Course Handbook

Ministry of Higher Education and Scientific research

Salahaddin University- Erbil

College of Education/ Shaqlawa

Biology Department

Fourth Year: First Semester

Subject: **Optional (Elective) Virology**

Academic Year: 2022-2023

Lecturer's name:

Assist. Lec. Sherko Muhammed Abdul-Rahman

Course Book

1. Course name	Virology
2. Lecturer in charge	Assist. Lec. Sherko Muhammed Abdul-Rahman
3. Department/ College	Biology Dept./ College of Education/Shaqlawa
4. Contact	E-mail: sherko.abdulrahman@su.edu.krd Tel: 00964 750 445 6357
5. Time (in hours) per week	Theory: 2 hrs
6. Office hours	2 Hours per week
7. Course code	EdB1405
8.Teacher's academic profile	**Education:** • Graduated from Nursing Preparatory School-Erbil in 1991-1994. • Obtained Diploma from Nursing Dept., Medical Technical Institute-Erbil in 1994-1996 • Obtained B.Sc. in Biology/Microbiology from college Science/ Salahaddin University-Erbil in 1996-2001. • Obtained Master in Management Business Administration (MBA)/Business Management University (BMU)/ Lebanon-French University in 2007-2010. • Obtained M.Sc. in Biology/ Microbiology from College Education/ Salahaddin University-Erbil in 2017-2019. **Thesis Title:** Neonatal Sepsis: Bacteriological Profile, Molecular Detection and Antimicrobial Susceptibility Test Among Preterm Pediatric in Erbil City. **Experiences & Qualifications:** • He worked as a teacher in college of nursing from 2004-2016 during these periods of time, he tried to work in collaboration with university and health sectors to improve nurse's role and participated in many education trainings courses. Also, he worked to introduce graduated nurses from the college of nursing as new models of career in Erbil city's hospitals. • 2006 until 2010, Head of Planning & Follow up Department in College of Nursing. • 2004-2016 experience in Journalism field, writing many articles in newspapers and websites. • Excellent computer skills in the whole Windows and Microsoft Office versions. • More than 20 years' experience in managing of Companies administration.

- He has been assigned as laboratory demonstrator in the Laboratory department between 2004-2016 in Nursing College, Hawler Medical University. This included practical Biology (such as Zoology, and Pathogenic Bacteria, Physiology and Biochemistry) in the laboratories.
- He started to study M.Sc./Microbiology in 2019, at department of Biology/ College of Education/Shaqlawa, Salahaddin University- Erbil. Then, he started to work in the same department, as an assistant lecturer.
- Member of the examination committee for College of Nursing from 2010-2016 except 2012, and at College of Education/Shaqlawa, from 2019 till now.
- He worked as Registrar of college of Education /shaqlawa from 2019-2021.
- Now, He is working as Head of Biology Department, college of Education /shaqlawa from 01-01-2021 till now.
- He has three published researches from International Journals mostly around Microbiology as following:

1. https://zjms.hmu.edu.krd/index.php/zjms/article/view/767
2. https://scholar.google.com/scholar?q=Neonatal+sepsis:+Bacteriological+profile,molecular+detection+and+antimicrobial+susceptibility+test+among+pre-term+pediatrics+in+Erbil&hl=en&as_sdt=0&as_vis=1&oi=scholart
3. https://scholar.google.com/scholar?q=Molecular+detection+of+%CE%B2-lactamase+genes+in+Klebsiella+pneumoniae+and+Escherichia+coli+isolated+from+different+clinical+sources&hl=en&as_sdt=0&as_vis=1&oi=scholart

Training course & conferences:

- June, 2000, Ishik Language Center, participant in WOW course (Window of the World).
- June 2005, Participant in First Nursing conference of Salahaddin University- Erbil.
- Dec. 2006, participant in E-Learning Courses in college of Nursing broadcasted from Greece supported by KLIMAKA NGO.
- July, 2007 participant in Internet & Computer Courses in Technical Institute by KPA Center.
- 2016-2019, completed four levels in face2face English language learning (Starter, Elementary, Pre-intermediate and Intermediate) in CIS institute center.
- Competition of the pedagogical training for teacher

	professional development (30 ECTS) from 01.12.2019 - 01.06.2020. **Membership of professional Bodies:** 1. Member of Syndicate of Kurdistan Biological. 2. Member in Erbil Trading & Commercial Chamber. 3. Member in Kurdistan Journalists Syndicate. 4. Member in Kurdistan Teachers Union. 5. **References:** 1. Prof. Dr. Badia Mohammed Najeeb, College of Nursing, Hawler Medical University, Erbil, Iraq. Mob.: 0750 488 80 59. 2. Prof. Dr. Adel Kamal Khedir, Department of Biology, College of Education, Salahaddin University- Erbil, Iraq. Mob.: 0750 447 29 08. Assist. Prof. Dr. Farhad Ali Mustafa, Dean of College of Education/Shaqlawa, Salahaddin University- Erbil, Iraq. Mob.: 0750 455 39 19.
9. Keywords	General Virology, academic profile, course book

10. Course overview:

Virology is a fascinating and rapidly developing subject, and is worthy of study purely because viruses are interesting! Furthermore, virology is a branch of science that is of immense relevance to mankind for a host of reasons, not least of which the threats to human health are caused by viruses, such as HIV, hepatitis B virus, papillomaviruses, measles and influenza viruses, to mention just a few. Evidence for the existence of very small infectious agents was first provided in the late 19th century by two scientists working independently: Martinus Beijerinck in Holland and Dimitri Ivanovski in Russia. Beijerinck called the agent a 'virus' and the term has been in use ever since. Viruses are the smallest infectious agents (ranging from about 20 nm to about 300 nm in diameter) and contain only one kind of nucleic acid (RNA or DNA) as their genome.

This course provides an introduction to the field of virology. The course emphasizes the intrinsic properties of viruses that cause human disease and their interaction with cells, their structure, classification and evolution, their ways to infect and exploit host cells for virus reproduction, their interaction with host organism physiology and immunity, the diseases they cause, the techniques to isolate and culture them, and their use in research and therapy. Virology is considered to be a subfield of microbiology.

11. Course objective:

This course is designed for undergraduate students who are learning about virology for the first time. The purpose of this course is to provide a foundation for the understanding of viruses that cause human disease. The objective of the Science of Virology course is to describe at the molecular level the replication strategies of representative DNA and RNA viruses and the effects of virus infection on cell growth control and survival. Emphasis is placed on developing an understanding of the experimental systems used to elucidate individual steps in virus life cycles and their interactions with host cells. Host cell-virus interactions leading to production of progeny virus and interactions involved in establishing and maintaining long term interactions, such as latency and oncogenesis. Also present the historical perspectives of virology, to introduce the idea that viruses whether pathogenic or benign are important members of the biosphere and have an important impact on our daily and future activities

12. Student's obligation

Students are expected to attend all classes. The official college attendance policy is followed. Attendance in each class is counted from the first day the student is eligible to attend the class as given on the student's assessment sheet registration card or student change notice. Student may obtain an excuse for the emergency absence from the dean of students upon presentation of satisfactory documentation.

13. Forms of teaching

1- Different forms of teaching will be used to reach the objectives of the course: power point presentations, definitions and description images, summary of conclusions, classification of materials and any other illustrations, besides worksheet will be designed to let the chance for practicing on several aspects of the course in the classroom.
2-Using white board
3-Classroom discussions about the lecture subjects and students' questions.

14. Assessment scheme:

No.	Exam (Evaluation)	Marks
1	Student presence	**5%**
4	Theory Activities	**10%**
5	Mid-term Exam	**25%**
6	Total Scores (Average)	**40%**
7	Final Exam	**60%**

15. Student learning outcome:

This course will provide a comparative overview of virus life cycles and strategies viruses use to infect and replicate in hosts. We will discuss virus structure and classification and the molecular basis of viral reproduction, evolution, assembly, and virus-host interactions. In the end of the course, it expects the students will be able to:

1- Define common terms used in virology and the history of virology.

2- Identify all the possible methods for diagnosis of virus, the special techniques by which we can replicate viruses, laboratory diagnosis of viruses using different techniques (such as: Molecular, immunological etc...)

3-Identify International classification of viruses; know the taxonomy of human viruses that cause disease

4-Understanding the main and new emerging threats of viral diseases e.g., HIV, influenza

5- How to combat viral infections.

6- Understanding the relationships between virus and the other Kingdome.

7- Compare different virus replication strategies and genome coding strategies

8- Have good knowledge of the prevention, control and eradication of viral diseases

9- Think critically in terms of their learning and research.

16. Course Reading List and References

1. Fundamentals of Molecular Virology, 2nd Edition by Nicholas H. Acheson,John Wiley & Sons, Inc. 2011
2- “Principles of Virology” Flint S.J., Enquist L.W., Racaniello V.R., Skalka A.M. 2008, 3rd edition, ASM Press.
3- “Fields Virology” David M. Knipe, PhD, Peter M. Howley, MD, Diane E Griffin MD, PhD, Robert A Lamb, PhD, ScD, Malcolm A Martin MD, Bernard Roizman ScD, and Stephen E Straus, MD. 2007, 5th edition, Lippincott Williams & Wilkins.
4-“Basic Virology” Edward K. Wagner, Martínez J. Hewlett, David C. Bloom, David Camerini.2007, 3rd edition, Wiley-Blackwell.
5-“Introduction to Modern Virology” N.J. Dimmock, A.J. Easton, K.N. Leppard. 2007, 6th edition, Wiley-Blackwell.
6- “Understanding viruses” Teri Shors. 2nd ed. Burlington: Jones & Bartlett Learning, cop. 2013.

17. The Topics

Week l: -Introduction and General characters of viruses

(History, definition, and importance of study)

-Viral structure

Virus structure and morphology

composition and function of viral structure

Week 2: Virus Architecture and Nomenclature

Viral shape (Symmetry) and different figure of virus

Classification of Animal Viruses (ICV and Baltimore scheme)

Week 3: Virus replication Strategies

Principal events involved in replication: Adsorption, penetration, uncoating nucleic acid and protein synthesis, assembly, maturation and release.

Week 4: Chemical and physical agent reaction

To discuss the effect of pH, temperature, Heat, cold and salts upon

Viral activities.

-Viral Immunopathology-Viral Immune response and viral evasion Mechanisms

Week 5: Laboratory Diagnosis of Virus Infections (Method of Diagnosis)

-Direct method

-In Direct method

-Serological and molecular method

Week 6 : Double stranded DNA Virus (Adenoviruses, Herpesviruses, Poxviruses

Week 7: Single strand DNA viruses (+ sense) DNA (e.g., Parvoviruses

Week 8: Positive single strand (+)ssRNA viruses (+ sense) RNA (e.g. Picornaviruses, Togaviruses)

Week 9: Double strand RNA viruses (e.g., Reoviruses)

Week 10: Negative single strand (−)ssRNA viruses (- antisense) RNA (e.g. Orthomyxoviruses, Rhabdoviruses)

Week 11: Single strand RNA-RT viruses (+ sense) RNA with DNA intermediate in life-cycle (e.g., Retroviruses)

Week 12: Double strand DNA-RT viruses (e.g., Hepadnaviruses)

Week 13: Viral Persistence: Chronic & Latent Virus Infections, Effect of Host Age.

Week 14: Antiviral Chemotherapy, Viral Vaccines.

18. Question Bank Examples

Fill the following blanks.

1. Prions is infectious particles that are entirely protein no nucleic acid highly heat resistant in animal affects nervous tissue and results in:
    a) ……
    b) ……
    c) ……
2. Poxvirus particles contain about 100 proteins, including many with enzymatic activities, such as a …….. , its replication occurs entirely within the cell cytoplasm.
3. Slow virus disease is a disease that, after an extended period of latency, follows a slow, progressive course spanning months to years, frequently involving the …… and ultimately leading to death.
4. Human herpesviruses include: -
    a) ……..……..
    b) ……..……..…….
    c) ……
    d) …….
    e) ……
    f) ……
5. There are four main schemes used for the classification of viruses are: -
    a) ……
    b) …….
    c) ……
    d) …….
6. Types of symmetry of virus particles, viral architecture can be grouped into three types based on the arrangement of capsomeres and the morphology of the nucleocapsid subunits
    a) ……..…….., e.g., Orthomyxoviruses
    b) Cubic symmetry (Icosahedral), e.g., …….
    c) …….., e.g., Poxviruses and Bacteriophage.
7. Types of Protein synthesis
    a) ……..……..
    b) ……
8. …… is a virus particle that is functionally deficient in some aspect of replication, it may interfere with the replication of normal virus.
9. Capsomer is morphologic units seen in the electron microscope on the surface of icosahedral virus particles. Capsomer represents ……

10. Viruses are infectious agents with both living and non-living characteristics:
    i. Living characteristics of viruses
        a) ……..
        b) ……..
    ii. Non-living characteristics of viruses
        a) ……
        b) ……

Q2/ Put (T) for true, (F) for false sentences, and <u>correct the false</u> sentences.

1. Hepadnaviruses cause acute and chronic hepatitis; temporary infections are associated with a high risk of developing liver cancer. Three viral types are known that infect mammals (humans, woodchucks, and ground squirrels) and another that infects ducks.
2. A special cell of the immune system called a T cell circulates looking for infections. One type of T cell is called a cytotoxic T cell, because it kills cells that are infected with viruses with toxic mediators. Cytotoxic T cells have specialised proteins on their surface that help them to recognise virally-infected cells. These proteins are called T cell receptors (TCRs).
3. Acute viral infection is characterized by rapid onset of disease, a relatively detail period of symptoms, and resolution within days. It is usually accompanied by early production of infectious virions and elimination of infection by the host immune system.
4. Coating can be defined as the complete or partial removal of the capsid to release the virus genome. Depending on the virus, the process can take place.
5. Some virus particles do not exhibit simple cubic or Icosahedral symmetry but are more complicated in structure, e.g., poxviruses are brick-shaped, with ridges on the external surface and a core and lateral bodies inside.
6. Structural units are the basic protein building blocks of the coat, they are usually a collection of more than one non identical protein subunit. The structural unit is often referred to as a capsomer.
7. Viruses can grow on artificial media, but only in living cells (specific host, Lab animals, chicken embryonated eggs & tissue culture).
8. Viral infected cells produce and release large proteins called interferons, which play a role in immune protection against viruses.
9. Herpes Simplex Viruses (HSV-1) usually lesions on the oropharynx, cold sores, fever blisters. While HSV-2 lesions on the genitalia, possibly oral

occurs in ages 14-29 and can be spread with visible lesions.

10. The nucleocapsid of Herpesviruses (Persistent Human Viruses) is 100mm in diameter, with cubic symmetry and 162 capsomeres, surrounded by a lipid-containing envelope. It's the genome is linear, double-stranded DNA, 125–240kbp in size and the presence of terminal and internal reiterated sequences results in several isomeric forms of genomic DNA.
11. The virus growth cycle can be divided into stages which are sequential, although in many cases these stages tend to meld alone almost taking place simultaneously. Range in time from minutes to hours depending on the virus and the host.
12. Gene vectors for protein production are viruses such as certain adenoviruses are used as vectors to take genes into human cells growing in culture.

Q/ Match the following items from column A to column B (<u>only one correct answer</u>)

Column A	Column B
1. Chickenpox and shingles	A. Herpesviruses
2. Genital infections	B. Cytomegalovirus (CMV),
3. Persistent human viruses	C. Varicella-Zoster Virus (VZV)
4. Envelope	D. 26–45 kbp
5. Viral components	E. Vesicle fluid or swab
6. Bacteriophage	F. Replicate within the nucleus
7. 252 capsomeres.	G. Peplomers
8. Erythema infectious	H. Glycoprotein
9. Herpetic gingivostomatitis	I. Virus that infects prokaryotic cells
10. Infection in utero	J. Adenovirus
K. Large single-stranded gap	
L. Oropharynx in young children	
M. Parvoviruses	

Q/ Put (T) for true, (F) for false sentences, and <u>Correct the false</u> sentences.

1. Slow virus disease is a disease that, after an extended period of latency, follows a slow, progressive course spanning months to years, frequently involving the central nervous system and ultimately leading to growth.

2. Viruses can also be added from the body by antibodies before they get the chance to infect a cell.
3. Latent phase during which the virion has entered the cell and before progeny virus are made. No infectious virus is present during this phase.
4. Neonatal infection at birth, is an acute, potentially life-threatening condition caused by the human immunodeficiency virus (HIV). e.g., Acquired immunodeficiency syndrome (AIDS).
5. The first three stages of viral growth cycle (viral infections), are attachment, penetration, assembly (Maturation), give rise to the eclipse period.
6. Interferons prevent replication of viruses, by directly interfering with their ability to replicate with an infected cell.
7. Many viruses can be grown in cell cultures or in animal cells under strictly controlled conditions. Growth of virus in animals is still used for the primary isolation of certain viruses and for studies of the pathogenesis of viral diseases and of viral oncogenesis.
8. The virions of many viruses are released from the infected cell when it removed, a process that may be initiated by the virus.
9. One mechanisms of viral transmission are fecal-oral, e.g., Astroviruses, Caliciviruses; these viruses cause acute gastroenteritis.
10. Cytotoxic T cells have specialised proteins on their surface that help them to recognise virally-infected cells.

Q2: Fill the following blanks:

1. ……., is a protein that can make pores in cell membranes; these pores allow entry of other factors into a target cell to facilitate destruction of the cell.
2. Viruses multiply only in living cells; the host cell must provide the energy and synthetic machinery and the low ……. precursors for the synthesis of viral proteins and nucleic acids.
3. Neonatal infection at birth, e.g., Acquired immunodeficiency syndrome (AIDS), is a chronic, potentially life-threatening condition caused by the ……
4. A special cell of the immune system in killing cells that have a ……. of class I major histocompatibility complex proteins (MHC class I) molecule on their surface, this cell is a natural killer cell (NK cell).

5. …… defined as the period between addition of virus and the appearance of assembled virus progeny inside the cell.
6. Cytokines include interferon-g and ……, and transfer a signal from the T cell to the infected, or other neighbouring cells, to enhance the killing mechanisms.
7. All of the six steps n viral replication process are not relevant to all viruses; the steps do not always occur in the …… order and some viruses have an additional step. In the later stages of replication several steps occur concurrently.

19. External Evaluator

I do approve the content of this course-book. It does cover the general concepts of general virology. The topics are broad and are aimed to equip students with required knowledge to enable them to understand the viruses concept equipment in latter stages.

Assist. Lec. Sherko Muhammed Abdul-Rahman
MSc. in Microbiology