

Unit 1: Introduction to Fish Health and Pathology

Definition of health and disease in fish: Pre-disposing factors, biotic and abiotic factors, stress and general adaptation syndrome; Host-pathogen-environment interaction; Role of physical (injuries, health, cold), chemical (pH, salinity, toxins, ammonia, nitrogenous waste, endogenous chemical metabolites, free radicals, oxidants), soil and water parameters in fish health; General pathology: Degeneration, cellular adaptation and abnormalities; Neoplasms: Etiology, classification, morphology and behaviour; Inflammation and cell death; Wound healing and tissue repair; General anatomy and systemic pathological changes caused by viral, bacterial and parasitic diseases in finfish and crustaceans.

Unit 2: Diseases of Fish & Shellfish

Major bacterial (furunculosis, aeromoniasis, columnaris disease, bacterial gill disease, vibriosis, mycobacteriosis, nocardiosis, haemophilosis, edwardsiellosis, enteric red mouth, pasteurellosis, pisci rickettsiosis, streptococcosis and clostridium disease, bacterial diseases of shellfish such as vibriosis, AHPND, necrotizing hepatopancreatitis, rickettsial diseases, mycobacteriosis), viral (Epizootic Haematopoietic Necrosis (EHN), Infectious Haematopoietic Necrosis (IHN), Oncorhynchus Masou Virus (OMV), Viral Encephalopathy and Retinopathy (VER), Spring Viraemia of Carp (SVC), Viral Haemorrhagic Septicaemia (VHS), Lymphocystis, Koi Herpes Virus (KHV), infectious salmon anaemia, salmonid alphavirus and red seabream iridoviral disease, WSSV, YHV, TSV, IHHNV, MBV, HPV, BP, BMN, LSNV, GAV, MrNV & XSV, infectious myonecrosis virus), fungal (Aphanomycosis, cotton wool disease, branchiomycosis, & aspergillosis), parasitic and non-infectious diseases of fish and shellfish in aquaculture systems; Common bacterial infections in fish and shellfish: Epidemiology, virulence and pathogenesis of major bacterial infections; Fungal pathogens of shellfish viz., *Lagenidium*, *Sirolopidium*, *Fusarium*; Classification of viruses, virus genome, replication of virus, virus-host relationships, molecular pathogenesis, major viruses infecting fish and shellfish and their pathogenesis, epidemiology; Virus isolation using cell lines, new antiviral compounds, virus and gene therapy; Life cycle, host-parasite relationship, treatment and control measures of important ecto- and endo-parasites infecting fish and shellfish; Fish-borne parasitic zoonoses; Patho-epizootiology, treatment and control of mycotoxicosis, EUS, saprolegniasis and other fungal pathogens of fish and shellfish.

Unit 3: Disease Diagnosis

Principles of disease diagnosis, specificity and sensitivity and efficiency of diagnostic techniques, conventional and rapid diagnostic methods of bacterial, viral, fungal, parasitic, non-infectious diseases of finfish and shellfish; Conventional clinical pathology and diagnosis of disease: Principles of sampling, sampling methodologies, physical examination, necropsy, hematology, clinical chemistry, microbiology and histopathology; Clinical laboratory examination of various biomaterials from fish and shellfish, normal picture of blood, serum

enzymology, disorders and their interpretations, examination of skin scrapings, gill, internal organs, other tissues, various immunological, serological and molecular diagnosis using PCR, RT-PCR, and real time PCR, LAMP, RPA, hybridization techniques, micro-arrayetc., and the principals involved in ELISA; Immunoperoxidase, immunochromatography, monoclonal antibody production, mAb-based diagnosis; Primer designing for probes; Cell lines and their use in viral diagnosis: Virus isolation, TCID50, electron microscopy, virus-neutralization test.

Unit 4: Defence System

Immune systems in fish: Organization and ontogeny of lymphoid system in fish, haematopoiesis; Innate and acquired immunity, antibody and cell mediated immunity in fish; Shellfish immune system: Organization, humoral and cellular factors and quasi immune response, trans-generational immune priming; Antigens: Structure and classification, antigen presentation, MHC restriction; Antibodies: Structure and types of antibodies, T-dependent and independent antibody production, antigen-antibody reactions, antibody class-switching; Immune response: Non-specific and specific, abnormalities in cell growth(aplasia, hypoplasia, atrophy, metaplasia, and dysplasia), macrophages, phagocyte systems, TOLL link receptors, RES, ROS, antigen presenting cells, non-specific humoral responses (complement system, lectins, antimicrobial peptides), B-cell and T-cell mediated immune response, subsets and nature of receptors, autoimmunity, immunological tolerances; Tumours and neoplasm growth, etiology, classification, morphology and behaviour, structure of tumour cell, tumour immunology, tissue responses to tumours, pathological features of neoplasms.

Unit 5: Disease Prevention and Control

Disease prophylaxis and therapeutics: Use of chemicals, antibiotics, conventional vaccines, viral vaccines, new antiviral compounds, prebiotics & probiotics, biochemical applications in disease control, DNA and RNA vaccines, recombinant vaccines, use of RNA interference, virus and gene therapy, SPF & SPR broodstock, certification, surveillance and reporting; Quarantine, biosecurity; Disease control through environmental management; Fish pharmacology: Principles, action mechanism of pharmacological agents of aquaculture importance, drug metabolism and regulation, drug application in aquaculture systems.