

S.R.R&C.V.R Govt. Degree College

DEPARTMENT OF BIOCHEMISTRY

BOARD OF STUDIES- AY 2019-20

DATE - 28/08/2019



For MBC program

BIOCHEMISTRY SYLLABUS FOR VI SEMESTER

BIOCHEMISTRY ELECTIVE PAPER - VII(A)

HUMAN PHYSIOLOGY AND CLINICAL BIOCHEMISTRY

Periods: 45

Max. Marks: 60

UNIT-I: Blood and Cardiovascular physiology

- 1.1 Composition of blood
- 1.2 Transport of gases in blood (O_2 and CO_2).
- 1.3 Molecular mechanism of blood coagulation, anticoagulants.
- 1.4 Heart- structure of the heart, cardiac cycle.

UNIT-II: Gastrointestinal and Renal physiology

- 2.1 Digestion and absorption of carbohydrates, lipids and proteins, digestive enzymes.
- 2.2 Metabolic importance of liver.
- 2.3 Structure of Kidneys, structure and function of Nephron
- 2.4 Mechanism of Urine formation-GFR, Tubular reabsorption & secretion

UNIT-III: Muscle and Neuronal physiology

- 3.1 Types of neurons, generalized structure of multipolar neuron.
- 3.2 Neurotransmission, Resting membrane potential, Action potential, Transmission of nerve impulse along an axon and across a synapse.
- 3.3 Classification of neurotransmitters (inhibitory and excitatory).
- 3.4 Types of muscle tissues- skeletal, smooth, and cardiac.
- 3.5 Mechanism of muscle contraction

UNIT-IV: Clinical biochemistry - I

- 4.1 Types of anaemias-iron deficiency anaemia, megaloblastic anaemia, haemophilia, sickle cell anaemia.
- 4.2 Hypertension, Congestive Heart Disease, Atherosclerosis.
- 4.3 Urine: Normal composition of urine-volume, pH, colour, specific gravity. Normal constituents-urea, uric acid, creatinine. Abnormal constituents of urine-glucose, albumin, ketone bodies, variations in urea, creatinine and their clinical significances in brief.

UNIT-V: Clinical biochemistry - II

- 5.1 Diagnostic enzymes: enzymes in health and diseases. Biochemical diagnosis of disease by enzyme assays- SGPT, SGOT, alkaline phosphatase, CPK, cholinesterase, LDH.
- 5.2 Liver function tests- conjugated and total bilirubin in serum, albumin: globulin ratio
- 5.3 Renal function tests- creatinine and urea clearance tests, phenol red test.
- 5.4 Glomerular nephritis, renal failure and Dialysis.

Suggested Readings:

1. Human Physiology, Vol. I & II, - C. C. Chatterjee - Medical Allied Agency - Calcutta.
2. Concise Medical Physiology - Choudhary - New Central Book Agency - Calcutta
3. TextBook of Medical Physiology - Guyton - Prism Books Pvt. Ltd. - Bangalore.
4. Harper's Biochemistry - Murray, Granner, Mayes, and Rodwell - Prentice Hall International Inc.
5. Textbook of medical physiology: A. C. Gyton, and J. E HallSaunders
6. Elsevier Publications, A division of Reed Elsevier India Pvt .Ltd. New Delhi ISBN 81-8147-084-2
7. Human physiology: Chatterjee, Medical Allied Agency.

BIOCHEMISTRY PRACTICAL SYLLABUS FOR V SEMESTER

BIOCHEMISTRY - ELECTIVE PAPER – VII(A)

HUMAN PHYSIOLOGY AND CLINICAL BIOCHEMISTRY (PRACTICALS)

1. Haematology.
 - a. RBC and WBC counting.
 - b. Differential leukocyte count.
 - c. Clotting time.
2. Separation of plasma proteins.
3. Urine analysis for albumin, sugars and ketone bodies.
4. Estimation of urinary creatinine.
5. Estimation of blood Glucose.
6. Estimation of serum total cholesterol.

BIOCHEMISTRY SYLLABUS FOR VI SEMESTER

BIOCHEMISTRY ELECTIVE PAPER - VII(B)

NUTRITION AND HEALTH

Periods: 45

Max. Marks: 60

Unit -I: Nutritional Biochemistry - I

- 1.1 Balanced diet.
- 1.2 Calorific values of foods and their determination by bomb calorimeter.
- 1.3 Specific dynamic action of foods.
- 1.4 BMR and factors affecting it.
- 1.5 BMI & its determination.

Unit- II: Nutritional Biochemistry - II

- 2.1 Recommended dietary allowance (RDA) for children, adults, Pregnant and lactating women.
- 2.2 Biological value of proteins.
- 2.3 Malnutrition- Kwashiorkor, Marasmus and PEM.
- 2.4 Obesity and starvation.
- 2.5 Diabetes mellitus (Type I and Type II)

Unit- III: Sources, structure, biochemical roles, deficiency disorders

- 3.1 Fat soluble vitamins: A, D, E, K
- 3.2 Water soluble vitamins: thiamine, riboflavin, niacin, pyridoxine, folate, Vitamin B12, vitamin C.
- 3.3 Ca, P, Fe, Zn, Cu their distribution in the body, Digestion, Absorption, Utilization, Transport, Excretion, Balance, Deficiency, Toxicity, Sources, RDA.
- 3.4 Iodine, Fluoride, Mg, Se, Manganese, Molybdenum, their distribution in the human body. Physiology, Function, deficiency, Toxicity and Sources.

Unit- IV: Life style diseases

- 4.1 Hypertension
- 4.2 Metabolic syndrome
- 4.3 Fluorosis
- 4.4 Effect of Smoking
- 4.5 Effect of Alcoholism

Unit- V: Food Adulteration

- 5.2 Adulterants in commonly consumed food items
 - 5.3 Accidental contamination: botulism, staphylococcal and aflatoxin intoxication
 - 5.4 Importance of food labels in processed foods and nutritional labelling
 - 5.5 Food laws, regulations and standards
- ☐ Prevention of Food Adulteration (PFA) Act
 - ☐ Agmark
 - ☐ Fruit Products Order (FPO)
 - ☐ Meat Products Order (MPO)
 - ☐ Bureau of Indian Standards (BIS)
 - ☐ MMPO
 - ☐ FSSAI

Suggested Readings:

1. Nutritional Biochemistry -- MS Swaminathan (2015)
2. Nutrition and Dietetics by Davidson S and Pasmore JR (2001)
3. Food science by B. Sreedakshmi (2010)
4. Food facts and principles -- Sakunthala Manay. Sachinshara Swami (2008)

BIOCHEMISTRY PRACTICAL SYLLABUS FOR VI SEMESTER

BIOCHEMISTRY ELECTIVE PAPER – VI(B)
NUTRITION AND HEALTH PRACTICES

1. Determination of moisture content of food
2. Determination of Vitamin C content in lemon juice
3. Estimation of amino acid by titration
4. Determination of saponification value of oil
5. Determination of iodine value of oil
6. Estimation of reducing sugars by Hedgedon & Jesson method
7. Estimation of minerals in food samples

BIOCHEMISTRY SYLLABUS FOR VI SEMESTER
BIOCHEMISTRY CLUSTER PAPER: VHEA-1
CLINICAL MICROBIOLOGY

Periods: 45

Max. Marks: 60

Unit-I Introduction to microscopy and bacteria

- 1.1 Microscopy (Bright field, Dark field, Phase contrast and Fluorescence microscopy)
- 1.2 Classification of bacteria
- 1.3 Morphology of bacteria
- 1.4 Sterilization techniques-(physical agents & chemical agents)
- 1.5 Staining of micro-organisms - principle and procedure of gram stain and acid fast stain.

Unit-II Microbial nutrition

- 2.1 Nutritional requirements of bacteria
- 2.2 Different types of media for growing bacteria and fungi.
- 2.3 Bacterial Growth curve
- 2.4 Batch and continuous culture
- 2.5 Growth of micro-organisms, factors influencing growth – Nutrition, carbon source, nitrogen source, temperature, pH and oxygen.

Unit-III Bacterial diseases

Infection and pathogenicity, diagnostics, therapeutics and vaccines, drug resistance.

- 3.1 Typhoid.
- 3.2 Botulism.
- 3.3 Tuberculosis.
- 3.4 Cholera.

Unit – IV Viral diseases

- 3.1 Classification of viruses based on genetic material
- 3.2 Structure and composition of viruses
- 3.3 Isolation and cultivation of viruses.
- 3.4 AIDS: history, causative agent, pathogenesis, diagnostics, drugs.
- 3.5 Other viral diseases such as Hepatitis, Rabies and Polio-History, causative agent, pathogenesis, diagnostics, drugs

Unit-V Host pathogen interactions, antibiotics and toxins

- 4.1 Host pathogen interactions of bacteria
- 4.2 Virulence factors and host pathogen interactions of viruses
- 4.3 Bacterial toxins, enterotoxins and their mode of action.
- 4.4 Antibiotics: Definition, mechanism of action of penicillin streptomycin, and chloramphenicol, antibiotic resistance in brief.

Suggested readings:

- 1. Jawetz, Melnick and Adelbergs Medical Microbiology 27th ed., McGraw Hill Education
- 2. Klien's Microbiology (2008) 7th ed., Prescott, Harley, Wiley, J.M., Sherwood, L.M., Woollverton, C.J, McGraw Hill International Edition (New York)
- 3. Sherris Medical Microbiology: An introduction to infectious diseases (2010). Kenneth J. Ryan, C. George Ray, Publisher: McGraw-Hill.

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BIOCHEMISTRY SYLLABUS FOR VI SEMESTER

BIOCHEMISTRY CLUSTER PAPER: VIIA-1

CLINICAL MICROBIOLOGY PRACTICALS

1. Grams staining for bacteria
2. Isolation and culture of bacteria from water/sewage samples.
3. Demonstration of various media for bacterial culture.
4. Isolation and enumeration of bacteriophages (PFU) from water/sewage samples
5. WIDAL test
6. Acid fast staining
7. Permanent slides of pathogens: Mycobacterium tuberculosis, Leishmania, Plasmodium falciparum.

BIOCHEMISTRY SYLLABUS FOR VI SEMESTER
BIOCHEMISTRY CLUSTER PAPER – YHFA-2)
BIOCHEMICAL CORRELATIONS IN DISEASES

Periods: 45

Max. Marks: 60

Unit I Inborn errors of metabolism & Hormonal Imbalances

- 1.1 Inborn errors in amino acid metabolism: Phenylketonuria, alkaptonuria, albinism, tyrosinosis, maple syrup urine disease, Lesch-Nyhan syndrome.
- 1.2 Disorders of Carbohydrate Metabolism – glycogen storage diseases, pentosuria, galactosemia.
- 1.3 Disorders of Lipids – Hypertlipidemia, hyperlipoproteinemia, Gaucher's disease, Tay-Sach's and Niemann-Pick disease, ketone bodies.

Unit II Nutritional deficiency based diseases and Life style diseases

- 1.1 Kwashiorkor, Marasmus, Beri-beri, Scurvy, Pellagra, Anaemia
- 1.2 Night blindness, Rickets, Osteomalacia, Osteoporosis
- 1.3 Obesity, Cardiovascular diseases, Atherosclerosis
- 1.4 Diabetes mellitus-II.
- 1.5 Wilson's disease, Inflammatory Bowel Disease (IBD).

Unit III Autoimmune diseases

- 1.1 Concepts in immune recognition - self and non self discrimination
- 1.2 Organ specific autoimmune diseases – Hashimoto's thyroiditis, Grave's disease, myasthenia gravis.
- 1.3 Systemic diseases - SLE, rheumatoid arthritis, Diabetes Mellitus-I.

Unit IV Diseases caused due to misfolded proteins and Biochemistry of Cancer

- 1.1 Alzheimer's, Huntington's disease, Kurt, Creutzfeldt-Jakob disease
- 1.2 Sickle-cell anaemia, Thalessemia.
- 1.3 Cellular differentiation in cancer, carcinogens and cancer therapy

Unit V Metabolic disorders

- 5.1 Digestive diseases – Maldigestion, malabsorption, creatorrhoea, diarrhoea and steatorrhoea.
- 5.2 Disorders of liver and kidney – Jaundice, fatty liver, introduction to nephritic and nephrotic syndrome.
- 5.3 Abnormalities in Nitrogen Metabolism – Uremia, hyperuricemia, porphyria.
- 5.4 Haemorrhagic disorders – Haemophilia, von Willebrand's disease.

Suggested readings :

- 1. Biochemistry (2013) 4th ed., Voet, D., Voet, J. & Pratt, C. Wiley & Sons, Inc. (New Jersey), ISBN: 978-1-11809244-6.
- 2. Biochemistry (2012) 7th ed., Berg, J.M., Tymoczko, J. L. and Stryer, L., W.H Freeman and Company (New York)
- 3. Textbook of Biochemistry with Clinical Correlations (2011) Deylin, T.M., John Wiley & Sons, Inc. (New York)
- 4. Klein's Microbiology, (2008) 7 ed., Prescott, Harley, Wiley, J.M. Sherwood, L.M. Woolverson, C.J. McGraw Hill International Edition (New York) ISBN: 978-007-126727.

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BIOCHEMISTRY SYLLABUS FOR VI SEMESTER

BIOCHEMISTRY CLUSTER PAPER – VII(A-2)
BIOCHEMICAL CORRELATIONS IN DISEASES PRACTICES

1. Glucose tolerance test.
2. Lipid profile: triglycerides and total cholesterol.
3. Obesity parameters.
4. RBC counting and haemoglobin estimation.
5. Blood pressure measurements.
6. Bone density measurements (visit to a nearby clinic).
7. T4/TSH assays

BIOCHEMISTRY SYLLABUS FOR VI SEMESTER

BIOCHEMISTRY CLUSTER PAPER: VIIIA-3

HAEMATOLOGY

Periods: 45

Max. Marks: 60

Unit – I: Laboratory Preparation in Haematology:

- 1.1 Introduction to basic requirements of Collection of blood.
- 1.2 Anticoagulants and effects of anticoagulants on blood cell morphology
- 1.3. Storage of blood.
- 1.4 Composition of blood.

Unit – II: Routine Haematology:

- 2.1 Types of haemoglobins, Haemoglobin synthesis.
- 2.2 Haemopoietic system of the body.
- 2.3 Blood cell counts, Erythropoiesis, Leucopoiesis and development of blood Corpuscles, Thrombopoiesis.
- 2.4 Laboratory technique of haemocytometry, Clinical significance of Total erythrocyte count, total leucocyte count, differential count.
- 2.5 Erythrocyte sedimentation rate and platelet count.

Unit – III: Haemostasis and Haematological Diseases:

- 3.1 General consideration of blood coagulation. Clinical significance of routine coagulation tests.
- 3.2 Mechanism of coagulation. The fibrinolytic Mechanism
- 3.3 Anaemia, Various types of anaemias – Iron deficiency anaemia, Aplastic anaemia, Pernicious anaemia, Sideroblastic anaemia and Sickel cell anaemia, Other haematological diseases – HDNB, Thalassemia, Leukacmia.
- 3.4 Inherited disorders of coagulation: Haemophilia A, Haemophilia B
- 3.5 Inherited disorders of fibrinogen.

UNIT- IV: Automation in Haematology:

- 4.1 General considerations.
- 4.2 Blood cell counters.
- 4.3 Flow through cytochemical differential counter.
- 4.4 Automated coagulation systems.
- 4.5 Automated clinical analysers

Unit - V: Immunohematology and Blood banking:

- 5.1 Human blood Group systems-ABO System & Rh system
- 5.2 Inheritance of blood group systems.
- 5.3 Collection of donor blood, processing of donor blood, storage of donor blood unit
- 5.5 Blood transfusion, adverse effects of transfusion.

Suggested readings

1. Park, K. (2007), Preventive and Social Medicine, B.B. Publishers
2. Godkar P.B. and Godkar D.P. Textbook of Medical Laboratory Technology, 1st Edition, Bhilani Publishing House
3. Cheesbrough M., A Laboratory Manual for Rural Tropical Hospitals, A Basis for Training Courses
4. Guyton A.C. and Hall J.E. Textbook of Medical Physiology.
5. Robbins and Cotran, Pathologic Basis of Disease, VIII Edition.

BIOCHEMISTRY SYLLABUS FOR VI SEMESTER
BIOCHEMISTRY CLUSTER PAPER: VIIIB-1
CELL BIOLOGY

Periods: 45

Max. Marks: 60

Unit-I Introduction to cell biology

- 1.1 Origin of life, Cell theory.
- 1.2 Structure of prokaryotic and eukaryotic cell.
- 1.3 Differences between Animal and Plant cell.
- 1.4 Mycoplasma.
- 1.5 Viruses, viroids and prions.

Unit-II Structure and function of subcellular organelles –

- 2.1 Composition of biological membranes.
- 2.2 Nucleus: Structure of nuclear envelope, nuclear pore complex nucleolus and chromatin.
- 2.3 Endoplasmic Reticulum: RER - Brief overview of co-translational and post-translational transport of proteins.
- 2.4 SER – Lipid synthesis, brief overview of export of proteins from ER.
- 2.5 Golgi apparatus: organization, brief overview of glycosylation of proteins within Golgi, lipid and polysaccharide metabolism in Golgi apparatus.

Unit-III- Cell Organelles

- 3.1 Lysosomes: Different forms of lysosomes, role in cellular digestion, lysosomal storage diseases.
- 3.2 Peroxisomes: assembly, functions and Glyoxysomes.
- 3.3 Mitochondria: structure, endosymbiont theory, genome.
- 3.4 Chloroplast: structure, endosymbiont theory, genome.
- 3.5 Cell Wall: Structure of prokaryotic and eukaryotic cell wall.
- 3.6 ECM components– proteins, polysaccharides and adhesion proteins; concept of anchoring junctions, tight junctions and communication junctions (gap junctions and plasmodesmata).

Unit-IV Cytoskeleton

- 4.1. Microtubules: Axonemal and cytoplasmic microtubules (cilia, flagella, centrioles, basal bodies).
- 4.2 Microfilaments: Actin and Myosin filaments.
- 4.3 Role of cytoskeletal elements in the entry of infectious agents.
- 4.4 Cell Cycle, Cell Division (Mitosis and Meiosis).
- 4.6 Apoptosis and necrosis (brief introduction).

Unit-V Cell Fractionation techniques:

- 5.1: Centrifugation, Sedimentation Coefficient, Differential and Density Gradient (isopycnic and rate zonal) centrifugation.
- 5.2 Cell Visualization techniques: Principle of Light microscope, Phase Contrast microscope
- 5.3 Principle of Fluorescence microscope, Confocal microscope
- 5.4 Electron microscope (only principle)
- 5.5 Staining techniques for microscopy studies (light microscopy, fluorescent microscopy, electron microscopy)

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BIOCHEMISTRY SYLLABUS FOR VI SEMESTER

BIOCHEMISTRY CLUSTER PAPER: VII(B-1)

CELL BIOLOGY PRACTICALS

1. To study different parts of microscope
2. Cytochemical staining of proteins by Methylene blue
3. Cytochemical staining of polysaccharides by PAS
4. Cytochemical staining of RNA by Methyl Green
5. Study of stages of Mitosis using onion root tip
6. Study of stages of Meiosis in onion flower buds/ grasshopper testes
7. To study cell organelles using electron micrographs
8. To study the effect of isotonic, hypotonic and hypertonic solutions on cells

BIOCHEMISTRY SYLLABUS FOR VI SEMESTER

BIOCHEMISTRY CLUSTER PAPER: VIIB-2

BIOTECHNOLOGY

Periods: 45

Max. Marks: 60

Unit I Plant genetic engineering:

- 3.1 Gene isolation, gene transfer systems, Ti plasmid.
- 3.2 Plant virus vectors.
- 3.3 Gene transfer methods :Electroporation, microinjection, microprojectile technology
- 3.4 Selection and identification of transformed cells.

Unit II Uptake of DNA by cells

- 2.1 Transduction and transfection.
- 2.2 Chemical and physical methods of DNA introduction into cells.
- 2.3 cDNA and Genomic libraries.
- 2.4 Southern and Northern hybridization.

Unit 1: Principles of gene cloning:

- 3.1 Restriction and modification systems, restriction endonucleases and other enzymes used in manipulating DNA molecules.
- 3.2 DNA ligases, linkers and adapters.
- 3.3 Vectors and characteristics of Plasmids and bacteriophages, viruses as vectors (M_{13} , λ).
- Cloning vectors based on E. coli plasmids- pBR322.
- 3.4 Viruses as vectors, cloning vectors based on M13 and λ bacteriophage

UNIT 4 Protein engineering

- 4.1 Production of recombinant pharmaceuticals such as insulin, human growth hormone.
- 4.2 Recombinant vaccines.
- 4.3 Yeast two hybrid systems,
- 4.4 Production of recombinant proteins by eukaryotic cells.

Unit 5 Applied biotechnology

- 5.1 Tissue culture – brief introduction about Plant tissue culture, anther and pollen culture, protoplast culture, animal cell lines and organ culture.
- 5.2 Transgenic plants and animals
- 5.3 Fermentation technology – Fermentors, general design of fermentor, fermentation processes, production of alcohols, antibiotics.
- 5.4 Immobilized enzymes.
- 5.5 Brief introduction on Enzyme electrodes, biosensors.

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BIOCHEMISTRY SYLLABUS FOR VI SEMESTER

BIOCHEMISTRY CLUSTER PAPER: VII(B-2)

BIOTECHNOLOGY PRACTICALS

1. Agarose gel electrophoresis for separation of DNA fragments.
2. Isolation of plasmid DNA from *E. coli*.
3. Transformation of *E. coli* cells with plasmid DNA.
4. Digestion of plasmid DNA with restriction enzymes.
5. Amplification of a DNA fragment by PCR.
6. Complementation of β -galactosidase for Blue and White selection

BIOCHEMISTRY SYLLABUS FOR VI SEMESTER
BIOCHEMISTRY CLUSTER PAPER: VIII-B-3
BIOINFORMATICS AND BIOSTATISTICS

UNIT- I Introduction

- 1.1 Basics of Computer, Operating systems, Hardware, Software
- 1.2 Introduction to programming Languages and Paradigms
- 1.3 Role of supercomputers in biology
- 1.4 Introductions to bioinformatics
- 1.5 Applications of bioinformatics

UNIT- II Scope of bioinformatics

- 2.1 Genomics and Proteomics.
 - 2.1 Comparative and functional genomics
- 2.2 Genome annotation
- 2.3 Gene prediction approaches and tools.
- 2.4 Transcriptome and Proteome: Tools of proteomic analysis.
- 2.5 DNA microarray

UNIT-III Biological databases:

- 3.1 Primary, secondary and composite databases and useful programs.
- 3.2 ClustalW, BLASTp, NCBI, EBI, ExPaSy
- 3.3 Nucleic acid databases (GenBank, EMBL, DDBJ, NDB)
- 3.4 Protein databases (PIR, Swiss-Prot, TrEMBL, PDB)
- 3.5 Metabolic pathway database ((KEGG, EcoCyc).

UNIT -IV Data Collection and Presentation:

- 4.1 Biological data management using statistical tools.
- 4.2 Concepts of population and sample, advantages of sampling
- 4.3 Basic concepts in sampling and designing experiments
- 4.4 Introduction to Analysis of variance: Mean, median, mode; Co-efficient of variation and standard deviation; Range
- 4.5 Probability

UNIT -V Introduction Hypothesis testing & Regression and Correlation:

- 5.1 General concepts – Null hypothesis, alternative hypothesis. Rejection of hypothesis.
- 5.2 P value and sample-size estimation.
- 5.3 Student's t-test. Chi Square Test – Observed and expected frequencies,
- 5.4 Calculating p values, –Pearson's correlation coefficient
- 5.5 Regression- Concepts, simple linear regression; ANOVA

NOTE: From underlined concepts no questions should be given.

Suggested readings:

1. Bioinformatics – 2008. Principles and Applications , 1st ed. Ghosh, Z. and Mallick, B., Oxford University Press (India),
2. M. Michaël Gromiha, 2010. Protein Bioinformatics: From Sequence to Function, Academic Press.
3. Bioinformatics: Sequence and Genome Analysis (2001), 1st ed., Mount, D. W. Cold Spring Harbor Laboratory Press (New York)
4. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins (2005), 3rd ed., Baxevanis, A.D. and Ouellette, B.F., John Wiley & Sons, Inc.(New Jersey).
- 5.1. Principles of Biostatistics, M. Pagano and K. Gauvreau (2000); Duxbury Thomas learnings.
2. Analysis of Biological Data, M. Whitlock and D. Schluter (2009); Roberts and company publishers