University of Anbar
جامعة الانبار

First Cycle – Bachelor's Degree (B.Sc.) - Biology

بكالوريوس – علوم حياة

Table of Contents

1. Overview

This catalogue is about the courses (modules) given by the program of Biology to gain the Bachelor of Science degree. The program delivers (46) Modules with (6000) total student workload hours and 240 total ECTS. The module delivery is based on the Bologna Process.

نظره عامه

يتناول هذا الدليل المواد الدراسية التي يقدمها برنامج قسم علوم الحياة للحصول على درجة بكالوريوس العلوم. يقدم البرنامج)٤٦(مادة دراسية مع) ٦٠٠٠(إجمالي ساعات حمل الطالب و٢٤٠ إجمالي وحدات أوروبية. يعتمد تقديم المواد الدراسية على عملية بولونيا.

2. Undergraduate Courses 2023-2024

Module 1

Code	Course/Module Title	ECTS	Semester
Bio-101	General Microbiology I	8	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1/2/1/1	124	76
Description			
General Microbiology is the study of single-celled organisms and viruses, which are ubiquitous on Earth and which are intimately involved in our lives, with both good and bad effects. General Microbiology is an introductory unit that gives students an overview of microbes, particularly bacteria, as well as specific skills in handling and using microbial cultures. You will gain knowledge that you can apply to control microbial growth in order to maximize the benefits of microbes whilst limiting their disadvantages. You are expected to be actively involved in your learning, which enhances not only your knowledge and understanding of microbiology, but also helps you to develop learning skills useful for future study. Practical classes take the form of a directed research project closely integrated with the theory course.			

Module 2

Code	Course/Module Title	ECTS	Semester
Bio-102	General Chemistry	8	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1/2/1/1	124	76
Description			
chemistry is the science that describes everything you touch, see, and feel: from the shampoo you used this morning to the plastic container that holds your lunch. In this course, we study chemistry from the ground up, beginning with the basics of the atom and its behavior, then progressing to the chemical properties of matter and the chemical changes and reactions that take place all the time in our world.			

Module 3

Code	Course/Module Title	ECTS	Semester
Sci-101	Computer Science	5	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
1	1/2/1	79	46
Description			
Computer Science is the study of computers and computational systems, in which computer scientists deal mostly with software and software systems; this includes their theory, design, development, and application. Principal areas of study within Computer Science include Microsoft Word, Excel, PowerPoint, artificial intelligence, computer systems and networks, security, database systems, human computer interaction, vision and graphics, numerical analysis, bioinformatics and theory of computing			

Module 4

Code	Course/Module Title	ECTS	Semester
Sci-102	Math and Biostatistics	6	1

Class (hr/w)	Lect/Lab./Prac./Tutor	SSWL (hr/sem)	USWL (hr/w)
2	1/0/1/1	78	72

Description
Mathematics is the abstract science of numbers, quantity and space. Mathematics may be studied in its own right (pure mathematics), or as it is applied to other disciplines such as physics and engineering (applied mathematics). Statistics is the science of collecting and analyzing numerical data in large quantities, especially for the purpose of inferring proportions as a whole from those in a representative sample. Most mathematics and statistics majors, however, use their problem-solving skills in the business world – analyzing processes, data, and algorithms, or in government research. Employers hire mathematics and statistics majors because employers know those students are able to work on hard problems, and to make logical decisions.

Module 5

Code	Course/Module Title	ECTS	Semester
UNI-101	Safety and Biosecurity	3	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	0	33	42

Description
Biosafety is the discipline that addresses the safe handling and containment of infectious microorganisms and hazardous biological materials. This includes how we handle animals, plants, cell culture, bacteria, viruses, fungi, parasites and public health crisis such as CoVID-19. Biosafety goal is to reduce or eliminate exposure of lab personnel, the community and the environment to potentially infectious or hazardous agents and this is achieved via the principles of containment and risk assessment. In addition, Biosecurity is defined as the strategic approach to analyzing and managing risks to human health, animal and plant life and the associated risks to the environment. It is based on recognition that hazards have the potential to be deliberately or accidentally misused resulting in harm. Specifically, laboratory biosecurity is a set of systems and practices employed in research facilities to protect microbial agents from loss, theft, diversion or intentional misuse.

Module 6

Code	Course/Module Title	ECTS	Semester
Bio-121	General Microbiology II	6	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1/2/1	94	56

Description
Nutrition and nutritional factors that influence microbial growth. As well as the role of metabolism in biosynthesis and microbial growth, environmental factors that influence microbial growth. Survival of microorganisms in the natural environment. Principles of microbial growth (binary fission, generation time). Microbial growth in laboratory conditions (Growth curve, colony growth, continuous culture) Enumeration of microorganisms in food and environment.

Module7

Code	Course/Module Title	ECTS	Semester
Bio-122	Geology and Environmental Science	7	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	0/2/0/1	79	96
Description			
Geology is the scientific study of planet Earth and involves the observation and interpretation of processes that form and change our world. Some of these processes, such as earthquakes, tsunamis, and volcanic eruptions, proceed rapidly, often with catastrophic consequences. Others, such as erosion or mountain building can progress so slowly that their results are scarcely noticeable over a human lifetime. Each of these processes, however, can exert a profound influence on human activities and can, in turn, be influenced intentionally or unintentionally by human activities. Environmental Science investigates the many interconnected systems and processes that formed our world, continuously change it, and, ultimately, sustain life on it. The Environmental Science Program at Wayne State offers an interdisciplinary approach combining a strong foundation from both geological and ecological perspectives, and a broad choice of electives in its course work. This interdisciplinary program addresses human impacts on the environment, earth surface processes, and ecosystem science with an emphasis on the urban environments. It will prepare students for graduate study, or for careers in various areas of environmental science including conservation, restoration, watershed management, environmental impact assessment, air and water quality monitoring, regulatory compliance, and environmental remediation.			

Module 8

Code	Course/Module Title	ECTS	Semester
Sci-121	Biophysics	6	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1/2/1	94	56
Description			

Biophysics is that branch of knowledge that applies the principles of physics and chemistry and the methods of mathematical analysis and computer modeling to biological systems, with the ultimate goal of understanding at a fundamental level the structure, dynamics, interactions, and ultimately the function of biological systems. Biophysics seeks to explain biological function in terms of the physical properties of specific molecules. is relevant to medicine, and many biophysicists direct their investigations towards biomolecules that play a key role in disease. At Michigan, examples include Alzheimer's disease, ALS ("Lou Gehrig's disease"), HIV, diabetes, breast cancer, and multiple sclerosis.

Module 9

Code	Course/Module Title	ECTS	Semester
UNI-121	حقوق انسان وديمقراطي ة	3	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1/0/0/0	48	27
Description			
زيادة معرفة الطالب بالجانب المفاهيمي النظري والتطور التاريخي لمادة حقوق الانسان والديمقراطية. تنمية مهارات الطالب التحليلية والنقدية فيما يتعلق بواقع ومستقبل حقوق الانسان والديمقراطية، تدريب الطالب على اهمية المشاركة الفاعلة في جوانب الحياة العامة كتعزيز احترام مبادى حقوق الانسان العامة والمشاركة الفاعلة في الحياة السياسية والثقافي ة. تمكين الطلاب من فهم اهمية التعليم ودوره في نشر ثقافة حقوق الإنسان والديمقراطية في بناء مجتمع حضاري يقوم على أساس الحكم الصالح الذي من اهم مقوماته الإيمان بحقوق الإنسان والتربية عليها والمشاركة الفاعلة في الحكم عبر الانتخابات الحرة والعادلة.			

Module 10

Code	Course/Module Title	ECTS	Semester
UNI-122	اللغة العربي ة	3	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1/0/0/0	48	27
Description			

تنمية معارف الطلبة للغة العربية، وأهميتها لهم. وأن يتعرف على شرح بعض سور القرآن الكريم ،ويحفظها. تعرف الطالب على تاريخ الأدب، وأهم مراحل تطوره. الاطلاع على شعراء لم يسبق للطالب التعرف عليهم، أن يضبط الطلبة كتابة الأملاء وعلامات الترقيم. القدرة على الحفظ والاستذكار، الموازنة بين لغة ادب العصر المذكور والآداب الاخرى. المشاركة الجماعية للمحتويات الادبية للمادة القدرة على تقديم المقترحات وحل المشكلات. أن يجمع الطالب كم كبيرا من المفردات والمعاني وأن يتعلم طريقة البحث في المعاجم والقواميس العربية.

Module 11

Code	Course/Module Title	ECTS	Semester
UNI-123	English language	3	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1/0/0/0	48	27
Description			
The course aims to develop communicative competence in English for intercultural contexts by teaching language items and communicative strategies essential for such scenarios, while at the same time giving students ample chances to output such items. The aims of this course are reflected in the content, which contains several themes, such as cultural awareness, intercultural awareness and English as a global language. Indicative content includes understanding the uniqueness of your own culture and other cultures, as well as being aware of the role culture plays in communication in English as a global language. In addition, this course allows for discussions about what it means for English to be a global language of communication and how misunderstandings and miscommunications when using English occurs. The course also includes practice in the pronunciation features that help improve intelligibility in intercultural contexts.			

Module 12

Code	Course/Module Title	ECTS	Semester
Bio-211	Entomology I	6	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1/2/1	94	56
Description			
entomology, branch of zoology dealing with the scientific study of insects. The Greek word entomon, meaning “notched,” refers to the segmented body plan of the insect. It includes Identify and distinguish types of insects. The student will be able to distinguish between beneficial and harmful insects. The possibility of dealing with insects in a scientific way. Know the terminology used in entomology, the possibility of classifying insects scientifically and can distinguish different species and learn about their environment. Breeding insects in laboratories, pest control, how to deal with insects, methods of collecting insects, and methods of hardening and collecting insects. Delivering information to society in a scientific way. Identify the areas where insects are found.			

Module 13

Code	Course/Module Title	ECTS	Semester
Bio-212	Plant Anatomy	6	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1/2/1	94	56
Description			
is the study of the tissue and cell structure of plant organs. The term anatomy, as applied to plants, generally deals with structures that are observed under a high-powered light microscope or electron microscope. (In zoology, the term anatomy refers to the study of internal organs. Introduction to plant anatomy, plant structure, plant cell structure, classification of plant tissue, plasma membrane, cell wall: primary cell wall, secondary cell wall, pits, type of pits: simple pits, borderd pits, blind pits, Protoplasmic Components: nucleus, chloroplast, colgi apparatus, endoplasmic reticulum, etc.., nonprotoplasmic components: vacuole, protein, oil drop, crystals.			

Module 14

Code	Course/Module Title	ECTS	Semester
Bio-213	Invertebrates	6	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1/2/1	94	56
Description			
invertebrate, any animal that lacks a vertebral column, or backbone, in contrast to the cartilaginous or bony vertebrates. More than 90 percent of all living animal species are invertebrates. Worldwide in distribution, they include animals as diverse as sea stars, sea urchins, earthworms, sponges, jellyfish, lobsters, crabs, insects, spiders, snails, clams, and squid. Invertebrates are especially important as agricultural pests, parasites, or agents for the transmission of parasitic infections to humans and other vertebrates. Invertebrates serve as food for humans; are key elements in food chains that support birds, fish, and many other vertebrate species; and play important roles in plant pollination. Despite providing important environmental services, invertebrates are often ancillary in wildlife research and conservation, with priority given instead to studies that focus on large vertebrates. In addition, several invertebrate groups (including many types of insects and worms) are viewed solely as pests, and by the early 21st century the heavy use of pesticides worldwide had caused substantial population declines			
among bees, wasps, and other terrestrial insects.			

Module 15

Code	Course/Module Title	ECTS	Semester
Bio-214	Plant Groups	6	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1/2/1	94	56
Description			
Plants are all unique regarding physical appearance, structure, and physiological behavior. Aside from that, they also vary in their habitats, tolerance, and nutrient requirement. So with that kind of diversity, the big question is, how do you exactly start to classify them? Good thing botanists have already devised ways to classify them. In fact, classifying plants is considered as one of the oldest approaches in studying botany. In general, botanists group plants into two major groups: non-vascular and vascular. The former is composed of early plants, while the latter consists of plants that had developed a vascular system. However, this kind of grouping seems very general and covers various scopes. The more commonly used plant classification is the more specific one: classifying them into different phyla.			

Module 16

Code	Course/Module Title	ECTS	Semester
Bio-216	Biochemistry I	6	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1/2/1	94	56
Description			
processes related to living organisms. It is a laboratory-based science combining biology and chemistry. Biochemists study the structure, composition, and chemical reactions of substances in living systems and, in turn, their functions and ways to control them.			

Module 17

Code	Course/Module Title	ECTS	Semester
Bio-221	Entomology II	6	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1/2/1	94	56
Description			

To study about characters of Phylum Arthropoda, classification of insects, characters and classification of order Orthoptera, Hemiptera, Phtheraptera, Lepidoptera, Hymenoptera, Diptera, Coleopter, Isoptera, and Neuroptera. Identification for different Orders using pictorial keys, key to major families of

Orthoptera, Hemiptera (Heteroptera , Homoptera) and Coleoptera by using Entomological methods.

Module 18

Code	Course/Module Title	ECTS	Semester
Bio-222	Plant Taxonomy	6	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1/2/1	94	56
Description			
Plant taxonomy is the science of classifying and naming plants. It is a branch of what is known as systematics, which is the science of determining how different biological organisms are related to each other. Taxonomy classifies plants and other organisms into different taxonomic levels. These different levels are as follows: Kingdom: A taxonomic category of the highest rank. Phylum: A phylum is a taxonomic level that sits below kingdom but above class. There are 12 different recognized plant phyla. Class/Order: The 'class' as a level of taxonomic classification was first introduced by French botanist Joseph Pitton de Tournefort in 1684. It sits below phyla and above order. Family: Plants are grouped by taxonomists into families, where plants grouped together have many common characteristics. Genus: The genus forms the first part of the binomial scientific name of a plant. Species, subspecies and variant: Genera comprise groups of different species that share certain common characteristics and are closely genetically related. A species is an interbreeding group of individuals that are capable of producing fertile offspring that can reproduce themselves. The term 'subspecies' and 'variant' are used to reflect variation within a species. Plant species/subspecies/variants are assigned binomial scientific names that appear in Italics.			

Module 19

Code	Course/Module Title	ECTS	Semester
Bio-223	Parasitology	6	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1/2/1	94	56
Description			

It is included the study of three major groups of animals: parasitic protozoa, parasitic helminths (worms), and those arthropods that directly cause disease or act as vectors of various pathogens. A parasite is a pathogen that simultaneously injures and derives sustenance from its host. Some organisms called parasites are actually commensals, in that they neither benefit nor harm their host (for example, Entamoeba coli). Although parasitology had its origins in the zoologic sciences, it is today an interdisciplinary field, greatly influenced by microbiology, immunology, biochemistry, and other life sciences.

Module 20

Code	Course/Module Title	ECTS	Semester
Bio-224	Biochemistry II	6	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	1/2/1	94	56
Description			
This course will focus on metabolic biochemistry: the study of chemical reactions that provide the cell with the energy and raw materials necessary for life. Students will examine metabolism of glycogen, fatty acids, amino acids, and nucleotides as well as the macromolecular machines that synthesize RNA, DNA, and proteins. Medical relevance is emphasized throughout the course. Topics Include: Metabolism, glycolysis and gluconeogenesis, citric acid cycle, oxidative phosphorylation, the pentose phosphate pathway, photosynthesis, lipid and steroid biosynthesis.			

Module 21

Code	Course/Module Title	ECTS	Semester
Bio-225	Microscopic techniques	4	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	64	36
Description			

The steps of microscopic preparation from killing the specimens to mounting. Learn about the tools and devices used in microscopic techniques. Knowledge of the method of preparing microscopic slides for animal and plant models and methods of preparing complete samples such as algae and parasite models. Distinguishing between different types of microscopes and their uses in the field of biology in addition to digital imaging applications. Mastering the preparation of microscopic samples and sectors (skins, pollen). Recognize the contents of cells and tissues. The use of biological and manufactured dyes in addition to the dyes used in tissue chemistry. Anatomy of some laboratory animals, isolation of organs and preparation of a microscopic slice of tissue. Preparation of microscopic slides by nonsectional methods such as bacteria and blood.

Module 22

Code	Course/Module Title	ECTS	Semester
Bio-226	Research Methodology	2	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
1	1	33	17
Description			
Discusses and explains the data collection and analysis methods you used in your research. A key part of your thesis, dissertation, or research paper, the methodology chapter explains what you did and how you did it, allowing readers to evaluate the reliability and validity of your research and your dissertation topic. It should include: The type of research you conducted. How you collected and analyzed your data Any tools or materials you used in the research. How you mitigated or avoided research biases. Why you chose these methods. Methodology section should generally be written in the past tense. Academic style guides in your field may provide detailed guidelines on what to include for different types of studies. Citation style might provide guidelines for your methodology section (e.g., an APA Style methods section).			

Module 23

Code	Course/Module Title	ECTS	Semester
Bio-311	Cell Biology	5	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2/1	79	46
Description			

Defining the cell, its types, shapes and sizes, and understanding the most important differences between single-celled organisms and multicellular organisms, and between animal and plant cells. Components of the cell: cytoplasm and nuclear organelles. Cell membrane: structure & function, mechanisms of membrane transport and cell to cell communication. Study of cellular organelles in terms of structure and function, represented by the smooth and rough endoplasmic reticulum, the Golgi apparatus, and the vacuoles. Studying the structure and function of mitochondria and their membrane systems and their role in cellular respiration and energy production. In addition to studying the plastids and their types in the plant cell and the steps of the photosynthesis process that occur inside them and the study of Golgi bodies and lysosomes. Part c- Cytoskeleton (Microtubules, microfilaments and intermediate filaments) Tubulin and actin, Cilia, flagella and microtubules. Nucleus, nucleolus, chromosomes, and protein synthesis process) cell cycle and cell division.

Module 24

Code	Course/Module Title	ECTS	Semester
Bio-312	Haematology	5	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2/1	79	46
Description			
Haematology involves the diagnosis and treatment of patients who have disorders of the blood and bone marrow. Whilst a major part of a haematologist's time is spent in providing direct clinical care to patients, diagnostic work in the laboratory is also a significant part of their work. Haematology is the specialty responsible for the diagnosis and management of a wide range of benign and malignant disorders of the red and white blood cells, platelets and the coagulation system in adults and children. Haematologists care directly for patients on hospital wards and outpatient clinics. Their patients may have a serious life- threatening illness such as leukaemia, lymphoma or myeloma that requires chemotherapy. They also advise GPs about how to care for patients in their homes. Some haematologists specialise in diseases affecting the blood coagulation system such as haemophilia, while others provide expertise in the areas of blood transfusion or disorders of haemoglobin such as sickle cell disease.			

Module 25

Code	Course/Module Title	ECTS	Semester
Bio-313	Histology	5	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2/1	79	46

Description
Histology is the science of the microscopic structure of cells, tissues and organs. It also helps us understand the relationship between structure and function. By examining a thin slice of bone tissue under a microscope, colorized with special staining techniques, you see that these seemingly simple bones are actually a complex microworld containing an array of structures with various different functions. In this article, we will introduce you to the microscopic world of histology.

Module 26

Code	Course/Module Title	ECTS	Semester
Bio-314	Mycology I	5	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2/1	79	46
Description			
mycology, the study of fungi, a group that includes the mushrooms and yeasts. Many fungi are useful in medicine and industry. Mycological research has led to the development of such antibiotic drugs as penicillin, streptomycin, and tetracycline, as well as other drugs, including statins (cholesterol-lowering drugs). Mycology also has important applications in the dairy, wine, and baking industries and in the production of dyes and inks. Medical mycology is the study of fungus organisms that cause disease in humans.			

Module 27

Code	Course/Module Title	ECTS	Semester
Bio-315	Plant Physiology	5	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2/1	79	46
Description			

Plant physiology includes the study of all the internal activities of plants—those chemical and physical processes associated with life as they occur in plants. This includes study at many levels of scale of size and time. At the smallest scale are molecular interactions of photosynthesis and internal diffusion of water, minerals, and nutrients. At the largest scale are the processes of plant development, seasonality, dormancy, and reproductive control. Major subdisciplines of plant physiology include phytochemistry (the study of the biochemistry of plants) and phytopathology (the study of disease in plants). The scope of plant physiology as a discipline may be divided into several major areas of research.

Module 28

Code	Course/Module Title	ECTS	Semester
Bio-316	Aquatic and Soil Microbiology	5	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2/1	79	46
Description			
This class discusses the fundamental aspects of microbiology of soil and water, its importance to mankind in a brief and articulate explanation of this newly originated science. Highlights the role of the different microorganisms found in soil and water and their different relationships with each other and with the environmental conditions in which they live. Students will be introduced to the most important microorganisms found in soil and water. B- Subject-specific skills: At the first university level, the student acquires the ability to distinguish between different organisms and their ways of living in soil and water. Methods of teaching and learning: It is a direct explanation with students through graphics and a Power Point presentation, in addition to educational videos on the subject assessment methods: daily exams (cozzes), monthly exams, reports on the subject in addition to final exams. C- Thinking skills: The student in the bachelor's degree acquires the ability to distinguish between living organisms, their types, distribution, and the importance of their presence in the soil. D- General and transferable skills (other skills related to employability and personal development). Gaining scientific knowledge and the ability to diagnose bacteria, fungi and protozoa from the environment in which they live			

Module 29

Code	Course/Module Title	ECTS	Semester
Bio-321	Genetics	5	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2/1	79	46
Description			

Genetics, study of heredity in general and of genes in particular. Genetics forms one of the central pillars of biology and overlaps with many other areas, such as agriculture, medicine, and biotechnology. Applied its principles to the improvement of cultivated crops and domestic animals. A Babylonian tablet more than 6,000 years old, for example, shows pedigrees of horses and indicates possible inherited characteristics. Other old carvings show cross-pollination of date palm trees. Most of the mechanisms of heredity, however, genetics arose out of the identification of genes, the fundamental units responsible for heredity. Genetics may be defined as the study of genes at all levels, including the ways in which they act in the cell and the ways in which they are transmitted from parents to offspring. Modern genetics focuses on the chemical substance that genes are made of, called deoxyribonucleic acid, or DNA, and the ways in which it affects the chemical reactions that constitute the living processes within the cell. Gene action depends on interaction with the environment. Green plants, for example, have genes containing the information necessary to synthesize the photosynthetic pigment chlorophyll that gives them their green colour. Chlorophyll is synthesized in an environment containing light because the gene for chlorophyll is expressed only when it interacts with light. If a plant is placed in a dark environment, chlorophyll synthesis stops because the gene is no longer expressed.

Module 30

Code	Course/Module Title	ECTS	Semester
Bio-322	Pollution	5	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2/1	79	46
Description			
Pollution is the introduction of harmful materials into the environment, which called pollutants such as volcanic ash, or runoff produced by factories. Pollutants damage the quality of air, water, and land. Many things that are useful to people produce pollution. Cars spew pollutants from their exhaust pipes. Burning coal to create electricity pollutes the air. Industries and homes generate garbage and sewage that can pollute the land and water. Pesticides—chemical poisons used to kill weeds and insects—seep into waterways and harm wildlife. Air and water currents carry pollution. Ocean currents and migrating fish carry marine pollutants far and wide. Winds can pick up radioactive material accidentally released from a nuclear reactor and scatter it around the world. Smoke from a factory in one country drifts into another country.			

Module 31

Code	Course/Module Title	ECTS	Semester
Bio-323	Animal Physiology	5	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2/1	79	46

Description
Definition of physiology and its most important branches and its relationship to other sciences and basic principles in knowing the functions of organs and ways to maintain homeostasis. Cellular level of organization: Components of the cell: cytoplasm and nuclear organelles. Cell membrane: structure & function, mechanisms of membrane transport and cell to cell communication. Systems: Nervous system and the special senses: Structure, function and physiology of the central and peripheral nervous system and the special senses; vision, hearing, taste, smell and touch. Cardiovascular, Respiratory and Urinary Systems: Structure, function and integrated physiology of the tissues and organs of these systems, Endocrine system, Muscles, their types and mechanism of action. Lactation: Mammary gland development, structure and regulation of milk production. Reproductive physiology. The physiology of thermoregulation.

Module 32

Code	Course/Module Title	ECTS	Semester
Bio-324	Mycology II	5	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2/1	79	46
Description			
Fungi were initially classified with plants and were a subject of interest for botanists; hence the influence of botany, can be seen on their classification. In 1969 R.H Whittaker classified all living organisms into five kingdoms namely (Monera, Protista, Fungi, Plantae and Animalia) Traditionally the classification proceeds in this fashion: Kingdom - Subkingdom - Phyla/phylum - Subphyla - Class - Order - Family - Genus- Species. This classification is too complicated to be dealt here. There are alternate and more practical approaches, one based on sexual reproduction and the other based on morphology of the thallus (vegetative structure). Based on Sexual reproduction: 1. Zygomycetes: which produce through production of zygospores. 2. Ascomycetes: which produce endogenous spores called ascospores in cells called asci. 3. Basidiomycetes: which produce exogenous spores called basidiospores in cells called basidia. 4. Deuteromycetes (Fungi imperfect): fungi that are not known to produce any sexual spores (ascospores or basidiospores).			

Module 33

Code	Course/Module Title	ECTS	Semester
Bio-325	Immunology	5	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**

2	2/1	79	46
Description			
is the study of the immune system and it is a very important branch of the medical and biological sciences. The immune system protects us from infection through various lines of defense. If the immune system is not functioning as it should, it can result in disease, such as autoimmunity, allergy and cancer. It is also now becoming clear that immune responses contribute to the development of many common disorders not traditionally viewed as immunologic, including metabolic, cardiovascular, and neurodegenerative conditions such as Alzheimer's.3. Basidiomycetes: which produce exogenous spores called basidiospores in cells called basidia. 4. Deuteromycetes (Fungi imperfect): fungi that are not known to produce any sexual spores (ascospores or basidiospores).			

Module 34

Code	Course/Module Title	ECTS	Semester
Bio-326	Microbial Physiology	5	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2/1	79	46
Description			
Microbial physiology is defined as the study of how microbial cell structures, growth and metabolism function in living organisms. It covers the study of viruses, bacteria, fungi and parasites. It is also conveyed as the study of microbial cell functions which includes the study of microbial growth, microbial metabolism and microbial cell structure. Microbial physiology is important in the field of metabolic engineering and also functional genomics.			

Module 35

Code	Course/Module Title	ECTS	Semester
Bio-411	Molecular Biology	6	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2/1	79	71
Description			

The field of molecular biology studies macromolecules and the macromolecular mechanisms found in living things, such as the molecular nature of the gene and its mechanisms of gene replication, mutation, and expression. Given the fundamental importance of these macromolecular mechanisms throughout the history of molecular biology, a philosophical focus on the concept of a mechanism generates the clearest picture of molecular biology's history, concepts, and case studies utilized by philosophers of science.

Module 36

Code	Course/Module Title	ECTS	Semester
Bio-412	pathogenic Bacteriology	6	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2/1	79	71
Description			
This class concentrates on bacteria that are known to cause disease in humans and animals. We will begin by exploring the concept of virulence factors and how they allow organisms to be more effective pathogens. Pathogenesis mechanisms of immune evasion, attachment and invasion of bacteria to host cells, and the production of toxins will be explored through a variety of molecular, protein, and whole cells assays. After covering virulence factor mechanisms, we explore many of the major diseasecausing groups of bacteria. How these organisms initiate disease will be covered, as well as clinical lab identification strategies, and how clinical specimens are processed. The course ends with students using identification tests learned in lab to identify unknown bacteria.			

Module 37

Code	Course/Module Title	ECTS	Semester
Bio-413	علم الاحياء المجهرية الغذائي ة	6	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2/1	79	71
Description			
تشمل مجموعة متنوعة من المواضيع والمفاهيم التي تتعلق بالأحياء المجهرية في السياق الغذائي. قد تشمل بعض المحتويات الإرشادية التالية: تعريف الأحياء المجهرية الغذائية: مفهوم الأحياء المجهرية الغذائية وأهميتها في علم التغذية. التعرف على الأحياء المجهرية الهامة في الغذاء، مثل البكتيريا والفطريات. تأثير الأحياء المجهرية على الغذاء: دراسة دور الأحياء المجهرية في تحضير وتلف الأطعمة. فهم تأثير الأحياء المجهرية على النكهة والعفونة والتحويلات الكيميائية في الغذاء. الأحياء المجهرية والجهاز الهضمي : دراسة الأحياء المجهرية المفيدة في الجهاز الهضمي، مثل البكتيريا المعوية المفيدة. فهم تأثير الأحياء المجهرية على هضم وامتصاص المواد الغذائية. الأحياء المجهرية والمحافظة على الغذاء: دراسة استخدام الأحياء المجهرية في تقنيات مختلفة			

Module 38

Code	Course/Module Title	ECTS	Semester
Bio-414	Biotechnology and Genetic Engineering	4	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2/1	79	21
Description			
This class discusses the fundamental aspects of biotechnology and genetic engineering its importance to mankind in a concise and lucid explanation of this newly founded science. The course emphasizes how cell structure and function is a vital starting point for knowledge of genetic engineering and gene technology. Lectures will underlie the principles and application of Recombinant DNA technology in industrial, agricultural, pharmaceutical, and biomedical fields.			

Module 39

Code	Course/Module Title	ECTS	Semester
Bio-415	Optional 1	4	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2/1	79	21
Description			
This class will be chosen by the department according to their need.			

Module 40

Code	Course/Module Title	ECTS	Semester
Bio-416	Research Project	4	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
	2/1/1/1	78	22

Description
All Internal Medicine residents are required to complete a research project during their residency. A research project is a scientific endeavor to answer a research question. Research projects may include: case series, case control study, cohort study, randomized, controlled trial, survey, and secondary data analysis such as decision analysis, cost effectiveness analysis or meta-analysis. Each resident must work under the guidance of a faculty mentor. Depending on your area of research interest or your research topic, you may be able to identify a mentor on your own, or if needed, you will be assigned one. You are also provided with a step-by-step guide to simplify the process and a suggested timeline for research project completion to ensure that you meet your requirement in a timely manner.

Module 41

Code	Course/Module Title	ECTS	Semester
Bio-421	Microbial Genetics	6	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2/1	79	71
Description			
Means genetics of microbes (bacteria, Archaea, viruses, including bacterial viruses i.e., bacteriophages and unicellular or mycelial eukaryotes: including yeasts, fungi, algae and protozoa). The first study on microbial genetics started by George W. Beadle (1903–1989) and Edward L. Tatum (1909–1975) while investigating genetics of tryptophan metabolism and nicotinic acid synthesis in Neurospora, a fungus postulating the "one gene one enzyme" hypothesis. However, studies on bacterial genetics started in 1947 (Joshua Lederberg) with demonstration of exchange of genetic factors through conjugation in Escherichia coli, mediated through plasmids, “fertility factors”. Later, by process such as transformation, transduction and chromosomal gene mobilization lead to genome (chromosome) mapping in bacteria. These techniques need to restriction enzyme analysis for sequencing, cloning and expression of several genes (in prokaryotic and eukaryotic).			

Module 42

Code	Course/Module Title	ECTS	Semester
Bio-422	Microbial Genetics	6	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2/1	79	71
Description			

This class discusses the fundamental aspects of virology and its importance to mankind in a brief and articulate explanation of this newly originated science. The course highlights the general morphology, genetic structure, function of viruses as a vital starting point for knowledge of virus diseases and gene transfer technology. Lectures will underlie the principles and application of Recombinant phage DNA technology in pharmaceutical, and biomedical fields.

Module 43

Code	Course/Module Title	ECTS	Semester
Bio-423	علم الاحياء المجهرية الصناعية	6	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2/1	79	71
Description			
مقدمة في الأحياء المجهرية الصناعية: يتم التعريف بمفهوم الأحياء المجهرية الصناعية وأهميتها في الصناعة والتطبيقات العملية. تصنيف وتعريف الكائنات الحية الدقيقة: يتم دراسة التصنيف والتعريف للبكتيريا والفطريات والخمائر والفيروسات وغيرها من الكائنات الحية الدقيقة المستخدمة في الصناعة. تقنيات التخمير الصناعي: يتم دراسة المفاهيم الأساسية لعملية التخمير وتطبيقاتها في الإنتاج الصناعي، بما في ذلك التخمير البكتيري والفطري واستخدام الخمائر. هندسة الجينات والهندسة الوراثية: يتم دراسة التقنيات المتقدمة في هندسة الجينات والتلاعب الوراثي لتحسين الكائنات الحية الدقيقة وتطبيقاتها في الصناعة. تحليل وتحسين العمليات الصناعية: يتعلم الطلاب كيفية تحليل وتحسين العمليات الصناعية المستخدمة في إنتاج المنتجات الحيوية، مثل التحكم في درجة الحموضة.			

Module 44

Code	Course/Module Title	ECTS	Semester
Bio-424	Optional 1	4	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2/1	79	21
Description			
This class will be chosen by the department according to their need.			

Module 45

Code	Course/Module Title	ECTS	Semester
Bio-425	Optional 1	4	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**

2	2/1	79	21
Description			
This class will be chosen by the department according to their need.			

Module 46

Code	Course/Module Title	ECTS	Semester
Bio-426	Research Project	4	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
	2/1/1/1	78	22
Description			
All Internal Medicine residents are required to complete a research project during their residency. A research project is a scientific endeavor to answer a research question. Research projects may include: case series, case control study, cohort study, randomized, controlled trial, survey, and secondary data analysis such as decision analysis, cost effectiveness analysis or meta-analysis. Each resident must work under the guidance of a faculty mentor. Depending on your area of research interest or your research topic, you may be able to identify a mentor on your own, or if needed, you will be assigned one. You are also provided with a step-by-step guide to simplify the process and a suggested timeline for research project completion to ensure that you meet your requirement in a timely manner.			

Contact

Program Manager:

Saad Mutlk | Ph.D. in Microbiology- Virology | Lecturer

Email: saad.t.mutalk@uoanbar.edu.iq

Mobile no.: 07821688893

Program Coordinator:

Thamer Yousif Mutter | Ph.D. in Microbial Molecular Genetics | Lecturer Email: mthamir78@uoanbar.edu.iq

Mobile no.: 07806417604