I T I "Arturo Malignani" - Udine

CLIL EXPERIENCE February – March 2007

Classi: SECONDE Indirizzo Scientifico Tecnologico progetto "Brocca"
SECONDE Biennio Istituto Tecnico

Docenti: prof.sse Acchiardi Chiara, Bittolo Manuela e Boasso Annamaria.

Nota introduttiva.

Il modulo è stato realizzato per l'applicazione in classi seconde.
Sono allegati i contenuti minimi da presentare, ma in essi sono presenti anche alcuni ampliamenti (in corsivo) da utilizzare per classi più avanzate o se il livello di conoscenza della lingua inglese è buono.
In neretto sono evidenziati i termini da utilizzare perché presenti poi negli esercizi.

Nella warming up activity sono elencati molti termini relativi a malattie virali che non compaiono poi nella trattazione, ma che potrebbero essere conosciute dagli allievi. Sarà scelta del docente se far scaturire in parte o in toto questi elementi.

E' previsto che agli allievi vengano forniti gli esercizi da eseguire nelle varie fasi (non in foglio unico).

La verifica finale comprende la lettura di un brano che può essere ridotto o utilizzato in modi diversi (es. rispondere alle domande proposte alla fine, sottolineare i sintomi e i modi di trasmissione, individuare i verbi,…).

Bibliografia

Siti Internet:
www.en.wikipedia.org
www. biology.ucsd..edu
www.micro.magnet.fsu.edu (per il brano sull'influenza)
www.hhmi.org/biointeractive/animations

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subjects involved: **Biology and English** **lessons required: 3 or 4** (final test included)

A.

1) **(10 min) Warming up activity.**

Give the title **("VIRUSES"** ***- picture 1-)*** of the lesson / write it on BB and **ask them:**

- **What do you expect the lesson to be about?**
  - elicit ideas
  - focus on notions they still possess
  - **write on BB the words we think could be useful for the rest of the lesson**

non living	infection
virus	disease
cell	flu - influenza
cell membrane	common cold
structure	vaccine
protein	mumps
immune response	polio
enzyme	viral hepatitis
replication	rabies
cycle	herpes
nucleic acid	smallpox
defence	human immunodeficency virus (HIV)
antiviral	acquired immunodeficiency syndrome (AIDS)
antibiotic	tumor
DNA/RNA	German measles
host	infection
electron microscope	

(strategy activated: prediction)

2) **(5 min) Display images of some of the most common viruses (*pictures 2 to 14*)**

- Give quickly the idea of the heterogeneous world of viruses.

(strategy activated: visual memory)

B. (3 min) Describe the aims of the activity and the points we want they learn about viruses.

1) Aims of the activity

- Learn about viruses
- Listen for specific information
- Use scientific terms
- Read and debate for detailed information

2) Points to be described during the activity

- Introduction
- Virus structure
- Virus replication
- Viruses and Medicine (diseases and medical treatments)

FIRST LESSON

►(give a copy of exercise A to the students)

1. **(10 min) Introduction (**see the contents: definition of what a virus is) ***(picture 16)***

2. **(15-20 min) Structure** (see the contents: description of the components and their main characteristics) ***(picture 15)***

A) While listening activity.

Complete the following sentences with the missing information.

1. The word "virus" means ……..
2. Viruses are not ……
3. They do not have a cell …… or other components of living cells.
4. Viruses infect a wide variety of organisms: eukaryotes like …….., fungi and …… and prokaryotes like ……..
5. Viruses contain an inner …… ……. (genetic material).
6. Viruses have an outer …….. coat called ……..
7. An outer …… may surround the capsid.

B) After listening activity (10 min)

►(give a copy of exercise A to the students)

1. Match the words you heard during the lesson in column A with the corresponding definitions in column B. (

A	B
Capsid	A virus that infects bacteria
Phage	The outer protein coat of a virus
Virus	Living cells infected by viruses
Parasite	Inside a cell
Host cell	Organisms with a nuclear membrane
Intracellular	Lives at the expence of another organism
Eukaryote	Is made of an inner nucleic acid core and a capsid

2. State whether the following sentences are True (T) or False (F).

1. Viruses infect livimg cells	T	F
2. Viruses can only infect animals	T	F
3. Viruses can contain DNA or RNA as genetic material	T	F
4. Viruses may contain a capsid	T	F
5. Viruses are bigger than 0.1mm	T	F

(strategy activated: detailed comprehension)

SECOND LESSON

►(give a copy of exercise A to the students)

1. (20 min) Replication (see the contents) ***(picture 17)***

2. (15 min) Viruses and Medicine - diseases and medical treatments. (see the contents) (it is possible to show again the first pictures - 2 to 14 – to remaind their structure)

A) While listening activity.

Complete the following sentences with the missing information.

1. A virus may have a ……. or lysogenic cycle.
2. In the lytic cycle the virus adhere to the …….. ……
3. Once inside, the genetic material is ……..
4. Viral DNA and ……. are produced.

B) After listening activity (12 min)

1. Match the words you heard during the lesson in column A with the corresponding definitions in column B.

A	b
Receptor	Putting together the parts of something
Replication	Making a copy of something
To adhere	To attack to something
Penetration	A molecule recognized by another one
Assembly	The entry of a virus into a cell

2. Order the following sentences about the lytic cycle of Bacteriophages (write in the square the number from 1 to 6).
   a. The host DNA disintegrates. ☐
   b. The viral DNA is replicated. ☐
   c. The protein coats and DNA are assembled into new viral particles. ☐
   d. The virus attaches to the bacteria cell and its DNA enters the host cell. ☐
   e. The viral DNA is transcribed and translated, producing protein coats and enzymes. ☐
   f. Lisozyme causes the host cell wall to rupture. The bacterium dies in the process. ☐

3. In the following sentences animal viruses are described. Underline the words concerning differences between animal and bacterial viruses (referred to different structures or different moments of the cycle). **Work in pairs or small groups**. (12 min)

a. Animal viruses have a membranous outer envelope. Their glycoprotein spikes (=punte) allow the virus to adhere to receptors on the plasma membrane. The viral membrane fuses with the plasma membrane of the cell, allowing the virus to enter.

b. Once inside, the uncoating process releases the DNA inside the cell.
c. DNA replication produces several copies of the viral DNA. Transcription and translation produce protein coats and glycoprotein spikes.
d. Envelope proteins move to the host cell surface. Virus are assembled. Any virus acquire its outer membrane when it buds (=gemma) from the cell.

CLIL LESSON - "Viruses"

FINAL TEST (30 min)

1. Write down the answer to 2 of these questions:

   a. What is a virus? Describe the general structure.
   b. Describe the lytic cycle of a bacteriophage.
   c. What are the differences among lytic and lysogenic cycles?
   d. List some axamples of viral diseases.

2. Complete the following sentences with the missing information.

   a. Viruses are not_____ .
   b. They form _____relationships with living cells .
   c. Viruses have an outer protein coat called _____
   d. The genetic material in some viruses is _____; in other ones is _____
   e. They do not _____ or respond to stimuli .
   f. Viruses infect living organisms and cause many _____ and some kinds of cancer.

3. State whether the following sentences are True (T) or False (F).

a. Viruses have a cell membrane and other components typical of living cells.	T F
b. Viruses infect living host cells.	T F
c. They have genetic material and can therefore mutate or evolve.	T F
d. Viral diseases can be treated with antibiotics.	T F
e. Viruses are usually smaller than 250 nm.	T F
f. Viruses cannot synthesize proteins, because they lack ribosomes.	T F
g. Viruses must use the ribosomes of their host cells.	T F
h. Viruses cannot generate energy.	T F
i. Viruses can only infect animals.	T F
l. One single virus can contain both DNA or RNA.	T F

4. Match the names to the correct definition.

a. Viruses	1. A protein that regulates the speed of chemical reactions.
b. Genetic material	2. The outer protein coat of viruses.
c. Capsid	3. The inner nucleic acid core contained in viruses. It may be DNA or RNA.
d. Host cells	4. They are not living cells and form parasitic relationships with living cells
e. Enzyme	5. Living cells infected by viruses and required for their reproduction.

5. Order the following sentences about the lytic cycle of Bacteriophages.

   a. The host DNA disintegrates. ☐
   b. The viral DNA is replicated. ☐
   c. The protein coats and DNA are assembled into new viral particles. ☐
   d. The virus attaches to the bacteria cell and its DNA enters the host cell. ☐
   e. The viral DNA is transcribed and translated, producing protein coats and enzymes. ☐
   f. Lisozyme causes the host cell wall to ropture. The bacterium dies in the process. ☐

6. Read the text and answer the questions about the article. (**20 min)**

The Influenza (Flu) Virus –

Next to the common cold, influenza or "the flu" in perhaps the most familiar respiratory infection in the world.
The symptoms of the flu are similar to those of the common cold, but tend to be more severe. Fever, headache, fatigue, muscle weakness and pain, sore throat, dry cough, and runny or stuffy nose are common and may develop rapidly. Gastrointestinal symptoms associated with flu are sometimes experienced by children, but for most adults, illness that manifests in diarrhea, nausea, and vomiting are caused by influenza virus though they are often inaccurately referred to as the "stomach flu".
A number of complications, such as the onset of bronchitis and pneumonia, can also occur in association with influenza and are especially common among the elderly, young children and anyone with a suppressed immune system.
Viruses can be inhaled directly by someone close by. Or, when we take a drink of water, we leave viruses behind on the rim of the cup.
We were all taught to cover our mouths when we sneeze or cough, but in doing so our hand, if we don't use a handkerchief, are sprayed with viruses. If we pick up a pencil and use it, and then put it down, the pencil now has viruses present on its surface. Someone else can come along and use the same pencil, transferring some of the viruses to his finges. If that someone then puts a finger in his mouth or nose, or eats a sandwich without washing his hands first, the viruses have easy access to the mucosal cells they target.
Frequent hand washing is one of the most effective ways to prevent colds, and not sharing a drinking cup is another.

a. What are the symptoms of the flu?
b. What are the complications?
c. How do viruses spread?

CLIL LESSON - "VIRUSES"

Guide to the main contents to be explained in the lesson.

The word "virus" means **poison**.

A virus **is not a cell**, in fact it hasn't a cell membrane or other components of living cells, so it **requires a living host cell** for its reproduction
A virus is unable to grow and reproduce outside of a living cell.

Viruses are considered non-living because they don't meet all the criteria of the generally accepted definition of life.
A virus is a small obligate intracellular parasite, in other words it is a microscopic particle that depends on a living host cell for energy, enzymes and ribosomes to multiply.

Viruses can infect the cells of a wide variety of organisms both eukaryotes (animals, fungi and plants) and prokaryotes (bacteria)
A virus that infects bacteria is called bacteriophage (or phage).

Any virus has specific host cell types: for example influenza virus infects cells lining the respiratory tracts, poliomyelitis virus infects nerve cells, hepatitis virus binds only to liver cell-receptors.

All viruses have a limited host range and even within a host they attach to and invade only those cells with the appropriate receptor sites (specificity).

Viruses contain an inner nucleic acid **core** (genetic material) and an outer protein coat called **capsid**, which is mainly composed of a few types of proteins.

They contain only one form of nucleic acid. Some viruses use RNA and other use DNA. Further, this nucleic acid polymer may either exist as double stranded DNA or RNA or as single stranded DNA or RNA.
The nucleic acid may contain as few as 4 to 7 genes for very small ones viruses, to 150-200 genes for very large ones.

Viruses range in **size from 20 nm to 250 nm**.
There are more than 4.000 virus species belonging to 71 families or groups.

With the discovery the electron microscope it became possible to study the morphology of viruses.
The size and the shape of an individual virus are a constant and distinguishing characteristic.
Viruses may consist of circles, ovals, long thick or thin rods, flexible or stiff rods and ones with distinctive heads and tail components. To classify a virus taxonomists consider the type of nucleic acid, whether it is single- or double-stranded, the presence or absence of an envelope, the type of host, the capsid shape, immunological properties and the type of disease caused.

All viruses have **attachment proteins** to attach to its target cell before it can enter that cell.

Some viruses pick up a lipid membrane from the host cell when it is released and it surrounds the capsid and it is called **envelope**.

Replication

Viruses don't grow through cell division; they use the metabolism of the host cell to produce a lot of copies of themselves.
They may have a **lytic or a lysogenic** cycle, with some viruses capable of carrying out both.

A virus can still cause degenerative effects within a cell without causing its death **(cytophatic effect).**

Viruses can be passed between hosts through either direct contact often via body fluids, or through a vector, while in aqueous environments, viruses float free in the water.

LYTIC CYCLE.

Adsorption. The viral glycoproteins on the outer membrane of the virus **adhere** to receptors on the plasma membrane of the target host cell.

Penetration. The viral membrane fuses with the plasma membrane of the cell, allowing the virus to **enter**.
Once inside, the process of uncoating releases the DNA. (In the case of phages the capsid stays outside).

Biosynthesis. Inside the cell, the protein capsid is removed and the viral genome is freed into the cytoplasm. Then the virus' nucleic acid uses the host cell structures to **produce** viral DNA, protein coats and glycoproteins.

Maturation and lysis. Viral proteins move to the host cell surface and viruses are **assembled** (typically 100-200), the cell is broken (lysed) to **release** the virus particles.
Some viruses do not lyse the cell but exit the cell via the cell membrane in a process called exocytosis, taking a small portion of the plasma membrane with them as a viral envelope. As soon as the cell is destroyed the viruses have to find a new host.

LYSOGENIC CYCLE.

It doesn't result in immediate lysing of the host cell, instead the viral genome **integrates** into the host DNA and replicate along with it. The assembly of viruses doesn't occur.

The virus remains **dormant** but after the host cell has replicated several times, or if the environmental conditions permit it, the virus will become active and enter the lytic phase.

This cycle allows to host cell to survive and reproduce and the virus is passed on to all the new cells. The virus may exist relatively harmlessly within an organism: an example would include the ability of the Herpes simplex, which causes cold sores, to remain in a dormant state within the human body

Reverse transcribing viruses (Retroviruses)
Those viruses contain RNA genomes. They use a DNA intermediate to replicate in fact they use a reverse transcription, which forms DNA from an RNA template. HIV is a retrovirus.

Viruses and diseases.

Examples of common diseases caused by viruses include the common cold, the flu, chickenpox. Viruses also cause serious **diseases** such as Ebola, AIDS, bird flu and SARS. Viral genes (**oncogenes**) can cause some kinds of cancer.

Prevention and treatment.

Because viruses use the host cell to reproduce and also reside inside them, they are difficult to eliminate without killing the host cell. The most effective medical approaches to viral diseases so far are **vaccinations** to provide resistance to infection, and drugs which treat the symptoms of viral infections or interfere with their replication (AZT, protease inhibitors,…)
Antibiotics are useless against viruses.

Geneticists regularly use viruses as vectors to introduce genes into cells.