

## **Brief history of the development of the Programme /Sub-discipline/Discipline to be accredited.**

When the University started in 1962, the degree Programme offered by the department was in the form of a three-year combined Honours degree Programme s with each candidate taking three suitable subjects in the first year and two main subjects plus a subsidiary subject in the second and third years. One such combined degree structure was as follows:

1st year: Botany, Zoology, Chemistry

2nd year: Botany, Zoology, subsidiary chemistry

3rd year: Botany, Zoology, subsidiary Biochemistry

The main subject combinations were Bot/Zoo., Bot/Chem., Zoo/Chem, Bio/Geog and the subsidiary was the third subject offered in the 1st year and/or one closely related to it. A Biology/Education combination was also offered in the late 60s in conjunction with the Faculty of Education. The rationale for the combined honours broad-based degree Programme of the department was to produce graduates that would be very useful to society, especially as science teachers in secondary and lower tertiary institutions. The combined honours Programme was run for the first and second batches of graduates (1965 and 1966). However, due to pressure from the students and a review of the university's policies, single Honours degree Programme s (in the areas of Botany and Zoology) were started in 1967. The Biology single Honours Programme was introduced later.

Since inception the fundamental philosophy and objective of the three single Honours degree Programme s has been the provision of broad-based training as against extreme specialization. Thus, prior to the introduction of the 4-year degree Programme , all students irrespective of whether they were reading Botany, Biology and Zoology, had to take the same courses in Parts I and II of the then 3-year Programme s. Only in the final year were any specialist options allowed. This policy has been maintained in the current 4-year degree Programme where all students irrespective of their degree option take the same courses in the first and second (i.e., 100-Level and 200-Level) years of study.

It is important to mention that the Department of Biological Sciences is one of the two science-based departments in the university that run three undergraduate degree Programme s (namely, B.Sc. Biology, B.Sc. Botany, and B.Sc. Zoology). The department also offers service courses to the Faculties of Medicine, Veterinary Medicine, Pharmacy, Agriculture, Education, and some other departments of the Faculty of Science. Furthermore, the science component of the B.Ed. and B.Sc. (Education Biology) Programme s of the Faculty of Education depend mainly on courses offered by the Department for the science component of those Programme s.

The B.Sc. Zoology degree Programme of the department received full accreditation in the 2006 Accreditation Exercise.

### **Philosophy of the Programme**

The main philosophy of the B Sc. Zoology Programme is to contribute to meeting the general educational objectives of Ahmadu Bello University and the Nigerian Nation, which include the acquisition and spread of knowledge, and the promotion of research and

education, (*with emphasis on Zoology as an important component of the Biological Sciences*). The Programme is designed not only to satisfy the intellectual demands of the students but also to facilitate their acquisition of basic and specialist science skills that instill qualities of self-confidence and self-reliance, so that the products of the degree Programme s can play active and informed roles in personal, community, national and international development strategies.

Since a broad and interdisciplinary orientation can hardly go with extreme specialization, the Programme is designed to discourage over-specialization by allowing for sufficient choice of electives within and outside each Programme. The recommended electives for the Programme have therefore been deliberately chosen to ensure relevance not only to academic content of each Programme, but also to endow the products of the Programme with the knowledge that will enable them make valuable contributions to contemporary biological issues of national and international interest.

This strategy has broadened the employment opportunities of our graduates as they are better prepared after training to establish as private entrepreneurs, or take up employment in Parks and nature reserves as conservationists; in Research Institutes as trainee scientists; in tertiary institutions as research scientists and teachers, and in Government Ministries as technocrats. These are in addition to their general availability as Science Teachers in secondary schools.

### **Objectives**

In pursuit of the general objective of producing these self-reliant young biological scientists and contributing to scientific knowledge, the following are the specific academic objectives of the B.Sc. Zoology degree Programme:

- To train academically sound future researchers and intellectuals in the area of general biology, with emphasis in areas on the cutting edge of modern biology, e.g., Molecular biology, Biotechnology, Genetics, Cytology, Cell and Tissue Culture, and Environmental Conservation.
- To contribute to discoveries and innovations in these aspects of the biological science discipline through research.
- To provide expert counsel and consultancy services to national and international organizations on issues relating to Zoology.
- To instill qualities of self-confidence and self-reliance in animals in prospective young Nigerian biologists.

Some graduates of the Biology Programme have been known to enroll in the MBBS and other medical and applied biology Programme s in furtherance of their carrier in the biological sciences.

### **(a) Admission Requirements:**

For admission to any of the three degree Programme in the Department of Biological Sciences, a student must satisfy the minimum University/Faculty of Science requirements of

a credit in Biology and credits in at least four other subjects including Chemistry, Physics, English and Mathematics at the GCE 'O' level or SSCE. Students that have successfully completed remedial Programmes that are approved by the University Senate and meet the GCE "O"-Level/SSCE requirements are also offered admission.

For direct entry admission into the 200 Level of study, a prospective candidate must satisfy the requirements stated above and in addition possess two or more G.C.E. A-Level papers (or its equivalent), which must include Biology and Chemistry.

#### Details of the Contents of course Units Offered By the Department

1. BIOL 111 – Plant Biology:

Principal groups of plants, representative life cycles, form and function, physiology & modes of nutrition, reproduction, growth and development (2 credit units).

2. BIOL 112 – Ecology:

Basic biological concepts, theories and principles of ecology, energy flow in the ecosystem, trophic levels and biogeochemical cycles, types of habitats, simple treatment of interactions between organisms (symbiosis), pollution and explanation of pollution terms; sanitation and sewage treatment, conservation needs and methods of conserving natural resources, soil and its components, effects of humans on the environment. (2 credit units).

3. BIOL 113 – Animal Biology:

History and scope of zoology, invertebrate and vertebrate structures, function and levels of organization including physiology, nutrition, respiration, excretion, circulatory systems, hormones and reproduction (2 credit units).

4. BIOL 114 – Introductory Evolution and Genetics:

The cell concept, ultrastructure of the cell, mitosis and meiosis. Chromosomes; genes; their relationships and importance, Mendelian laws, explanation of key genetics terms e.g. genotype, phenotype, heterosis/hybridity, dominance, alleles etc., concept of multiple alleles (e.g. blood groups), sex linkages and sex linked characters, mutation (including their advantages and disadvantages), gene expression. General importance and application of genetics in agriculture and medicine (2 credit units).

5. BIOL 211 – General Ecology:

Relationships between individuals or groups within a species, and between individuals or groups of different species (symbiosis), some aspects of applied ecology e.g. biological control, game and rangeland management, population dynamics: growth survivorship curves, life tables, age structure, carrying capacity and environmental resistance; the ecology of humans: resources, pollution, population. (2 credit units; Prerequisite – BIOL 112).

6. BIOL 212 – General Physiology:

Chemicals of life: aspects of the chemistry of organic compounds of biological importance, general characteristics of enzymes; nutrition, digestion and absorption in animals; biological oxidation; composition, structure, properties and functions of proteins, lipids, carbohydrates and nucleic acids. Biosynthesis: photosynthesis and protein synthesis. Cell membrane

structure and function. (3 credit units; Prerequisites – BIOL 111, 113)

7. BIOL 213 – Biological techniques:

Handling and care of microscopes, hand lens; microscopic examination of marials; hand sectioning, care and uses of biological tool kits and simple physiological apparatus; dissection guides, biological illustrations. (2 credit units; Prerequisite – None, except 200 Level standing).

8. BIOL 214 – General Genetics:

Chromosomal basis of inheritance; cytoplasmic inheritance; fertilization and genetic interactions; chemical basis of inheritance (DNA, RNA); Genetic linkage and recombination; mutation, cytogenetic effects of radiation and chemical agents. (2 credit units, Prerequisite – BIOL 114).

9. BIOL 215 Biological Nomenclature and Taxonomy:

Historical background, pre-Linnean, Linnean and Darwinian, taxonomic hierarchies; species concept, categories below species, and categories above species; biological nomenclature, new systematics; numerical and biochemical taxonomy, keys and keying. (2 credit units, Prerequisites – BIOL 111 and BIOL 113).

10. BIOL 216 Hydrobiology:

Principles of aquatic biology with particular reference to limnology, the physical properties of water and their biological significance, thermal stratification of lakes, waves and currents and their effects on substratum, dissolved oxygen and carbon dioxide and inorganic ions in freshwater, the carbonate-bicarbonate system and pH, eutrophic and oligotrophic lakes, the chemical composition of African lake waters, freshwater communities, factors influencing the distribution and productivity of aquatic macrophytes, phytoplankton, benthic algae, zooplankton in freshwater, the marine, brackish water/estuarine communities and chemical factors, colonization and succession in aquatic ecosystems, adaptations and inter-relationships (2 credit units; Prerequisite – BIOL 211).

11. BIOL 218 Biostatistics:

Variability in biological data: continuous and discontinuous variables; Statistical sampling procedure – observations and problems of estimation; Representation and summarization of biological data; Frequency distribution; Measures of central tendency and dispersion; Probability theory; Normal, binomial and Poisson distribution; t-test, F-test and chi-squared test; Analysis of variance (ANOVA) and covariance; Principles of experimental design; Correlation; linear and curvilinear regression; Transformation. (2 credit units; Prerequisite O-Level Maths and 200 Level standing).

12. BOTY 221 – Cryptogamic Botany:

Review of the Thallophyta, Bryophyta and Pteridophyta; characteristics of the groups and their phylogenetic relationships; the development of more advanced structures and their origin from lower plant groups; comparative study of life histories to emphasize the differences between the groups; some aspects of palynology. (2 credit units; Prerequisite – BIOL 112).

13. BOTY 222 – Spermatophyta:

Review of the gymnosperms and angiosperms; similarities and differences between gymnosperms and angiosperms, the development of the spermatophytes, and differences between the group and cryptogams; characteristics of classes, phylogenetic relationships; comparative studies within the group. (3 credit units, Prerequisite – BIOL 111).

14. ZOOL 231 – Invertebrata:

General classification of invertebrates, characteristics of the main invertebrate classes; levels of organization, biology of some selected invertebrates of economic importance, e.g. mollusca and arthropoda; phylogenetic relationships, evolution and adaptive biology of major invertebrate groups. (2 credit units; Prerequisite – BIOL 113).

15. ZOOL 232 – Vertebrata:

Evolution, classification and general characteristics of the fishes (Agnatha, Chondrichthyes, Osteichthyes) and the Tetrapods (Amphibia, Reptilia, Aves and Mammalia) with special reference to taxa of 5aculates5on origin; evolutionary adaptations for terrestrial life. (2 credit units; Prerequisite – BIOL 113).

16. BIOL 300 – Students' Industrial Work Experience (SIWES)

Students spend a six-month period of attachment to gain real life practical experiences of processes, procedures and activities in a biology-related establishment (e.g., laboratories, research institutes, industries, etc.) (6 credit unit; Prerequisite –300 Level standing).

17. BIOL 311 – Field Course I:

Biological sampling techniques in local habitats; also involves visits to research institutes, industries etc. within the locality (20-km radius of Zaria). (1 credit unit; Prerequisite – None, except 300 Level standing).

18. BIOL 313 – Biogeography and Soil Biology:

- i) Distribution of world flora, floristic regions of the world and zoogeographic regions of the world; comparison of tropical and temperate flora, dispersal and colonization of land by plants and animals; island biogeography; relationships between vegetation, soil types and climate; relationships between plant distribution and world fauna.
- ii) Classification and characteristics of soils, soil analysis, plant and soil water relationships. Soil sampling techniques in local habits; Adaptations of organisms to subterranean life. (2 credit units; Prerequisite – BIOL 211 and BIOL 215).

19. BIOL 315 – Microbial and Molecular Biology:

Genetic studies of microorganisms; Metabolic pathways, genes and chromosomes, nucleic acids, replication, transcription and translation, gene expression and regulation, gene sequencing, protein synthesis. (3 credit units; Prerequisite – BIOL 214).

20. BOTY 321 Algae:

A detailed account of the systematics, morphology, reproductive systems, life histories and

ecology of freshwater and marine algae, including considerations of their biological and economic importance. (2 credit units; Prerequisite – BOTY 221).

21. BOTY 323 – Mycology:

A detailed account of the systematics, morphology, life cycles, and dissemination of fungi with special reference to those of economic importance; and consideration of standard mycological techniques. (2 credit units; prerequisite – BOTY 221).

22. BOTY 325 – Plant Physiology I:

Seed morphology and germination; growth patterns of plants from seed to senescence with all metabolic activities involved; development of roots, stems and leaves; growth apices; flowering; formation and dispersal of seeds and fruits; rhythms of growth and growth correlations; factors affecting growth; methods of growth analysis. (2 credit units; Prerequisite – BIOL 212).

23. BOTY 327 – Bryophyta, Pteridophyta and Gymnospermae:

Study of the life cycles, morphology and anatomy of Bryophyta, Pteridophyta and Gymnospermae; origin and evolution of vascular elements and the seed habit; characteristics of selected species of economic or botanical importance. (3 credit units; Prerequisite – BOTY 221).

24. ZOOL 331 – Protozoology:

General classification and characteristics of parasitic protozoans, 6aculates6on, modes of infection, life cycles, pathogenicity, diagnosis and control of important protozoan parasites of humans and domestic animals. (2 credit unit; Prerequisite – ZOOL 231).

25. ZOOL 335 – Arthropoda and Mollusca:

- a. Arthropod evolution, classification and distribution (including a synopsis of the Class Insecta); examples to show organization of external and internal structures; ingestion, digestion, and excretion, blood circulation, water regulation, respiration reproduction.
- b. General classification of the Mollusca; levels of 6aculates6on and comparative morphology, anatomy, histology, physiology, zoogeography, behavior, embryology and development of the Class Mollusca, evolution and adaptive radiation of the Mollusca in the ecosystem; human and animal health; shell-fisheries. (3 credit units; Prerequisite – ZOOL 231).

26. ZOOL 337 – Comparative Animal Histology and Embryology:

A survey of comparative animal embryology including fertilization, cleavage, gastrulation, and examples of organogenesis, embryo nutrition, effects of yolk on development, placenta and its formation, comparative embryology of starfish; amphioxus, chick and mammals, a brief review of animal growth and its controlling mechanisms; comparative histology of animal specialized cells and tissues and their functions. (2 credit units; Prerequisite – ZOOL 232).

27. BIOL 400 – Research orientation and Project:

Each final year students is required to carry out an original research project under the supervision of an academic staff member. The findings of the research are presented by the student at a departmental seminar. A thesis (based on the project) is prepared, bound and submitted by the student for evaluation by the department, and is defended in a viva voce before an External Examiner. (6 credit units; Prerequisite – None, but to be eligible to undertake this course unit, a student who came in at the 100 Level of study must accumulate a total of 66 earned credit units, or 42 earned credit units if he/she came in at the 200 Level.)

28. BIOL 411 – Field Course II:

Field trips are conducted to fulfill the requirements of field ecology, hydrobiology, entomology, plant soil relations, etc. The trips include visits to game and forest reserves and National Parks, Research Institutions of pure and applied biology, seashores and human-made lakes, etc. (2 credit units; Prerequisite – BIOL 311)

29. BIOL 412 – Principles of Plant and Animal Breeding:

Importance of plant and animals breeding, cytogenetical principles of breeding, heterosis, inbreeding consequences, incompatibility mechanisms, sterility, breeding methods, disease and pest resistance and their inheritance, major farm and domestic plants and animals and breeding practices used to sustain the desired qualities in them. (3 credit units; Prerequisites BIOL 315).

30 BIOL 413 – Population Biology and Evolution:

Biological properties of a species; Natural selection, variations, isolation mechanisms (including their breakdown resulting in hybridization, adaptation, origin of life, origin of species, and adaptive radiation, Evolution of selected groups of plants and animals, including human. (3 credit units, Prerequisites – BIOL 211, 214).

31. BIOL 414 – Conservation and Development of Natural Resources

Deforestation and Afforestation; principles, problems and prospects of forestry conservation practices in Nigeria. Desertification and its control. World outlook on conservation (Biodiversity conservation: international biodiversity conventions); management and utilization of forest resources; plant genetic resources in breeding: seed preservation, viability and health. Food crops and domestic animals and their wild relatives; Captive breeding in botanical and zoological gardens, and wildlife parks and arboreta. Field gene banks. Safe movement of germplasm. Conservation of mineral resources. (2 credit units; pre-requisite – BIOL 311).

32. BIOL 415 – Plant and Animal Cytogenetics:

Karyotype and identity of chromosomes, polyploidy, changes in structure of chromosomes; sex chromosomes and sex determination; Karyotyping in humans, Polytene chromosomes, and effects of radiation and chemical agents. Chemical mutagens, effects of radiation on biomolecules. Radiation effects on chromosomes. (3 credit units; Prerequisites BIOL 214).

33. BIOL 416 – Special Options: (Restricted Electives in Specialized Areas)

Students are required to take 3 credits of directed studies in any one of the areas listed below. Availability of each area depends on the availability of staff on ground. (3 credits;

Prerequisite – None, except 400 Level standing).

Examples of options offered are:

- a) Environmental pollution
- b) Biological control methods
- c) Biological Conservation and gene banks
- d) Biotechnology
- e) Radiation Biology
- f) Silviculture and afforestation
- g) Horticulture
- h) Plant tissue culture
- i) Weed Biology
- j) Pest Control
- k) Public Health
- l) Human Genetics
- m) Aquaculture
- n) Introductory Field Ornithology
- o) Beekeeping
- p) Immunology of insect vectors
- q) Principles of animal production
- r) Environmental impact assessment
- s) Introduction to bioinformatics
- t) Plant virology
- u) Trace elements in the biofare
- v) Insects and man
- w) Serological techniques in disease diagnosis

34. BIOL 417 – Nigerian Fauna and Flora:

Field identification and recognition of Nigerian plants and animals; Plant and animal indicators of Nigerian biomes (i.e., association of habitats with specific plants and animals); identification of plants through preserved herbarium specimens, identification of animals through signs left by them; e.g footprints, trails, runways and museum specimens, Life history strategies of selected Nigerian plants and animals; Nigeria's protected area system. (3 credit units; Prerequisite BIOL 311, 313).

35. BIOL 418 – General Practical Biology/Botany/Zoology

This course unit examines students on the basis of their pooled laboratory and field practical experiences during the entire degree Programme . (2 credit units; Prerequisite – None, except 400 Level standing).

36. BOTY 421 – Plant Physiology II:

Light and its effect on biological processes in plants, photoperiodism; plant tropisms and factors controlling them; effects of temperature – vernalization; water absorption, movement of water and minerals in plant body; transpiration and translocation; physiology of senescence and fruit ripening; abscission and cell death. (2 credit units; Prerequisite – BIOL 212).



37. BOTY 422 – Plant Pathology

The concept of diseases in plants, classification of plant diseases, detailed study of common local plant diseases, isolation and study of pathogens, Koch's postulates, general epidemiology, plant disease physiology, control of plant diseases, disease resistance. (2 credit units; Prerequisite – BOTY 222).

38. BOTY 423 – Economic Botany

Plants of economic importance such as cotton, groundnut, cocoa, etc., their origin, distribution, agronomic practices, breeding, diseases and their control, processing and marketing, weed biology and control methods. Non-Timber Forest Plant Products of Nigeria (medicinal plants, spices, edible wild fruits and vegetables) (3 credit units; Prerequisites – BOTY 222).

39. BOTY 424 – Angiospermae:

Origin and evolution of angiosperms with special reference to their reproductive parts and vascular elements; morphology and anatomy of angiosperms; comparative study of classes of angiosperms; life histories of selected members which are of economic/botanical importance. (3 credit units; prerequisite – BOTY 222).

40. BOTY 425 – Comparative Plant Anatomy

Characteristics and classifications of tissues, meristem organization, evolution of vascular tissues, comparative wood anatomy, anatomical adaptations to specialized habitats, applied aspects of plant anatomy. (3 credit units; Prerequisite – BOTY 221, BOTY 222).

41. BOTY 426- Advanced Plant Physiology:

Bud and seed dormancy, biochemistry of seed germination, chemical control of plant growth – natural and artificial controls, the occurrence, structure and mode of action of growth regulators – promoters, inhibitors and herbicides; Introductory ecophysiology: plant pollutants and their modes of action. (3 credit units; Prerequisite – BOTY 421; 327).

42. ZOOL 431 – Applied Entomology

Insects and their allies as pests and parasites; myiasis and vectors of disease of humans, animals and crops; Chemical pest control methods; formulations of insecticides; problems of insecticide persistence in the environment and pesticide resistance in insects, biological control of pests, integrated pest control methods and programs; diapause in insects as factor in their control, insect migration and control strategy. (3 credit units; Prerequisite – ZOOL 335).

43. ZOOL 432 – Parasitology and Immunology

Animal associations and concepts of parasitism, physiology and ecological aspects of parasite relationships, antagonistic and synergistic reactions, effects of parasites on host, immunity to parasites, evolution of defense systems, mechanism for development of resistance against parasitic infections, production of antibodies, production of antigens and antibodies, antigen-antibody reactions, types and development of immunity against various diseases, evolution of parasites, principles of control of parasites and parasitic diseases. (2

credit units, Prerequisites – ZOOL 331).

44. ZOOL 433 – Principles of Wildlife Management

General principles of ecosystem management, wildlife diseases, Principles of wildlife management. Wildlife in Nigeria: conservation policies, problems and prospects. World wildlife resources and their protection. (2 credit units; Prerequisite – BIOL 311).

45. ZOOL 434 – Helminthology and Nematology:

General classification and characteristics of helminth parasites, studies of morphology and life cycles, epidemiology, pathogenicity, progenesis and progenetic forms, control of trematodes and cestodes of medical and veterinary importance. Classification and characteristics of animal and plant parasitic nematodes, general account of nematode structure, life cycles, epidemiology, pathology, diagnosis and control of important nematode parasites of humans and domestic animals, agricultural importance of plant parasitic nematodes, pathological studies of these nematodes with reference to their role as vectors of soil-borne viruses and relationships with other pathogens. (2 credit units; Prerequisite – ZOOL231).

46. ZOOL 435 – Neurophysiology

Co-ordinating systems; nervous and endocrine control mechanisms; basic principles involved in the electro-chemical activities of nerve cells; simple treatment of affector and effector organs; Endocrine glands and their origin; secretion and regulatory mechanisms; Neuroendocrine interactions. (2 credit units; Prerequisite – BIOL 212).

47. ZOOL 436 – Animal Behaviour

The science of animal behaviour, historical development, glossary of ethology terms, behavioral patterns in animals, characteristics of innate and learned behavior, the interaction of nature and nurture, social behavior, migration and homing, biological clocks and biorhythms. (2 credit units; Prerequisite – BIOL 211).

48. ZOOL 437 – Comparative Chordate Anatomy and Physiology:

Principles of homeostasis; A comparative account of physiological processes involved in nutrition, respiration, irritability, growth, excretion and reproduction in the animal kingdom, osmotic regulation and animal transport systems, comparative review of dysfunctions of animal hearts and circulatory systems, arteriosclerosis, physiology of muscles, nerves and sense organs, (3 credit units; Prerequisite – BIOL 212).

49. ZOOL 438 – Principles of Fisheries Management

The gross external morphology of bony and cartilaginous fishes; Basic functions of piscine organs and major systems in fish; food and feeding habits of fishes; Age and growth determination; fecundity; fish culture techniques e.g. monoculture, polyculture); pond construction and management, hatchery management; fish feed formulation; induced breeding and hybridization techniques; major fish processing techniques. (2 credits; Prerequisite – BIOL 216)