting, Northern blotting, Western blotting, antibody production, Co-immunoprecepitation, in vitro translation, yeast two hybrid system, DNA sequencing, PCR, genomics, microarrays, proteomics, cells transfection, RNA-Seq, Flow-cytometry, fluorescence microscope.	18

Suggested Reading:

1. Jan Barciszewski, (2003) Non-Coding RNAs: Molecular Biology and Molecular Medicine, Springer Publisher.
2. Ondrej Slaby, (2012) MicroRNAs in Solid Cancer: From Biomarkers to Therapeutic Targets (DNA and RNA: Properties and Modifications, Functions and Interactions, Recommendations and Applications), Nova Science Publishers.
3. Lauren Pecorino (2012) Molecular Biology of Cancer: Mechanisms, Targets, and Therapeutics, Oxford Edition.
4. Bruce Alberts (2008) Molecular Biology of the Cell, Garland Science
5. Lewis C. Cantley, Tony Hunter, Richard Sever (2014) Signal Transduction: Principles, Pathways, and Processes, Cold Spring Harbor Laboratory Press.

LAS.704: Neuroendocrinology **4 credits**

Unit	Syllabus	Lectures
1.	**Aims and Scope of Neuroendocrinology:** General introduction to hormone, neurosecretions. Hormonal mechanism of integration, neuroendocrine system and neurosecretion. Concept of brain plasticity, neuroendocrine integration, master Gland, hormones of Pituitary, hypothalamic hormones, metabolic disorders like obesity, diabetes etc.	18
2.	**Male Reproductive System:** Testis structure, spermatogenesis, paracrine and autocrine regulation. Concept of seasonal breeding. The feedback mechanism of hormonal regulation, hormonal assay by ELISA, RIA.	16
3.	**Female reproductive system:** Ovary structures, Origin of GnRH cells, migration and site of release, reproductive cycles in females. Chemotrophic factors involved during early GnRH development and adult GnRH System. Interplay of hormones during Reproductive cycle.	18
4.	**Hypothalamic pituitary disorders:** Sterility: Male and Female, regulation of male and female fertility. Puberty and mechanism of puberty, reproductive disorders like IHH and Kallmann syndrome, precocious puberty.	18

Suggested Reading:

1. Norris, D.O., and Carr, J.A. *Vertebrate endocrinology*, 5th Edition. Academic Press, 2012. Nelson, David L., and Cox, Michael M., *Lehninger Principles of Biochemistry*, 5th Edition. WH Freeman & Company, New York, 2008.
2. Widmaier, E.P., Raff, H., and Strang, K.T. *Vander's Human Physiology*, 13th Edition. McGraw-Hill Higher Education, 2013.
3. Lodish, H., Berk, A., Kaiser, C.A., Krieger, M., Bretscher, A., Ploegh, H., Amon, A., and Scott, M.P. *Molecular Cell Biology*, 7th Edition. W.H. Freeman, 2012.
4. Rhoades, R.A., Tanner, G.A., Medical Physiology, 2nd ed., Lippincott Williams and Wilkins, 2003.

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LAS.705: Parasites & Vectors **4 credits**

Unit	Syllabus	Lectures
1.	**Important Vectors of Human Disease:** Morophology, Taxonomy, Geographical distribution, Epidemiology & Socio-Economic impact, Sampling & Identification.	18
2.	**Parasite Biology:** Structure, growth, Development, Genetics, Ecology and Evolution, Clinical Parasitology.	18
3.	**Vector Biology:** Vector life cycles & Nutrition, Blood meal digestion & Peritrophic membrane, Midgut & Salivary gland, Nervous system & Host seeking behavior, Hormones & Reproduction, Oxidative stress, Vector immunity, & Gut microbiome.	18
4.	**Vector-Parasite Interactions:** Transmission with reference to malaria parasite, Arboviral vector transmission, Genomic and Proteomic advances, Online resources, Vector control strategies & Disease control programs, Vaccine and Drug development.	18

Suggested Reading:

1. Beaty, B.J. & Marquardt, W.C. (1996) *The Biology of Disease Vectors*. Colorado University Press.
2. Lehane, M.J. (2005) *Biology of Blood-sucking in Insects*. Cambridge University Press.
3. Despommier, D.D., Gwadz, R.G., Hotez, P., Knirsch, C. (2006). *Parasitic Diseases,* Apple Trees Productions, LLC, Pub., New York , NY. 5th edition. Second printing.
4. Roberts, L.S. & Janovy, J. (2009). *Gerald D Schmidt & Larry S Roberts' Foundations of Parasitology.* 8th edition. McGraw Hill Higher Education.
5. Beaver P.C., Jung, R.C. & Cupp, E.W. (1984) *Clinical Parasitology*. Lea & Febiger, 9th edition.
6. Zeibig, E. (2012) *Clinical Parasitology: A Practical Approach*. 2nd edition. Saunders. ISBN-10: 1416060448 ISBN-13: 978-1416060444.
7. Peters, W. & Pasvol, G. (2002) *Color Atlas of Tropical Medicine and Parasitology*, Elsiever, London, 5th edition.