

Lecture One :

History of Virology & Significant Events

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Learning outcomes

By the end of this lecture students should

- Be able to describe how viruses were first discovered.
- Be able to know how viruses were detected.
- Be able to recognize the history of vaccinology.
- Be able to discuss the significant events in the field of virology.



Virus History

A Short History of the Discovery of Viruses

- The viruses were first described only in the 1890s-yet have probably co-existed with cellular life through nearly the whole of evolutionary history on this planet.
- There are millions of different types of viruses, although only about 5,000 types have been described in detail.
- There are more than 219 virus species that are known to be able to infect humans.



Rabies was one of the Most Feared Diseases of Man

➤ Mesopotamian laws concerning rabid dogs date from 5000-1000 BC. People who let rabid dogs run free were fined. Rabies is known on all continents. Recent epidemics in North America, Europe & India.

➤ Rabies virus causes disease and death in most mammals. Transmitted in nature by foxes, raccoons, skunks and bats to domestic animals.

➤ Dogs and bats transmit to humans.



Here this firebrand, rabid Hector, leads the charge.
Homer, *The Iliad*.

The Greek poet Homer characterizes Hector as "rabid" in the Iliad.

The Year 3700 BC

The first written record of a virus infection consists of a heiroglyph from Memphis, the capital of ancient Egypt, drawn in approximately 3700 BC, which depicts a temple priest called Ruma (at another place the name is Siptah and it says that it was 1400 BC) showing typical clinical signs of paralytic poliomyelitis.



Egyptian stele from the 18th dynasty (1403-1365 B.C) represent a polio victim with depicting a man with a withered leg and the "drop foot" syndrome characteristic of polio.

The Year 1193 BC

The Pharaoh **Siptah** rules Egypt from 1200-1193 BC when he dies suddenly at the age of about 20.

His mummified body lays undisturbed in his tomb in the Valley of the Kings until 1905 when the tomb was excavated.

The mummy shows that his left leg was withered and his foot was rigidly extended like a horse's hoof - classic paralytic poliomyelitis



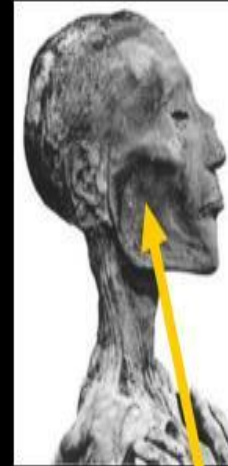
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The Year 1143 BC

Ramesses V's preserved mummy shows that he died of smallpox at about the age of 35 in 1143 BC.

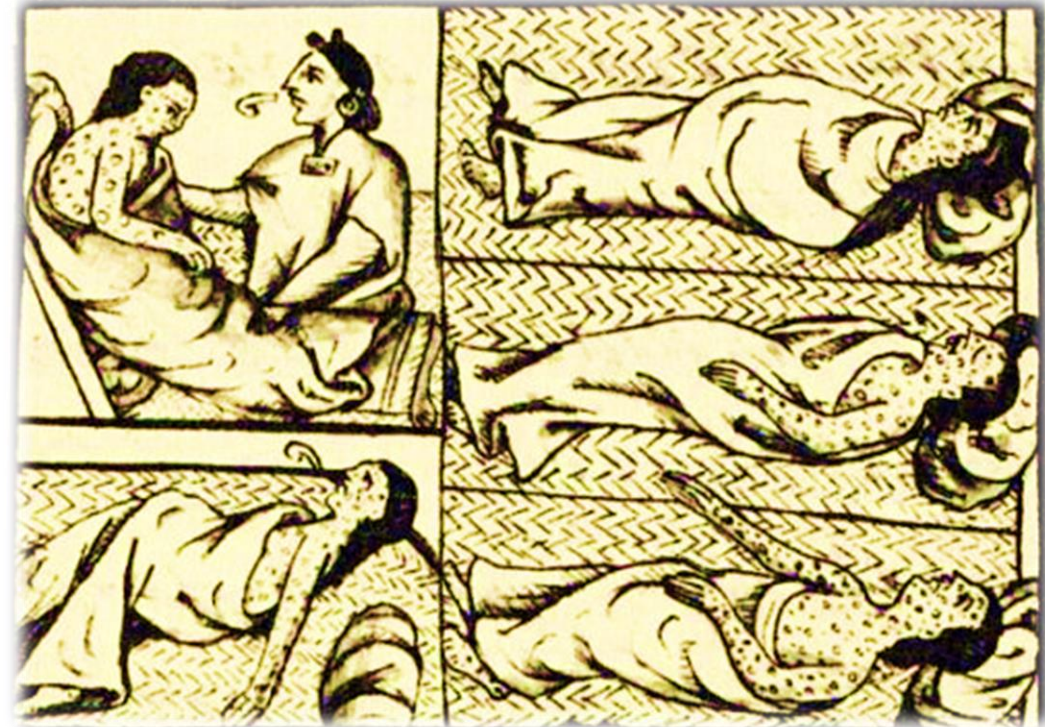
The pustular lesions on the face of the mummy are very similar to those of more recent patients. However, his head also displays a major wound inflicted either before or shortly after death.



Virus History

THE EARLY YEARS

- ❖ Choosing a precise beginning for the history of the science of virology is somewhat arbitrary, in part because several illnesses that now are known to result from virus infections had been recognized for thousands of years without any knowledge of viruses.
- ❖ Regardless, there is some justification for beginning 1,000 years ago with smallpox.
- ❖ During that time empirically based measure was adopted to control the disease which was variolation. Uninfected individuals were inoculated with materials from the scabs of individuals who survived smallpox infection.



500-year-old drawing depicts Nahua Native Americans suffering from smallpox.

Virus History: Discovery and Detection

Porcelain filters and the discovery of viruses



The invention that allowed viruses to be discovered at all was the **Chamberland-Pasteur filter**. This was developed in **1884** in Paris by **Charles Chamberland**, who worked with **Louis Pasteur**.

Eras in virology

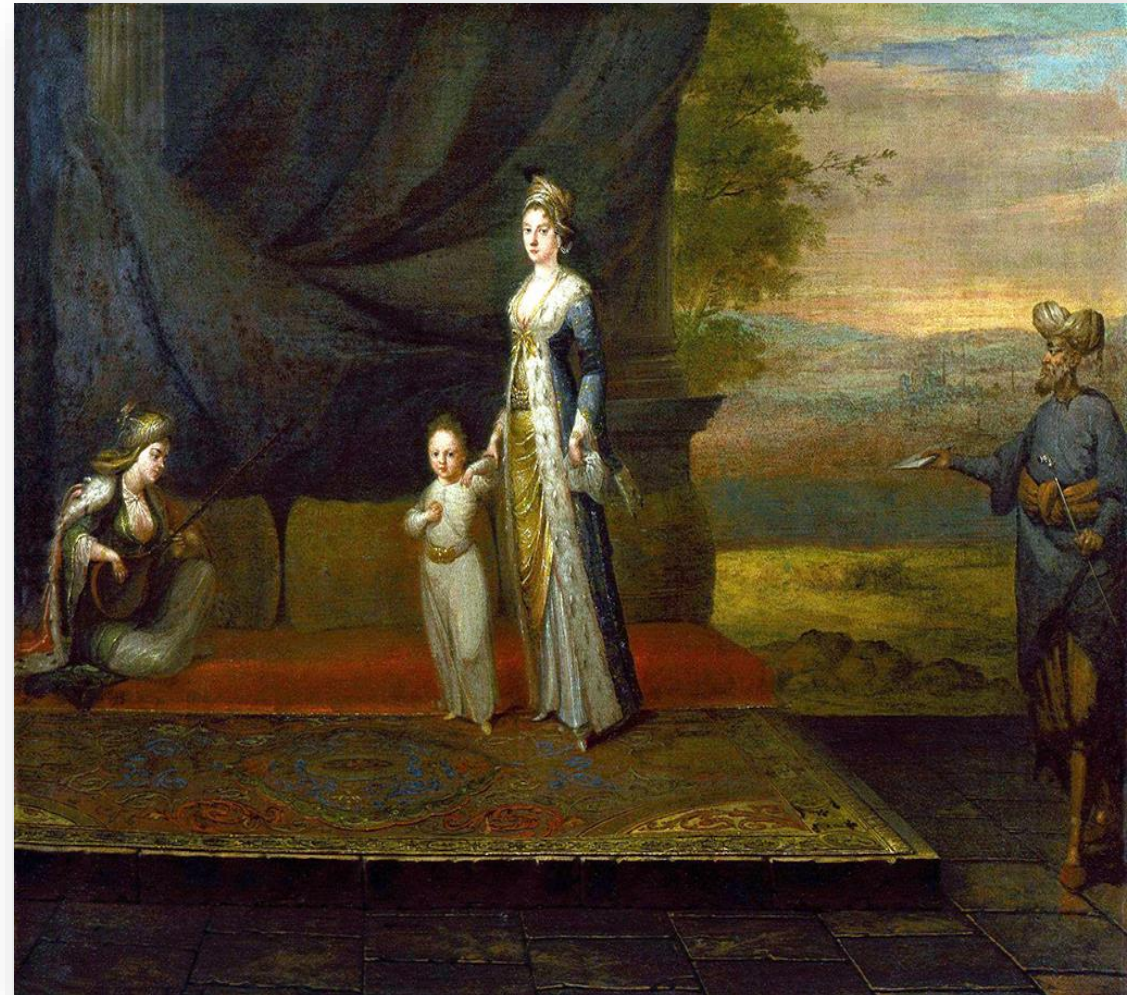


Era	Years	Description
Protovirology	1796-1885	Before viruses were recognized
Auroravirology (named for the Roman goddess of dawn)	1892-1933	Dawn of virology
Meridiovirology (from Latin for midday, sequel to dawn)	1934-1955	From the demonstration that bacteriophages are composed of protein and nucleic acid and the crystallization of TMV to the in vitro assembly of infectious TMV from purified RNA and protein
Janovirology (named for the Roman god of endings and beginnings)	1956-1975	Spans the interval between classic virology and the beginning of the era dominated by viral sequence information; encompasses the elucidation of essential features of gene structure, expression, and regulation and the development of essential techniques, including cloning and restriction sequence mapping
Neovirology	1976-present	Begins with the first complete sequencing of viral genomes and atomic resolution structures of intact viruses

Virus History

The year 1715

- ❖ Lady Mary Wortley Montague, the wife of the British ambassador to Turkey, had her children undergo variolation.
- ❖ Smallpox in a dried-out lesions is partially inactivated by that person's immune response as well by the drying itself.
- ❖ During this time, variolation was based on the observation that smallpox survivors were resistant to subsequent episodes of infection.



Virus History

The year 1798

- 🦠 **Edward Jenner**, English country doctor, made a major leap forward in preventing smallpox.

The Year 1796

On 14th May 1796, **Edward Jenner** vaccinated an 8 year old boy, James Phipps, with material from a cowpox lesion on the hand of a milkmaid, Sarah Nelmes. James, who had never had **smallpox**, developed a small lesion at the site of vaccination which healed in 2 weeks. On 1st July 1796, Jenner challenged the boy by deliberately inoculating him with material from a real case of **smallpox** !



Virus History

The year 1798

- 🦠 **Edward Jenner**, English country doctor, made a major leap forward in preventing smallpox.
- 🦠 **Jenner** observed that milkmaids, were “resistant” to smallpox.
- 🦠 **Jenner** inoculated a child, **James Phipps**, with extract from a cowpox lesion and then demonstrated that young Phipps was resistant to a subsequent challenge with smallpox.



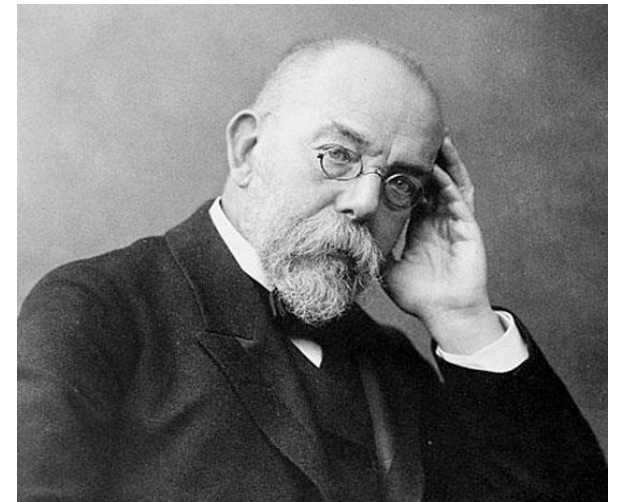
Virus History

The year 1867

- ✿ **Louis Pasteur**, French biologist, microbiologist and chemist, proposed that microorganisms might produce different kinds of diseases.
- ✿ Aseptic techniques that **Lister** then introduced dramatically reduced infections during surgery.
- ✿ Robert Koch created a series of four generalized principles linking specific microorganisms to specific diseases (**Koch's postulates**).



Louis Pasteur: 1822-1895



Robert Koch: 1843-1910

Virus History

The year 1885

- 🦠 **Louis Pasteur**, developed the second human vaccine which was against rabies.
- 🦠 He attenuated the virus by serial passage of the rabies agent in rabbits.
- 🦠 **Pasteur** coined the word “vaccination” based on the Latin word for cow (vacca) in recognition of **Jenner’s** contribution.



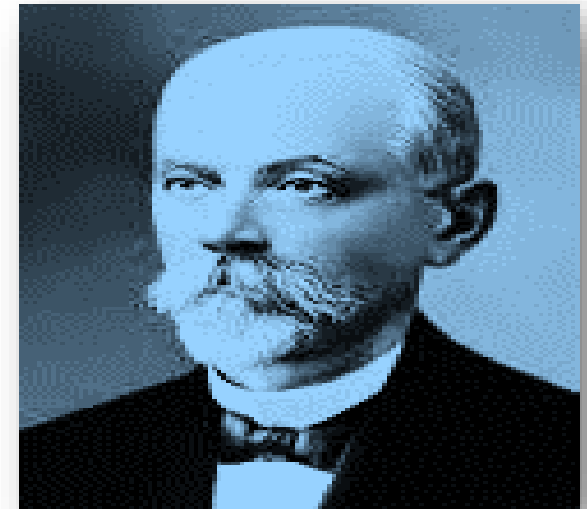
Virus History

The year 1887: Birth of virology

- 🦠 **Dmitry Ivanovsky**, a Russian scientist repeated the work of German **Adolf Mayer** to identify the causative agent of tobacco mosaic disease.
- 🦠 The first use of porcelain filters to characterize the virus was reported by **Dmitri Ivanovski**
- 🦠 Both found that the sap of diseased plants transmit the disease to healthy plants.
- 🦠 However, **Ivanovsky** went an important step further, He found that the infectious agent could actually pass through the so called Chamberland Filters.
- 🦠 Both were unable to satisfy an important components of **Koch's** postulates “**that is the cultivation of a single species of microorganisms in pure culture**”.



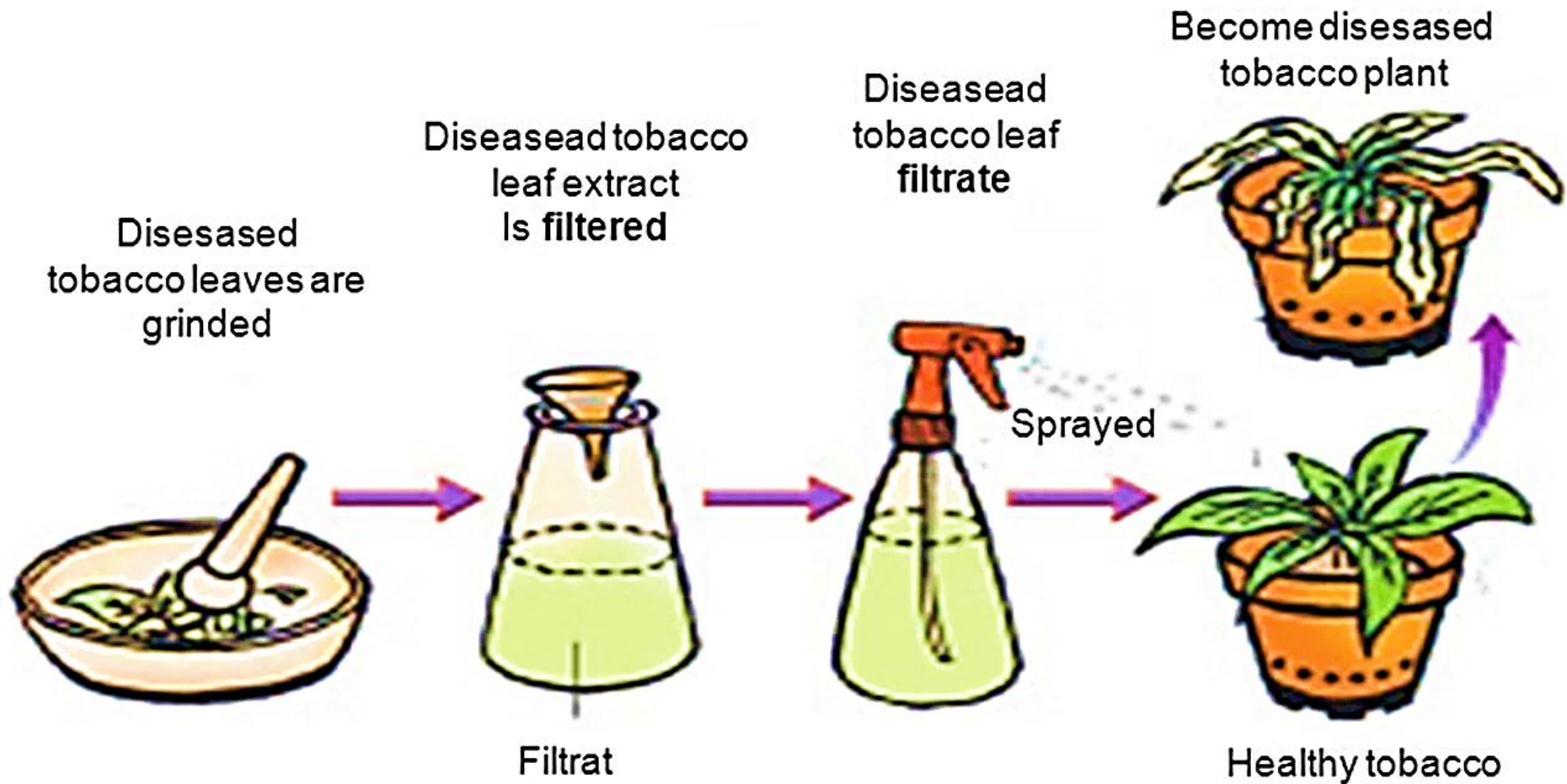
Adolf Mayer: 1843 –1942



Dmitry Ivanovsky :1864 -1920

Virus History

Dmitri Ivanovsky (1892)



Virus History

- ❖ The influence of Koch's postulates was so strong that Ivanosky did not want to that he might actually have seen evidence for a previously unknown kind of microorganism.
- ❖ Perhaps the causative agent was a bacterium and the filters were defective, or perhaps the causative agent was a toxin, a non-reproducing poisonous substance produced by an organism.


The year 1898

- ❖ Dutch microbiologist **Martinus Willem Beijerinck**, who was working with **Mayer** but was unaware of **Ivanovsky's** findings, he gave the term virus.
- ❖ He did the same work of **Ivanosky**, however, he went another major step further.



Martinus Beijerinck: 1851 -1931

Virus History

- 
- ❖ **Beijerinck (Father of virology)** demonstrated that dilution of the sap did not affect its ability to cause disease
(i.e. **the disease-causing agent was in fact replicating in the plant tissue, thus accounting for its ability to replenish its pathogenic activity**).
 - ❖ The work of **Beijerinck** led to identification of two fundamental properties that are characteristic of this new class of pathogens.
 - ❖ First, they are smaller than bacteria, since they pass through filters that block bacteria.
 - ❖ Second, they require living cells or tissue to support their propagation.
 - ❖ **Beijerinck** termed the submicroscopic agent responsible for tobacco mosaic disease ***contagium vivum fluidum*** .

Virus History



The year 1898 The first animal viruses

- 🦠 **Loeffler and Frosch** isolated the first virus obtained from animals, the foot-and-mouth disease virus. They showing that possible to vaccinate cows and sheep against the disease.

The year 1901 The first human virus: yellow fever

- 🦠 **Walter Reed** isolated the first virus pathogenic in humans, yellow fever virus.


Viruses and cancer 1908

- 🦠 **Peyton Rous** found that sarcomas (cancers of connective tissue) in chickens could be transmitted by a virus that is now known as the **Rous sarcoma virus (Nobel price in 1962)**

The year 1938

- 🦠 The first electron micrographs of TMV were taken.
- 🦠 The term “virus,” from the Latin word for poison, came to be used to refer to the agents having the properties described by **Mayer, Ivanovsky, and Beijerinck**.

Landmarks in the study of viruses



Era and year	Landmark (virus or scientist)
Protovirology	
1798	Cowpox lesions used to vaccinate against smallpox (Jenner)
1882	Transmission of tobacco mosaic disease with cell-free extracts (Mayer)
1885	Development of rabies vaccine (Pasteur, Roux)
Auroravirology	
1892	Description of filterable infectious agent (TMV) (Ivanovsky)
1898	Development of concept of virus as contagious element (TMV) (Beijerinck)
	Discovery of first animal virus (FMDV) (Loeffler, Frosch)
1901	Discovery of first human virus (yellow fever virus) (Reed)
1903	Discovery of rabies virus (Remlinger, Riffat-Bay)
1908	Discovery of first leukemia-causing virus (Ellerman, Bang)
1909	Discovery of poliovirus (Landsteiner, Popper)

Landmarks in the study of viruses- Continue

1911	Discovery of first solid tumor virus (RSV) (Rous)
	Discovery of measles virus (Goldberger, Anderson)
1913	Virus cultivation in tissue culture (VV) (Steinhardt, Lambert)
1915	Discovery of bacterial viruses (bacteriophages) (Twort, d'Hérelle)
1917	Development of the plaque assay and discovery of the particulate nature of viruses (bacteriophage) (d'Hérelle)
1931	Propagation of virus in embryonated chicken eggs (Woodruff, Goodpasture)
1932	Discovery of first mammalian tumor virus (MMTV) (Little, Bittner)
1933	Discovery of human influenza virus (Smith)
	Discovery of rabbit papillomavirus (Shope)
	First description of viral mutants (TMV) (Jensen)



Landmarks in the study of viruses- Continue

Meridiovirology	
1934	Discovery that bacteriophages are composed of protein and nucleic acids (Schlesinger)
1935	Crystallization of TMV (Stanley)
1938	Development of yellow fever vaccine (Theiler)
	Use of electron microscopy for viruses (TMV) (von Borries, Ruska, Ruska)
1939	Description of one-step growth cycle (bacteriophage) (Ellis, Delbrück)
1941	Discovery of first virus-associated enzymes (influenza virus) (Hirst)
1943	Discovery of genetic origins of mutations (bacteriophage) (Luria, Delbruck)
1945	Development of influenza vaccine (Francis)
1946	Discovery of genetic recombination by bacteriophage (Delbruck)
	Replication of poliovirus in nonneuronal cell cultures (Enders, Weller, Robbins)
	Discovery of eclipse phase of virus infection (bacteriophage) (Doermann)
1951	Discovery of bacteriophage λ (E. Lederberg)
	Discovery that lysogenic phages produce diphtheria toxin (Freeman)



Landmarks in the study of viruses- Continue

1953	Discovery of host-controlled restriction and modification (Luria, Bertani, Weigle)
1954	Development of polio vaccines (Salk, Sabin)
1955	Culture of human cells (HeLa) (Gey)
	Optimization of cell growth medium (Eagle)
	Definition of a gene (cis-trans test) (bacteriophage) (Benzer)
	In vitro assembly of infectious virus (TMV) (Fraenkel-Conrat, Williams)
Janovirology	
1956	Discovery of mRNA in bacteriophage infection (Volkin, Astrachan, Brenner, Jacob, Meselson)
	Discovery that virus particles are composed of identical subunits (Watson, Crick)
	Discovery that RNA can carry genetic information (TMV) (Schramm, Fraenkel-Conrat, Williams)
1957	Discovery of interferon (Isaacs, Lindemann)
	Discovery of respiratory syncytial virus (Chanock)
1958	Discovery of bacteriophage λ regulation paradigm (Pardee, Jacob, Monod, Lwoff)
1960	Discovery of SV40 (Sweet and Hilleman)
	Demonstration of the triplet nature of the genetic code (bacteriophage) (Crick)
	Elucidation of nonsense codons (bacteriophage) (Campbell, Epstein, Bernstein)
1962	Studies of virus structure (Klug, Caspar)
1964	Demonstration of the colinearity of gene with polypeptide chain (bacteriophage) (Brenner)
	Discovery of first human tumor virus (EBV) (Epstein, Barr, Burkitt)
1965	Autocatalytic in vitro synthesis of bacteriophage DNA (Spiegelman)
1966	Experimental transmission of spongiform encephalopathy to primates (kuru) (Gajdusek, Gibbs, Hadlow)



Landmarks in the study of viruses- Continue

1967	Discovery of hepatitis B virus (Blumberg)
	Isolation of bacteriophage λ repressor (Ptashne)
	Discovery of viroids (Diener)
	Discovery of first virion-associated polymerase (VV) (McAuslan, Kates)
1970	Discovery of retroviral reverse transcriptase (Temin, Baltimore)
1971	Discovery of RNA polyadenylation (Darnell, Edmonds)
1972	Development of first recombinant DNA molecules (phage λ , SV40) (Berg)
	Proposal that reassortment of influenza virus segments is the origin of pandemic strains (Webster, Laver)
1973	Development of first restriction map (SV40) (Nathans)
	Discovery of major histocompatibility locus restriction of viral antigen recognition (Doherty, Zinkernagel)
	Discovery of human rotavirus (R. Bishop)
1974	Development of first transgenic mouse (SV40) (Mintz)
1975	Discovery of mRNA capping (Shatkin, Moss)
Neovirology	
1976	First RNA virus genome sequenced (bacteriophage MS2) (Fiers)
	Demonstration that retroviral oncogenes are derived from cells (J. M. Bishop, Varmus)
1977	First DNA virus genomes sequenced (Φ X174, SV40) (Sanger, Fiers, Weissman)
	Discovery of RNA splicing (adenovirus) (Roberts, Sharp)
	Discovery of tumor suppressor p53 (SV40) (Levine, Crawford)
	Description of first virus crystal structure (TBSV) (Harrison)
1978	Development of the first infectious molecular clone of an RNA virus (Qbeta, Weissmann)



Landmarks in the study of viruses- Continue

1979	Declaration of smallpox eradication by World Health Organization
	First in vitro replication of eukaryotic viral DNA (adenovirus, SV40) (Kelly, Hurwitz, Stillman)
	Development of first in vitro mRNA transcription system (adenovirus) (Roeder)
	Discovery of first highly active, template-specific, RNA-dependent RNA polymerase from a eukaryotic source (BMV) (Hall)
	Discovery of tyrosine kinases (Hunter, Erikson, Eckhart)
1980	Discovery of first human retrovirus (HTLV-1) (Gallo)
1981	Development of first infectious molecular clones of an animal RNA virus (poliovirus) (Baltimore)
	Discovery of transcriptional enhancers (Chambon, Khoury, Schaffner)
	Development of hepatitis B virus vaccine
	Identification of mammalian transcription factors (MMTV, SV40) (Yamamoto, Tjian)
	Discovery of insertional activation of cellular oncogenes by retroviruses (Hayward, Astrin)
	Identification of polyadenylation signal (Shenk)
	Discovery of the Cre/lox recombination system in phage P1 (Sternberg)
1982	Development of antiviral and other drugs (Elion, Hitchings)
	Definition of prions (Prusiner)
1983	High-risk human papillomaviruses identified and linked to cervical cancer (zur Hausen)
	Discovery of AIDS virus (HIV) (Montagnier, Barre-Sinoussi, Gallo)
1984	Discovery of nuclear localization signals (Smith, Butel)
	Production of first infectious, multicomponent virus from cloned DNA (BMV) (Ahlgquist)



Landmarks in the study of viruses- Continue

1986	Development of first recombinant viral vaccine (hepatitis B virus)
	Generation of transgenic virus-resistant plants (TMV) (Beachy)
	Discovery of hammerhead ribozymes (TRSV, ASV) (Bruening, Symons)
1988	Discovery that DNA virus oncogene products bind cellular tumor suppressor proteins (adenovirus, SV40, HPV) (Harlow, Weinberg, Livingston, Howley)
	Development of first ribozyme with engineered specificity (Haseloff)
	Discovery of internal ribosome entry sites (poliovirus) (Wimmer, Sonenberg)
1989	Discovery of hepatitis C virus (Houghton)
1990	Development of first human gene therapy with a retrovirus vector (Anderson, Blaese)
1991	Discovery of viral antiapoptotic proteins (baculovirus) (Miller)
1995	Development of HAART treatment for AIDS
1998	Discovery of gene silencing by double-stranded RNA, an antiviral response (Fire, Mello)
	Use of plant virion for synthesis of nanoparticles (Young)
	Discovery that plant viruses encode suppressors of RNAi (Vance, Baulcombe)
2001	Discovery of the caveosome (SV40) (Helenius)
2002	Worldwide outbreak and containment of SARS
2005	Reconstruction and sequencing of the 1918 influenza virus genome (Palese, Garcia-Sastre, Tumpey, Taubenberger)
2006	Development of vaccine against human papillomavirus, the first vaccine designed to prevent human cancer





1796

1796 Edward Jenner administers the first smallpox vaccine, which is heralded as the world's first vaccine. The vaccine consists of fluid from a cowpox blister, a virus similar to smallpox, which is scratched onto the skin of an 8-year old boy. When the boy is later inoculated with smallpox matter, no disease develops.

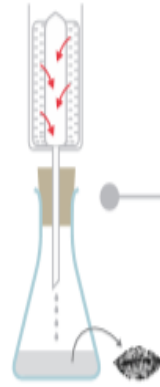


1885

1885 French scientists, Louis Pasteur and Emile Roux, develop the first effective rabies vaccine. The virus is grown in rabbits and a vaccine is made from dried rabbit nervous system tissue, which is successfully administered to a boy that was bitten by a rabid dog.

1892 Dmitri Ivanovsky shows that tobacco mosaic disease, a single-stranded RNA plant virus, can be transmitted by extracts passed through porcelain Pasteur-Chamberland filters, which exclude the smallest known bacteria.

1892



1898 Martinus Beijerinck replicates the filtration experiments performed by Dmitri Ivanovsky and calls the infectious agent that causes tobacco mosaic disease a "virus", which he describes as a "contagium vivum fluidum" or "contagious living fluid". Beijerinck along with Ivanovsky are considered to be the founders of virology.

1898

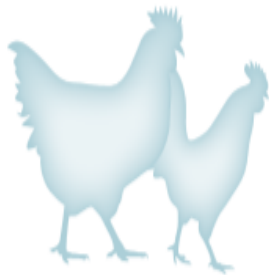
1898 The first animal virus, known as foot and mouth disease virus, is discovered by German scientists, Friedrich Loeffler and Paul Frosch. They show that cows and sheep can be vaccinated against the virus using a heat-inactivated, filtered vesicle extract.



1901



1901 Walter Reed heads the U.S. Army Yellow Fever Commission, which discovers that yellow fever is transmitted by the bite of an *Aedes aegypti* mosquito rather than by direct contact.



1911 Peyton Rous discovers Rous sarcoma virus (RSV), the first oncogenic retrovirus to be described, which is found to cause sarcoma in chickens. Rous shares the Nobel Prize in Physiology or Medicine in 1966 for his discovery of tumor-inducing viruses.

1911



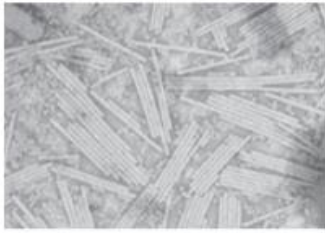
1933

1933 Cottontail rabbit papillomavirus (CRPV) is discovered and is shown to be the first oncogenic DNA virus in 1935. CRPV causes skin tumors and warts that are typically located on the heads of infected rabbits.



1935

1935 Wendell Stanley produces the first crystals of tobacco mosaic virus and shows that the virus remains active after crystallization. Crystallization of the virus was the first step toward proving that the virus is particulate.



1937

1937 Max Theiler grows the yellow fever virus in chicken eggs and produces a vaccine from an attenuated virus strain. In 1951, he receives the Nobel Prize in Physiology or Medicine for his discovery of an effective yellow fever vaccine, the only Nobel Prize ever awarded for the development of a virus vaccine.



1951

1951 Ludwik Gross identifies the first murine leukemia virus.

1953



1953 Jonas Salk announces on a national radio show and later reports in *The Journal of the American Medical Association* that he has successfully developed and tested an injectable, killed-virus vaccine against poliovirus, the virus responsible for poliomyelitis. Testing of the vaccine starts in 1954 and in 1955, it is announced that the vaccine is safe and effective. In 1962, an oral vaccine developed by Albert Sabin using a weakened form of the live virus becomes available.

1955

1955 Rosalind Franklin proposes the full structure of tobacco mosaic virus, suggesting that the virus contains a single strand of RNA that spirals in a helical groove inside the center of the viral proteins. Solving the structure of the tobacco mosaic plant virus paved the way for solving the structure of animal viruses, which Franklin's lab subsequently pursued, leading to a publication following her death that described the crystal structure of poliovirus.



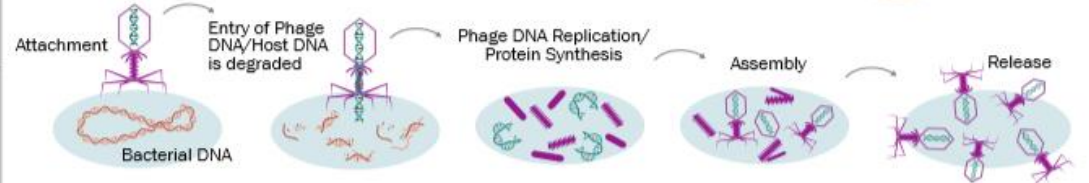
1962

1962 John Trentin reports that human adenovirus is capable of causing tumors in experimentally-infected animals. This is the first known human virus reported to be capable of inducing cancer.



1936

1936 John Bittner reports that an infectious, filterable agent present in the milk of certain cancer-prone mouse strains can be transmitted to newborn, cancer-resistant mice by suckling and it can lead to the development of mammary tumors. This infectious agent later came to be known as mouse mammary tumor virus.

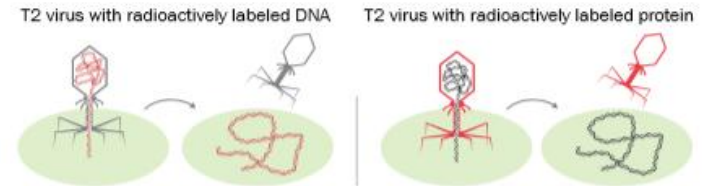


1939

1939 Emory Ellis and Max Delbruck establish the concept of the one-step virus growth cycle, which serves as the basis for understanding viral replication and the virus life cycle. They demonstrate that virus particles do not grow, but rather are assembled from preformed components.

1952

1952 Hershey and Chase demonstrate that DNA alone, not protein, enters a bacterial cell upon infection with enterobacteria phage T2, which is a virus that infects and kills *E. coli*.



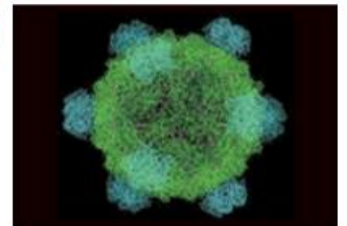
1954

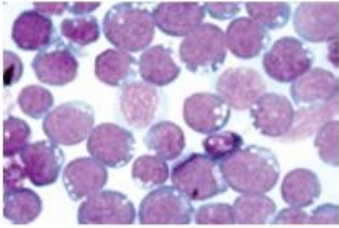
1954 John Franklin Enders, known as "The Father of Modern Vaccines", along with Thomas Huckle Weller and Frederick Chapman Robbins share the Nobel Prize in Physiology or Medicine for their discovery that poliovirus could be grown in cultures using various types of tissues without needing an intact organism. This finding allowed both inactivated and live polio vaccines to be produced for the first time and was critical to being able to create large quantities of different kinds of viruses for research.



1959

1959 The Nobel Prize in Physiology or Medicine is jointly awarded to Severo Ochoa and Arthur Kornberg for their discovery of the mechanisms in the biological synthesis of ribonucleic acid and deoxyribonucleic acid. Ochoa discovered an enzyme that could synthesize RNA, while Kornberg discovered an enzyme that could synthesize DNA. Kornberg later showed that DNA synthesized in a test tube by purified enzymes could produce all of the features of a natural virus using the bacteriophage Phi X 174, a single-stranded DNA virus, as a model.





1964

1964 A paper describing the first virus directly associated with human cancer is published in *The Lancet*. The virus, known as Epstein-Barr virus, is a human herpesvirus discovered by Michael Epstein, Yvonne Barr, and Bert Achong through their research on Burkitt's lymphoma cells.



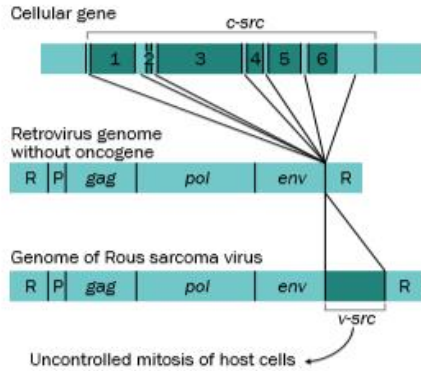
1963



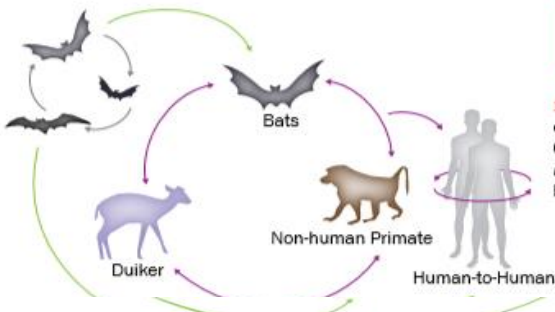
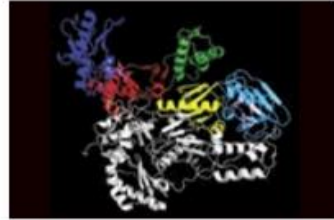
1963 John Franklin Enders uses cultivated measles virus that was isolated from blood samples collected from David Edmonston during a measles outbreak at the Fay School in Massachusetts to develop a vaccine. This vaccine, based on the attenuated Edmonston strain, is licensed by the U.S. in 1963.

1970

1970 The first retroviral oncogene, v-Src, is discovered in Rous sarcoma virus. This gene encodes a tyrosine kinase involved in cell growth and differentiation.



1970 Reverse transcriptase is discovered by Howard Temin in RSV virions and independently isolated by David Baltimore from two RNA tumor viruses, R-MLV and RSV. The enzyme is used by retroviruses to generate complementary DNA from an RNA genome, which is then stably integrated into the chromosomal DNA of the host. Temin and Baltimore are jointly awarded the Noble Prize in Physiology or Medicine in 1975, along with Renato Dulbecco, for their discoveries.



1976

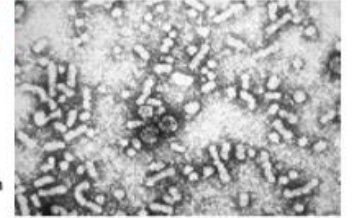
1976 The first known outbreaks of Ebola virus disease (EVD) occur in South Sudan and in the Democratic Republic of the Congo, and are found to be caused by two distinct subtypes of *Ebolavirus*. While the natural host of Ebola remains unknown, bats are now believed to be the most likely reservoir.



1980

1980 Robert Gallo discovers the first human retrovirus, Human T-Lymphotropic Virus (HTLV-1), by visualizing viral particles in cultured human T cell lymphoma cells.

1965



1965 Baruch Blumberg and his colleagues discover a new antigen in the serum of an Australian aborigine that reacts with an antibody in the sera from patients with hemophilia who had received blood transfusions. This antigen is called the Australian antigen, and is later found to be a surface antigen on the hepatitis B virus (HBV). In addition to discovering HBV, Blumberg later develops a screening test for the virus and an approach for developing a vaccine. In 1976, he shares the Nobel Prize in Physiology or Medicine for his discovery of the new mechanisms for the origin and dissemination of infectious diseases.

1971



1971 The measles, mumps, rubella (MMR) vaccine is developed by Maurice Hilleman at Merck Pharmaceutical Co. The vaccine is a mixture of the three attenuated viruses. Over his lifetime, Hilleman is credited with developing over 40 vaccines and saving millions of lives through his efforts.

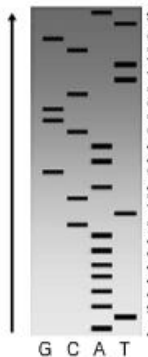
1975

1975 Baruch Blumberg discovers a link between chronic hepatitis B virus (HBV) infection and hepatocellular carcinoma (HCC). This link is confirmed in a 1981 paper by Beasley, R.P. et al. published in *The Lancet*, which reports that chronic HBV infection is associated with a 100-fold increase in the risk of developing HCC.



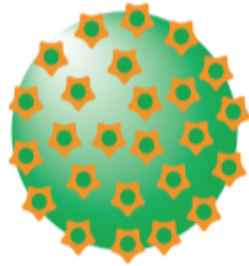
1977

1977 Frederick Sanger completes the first full genome sequencing project for an organism using DNA from the bacteriophage Phi X 174, a single-stranded DNA virus.



1979



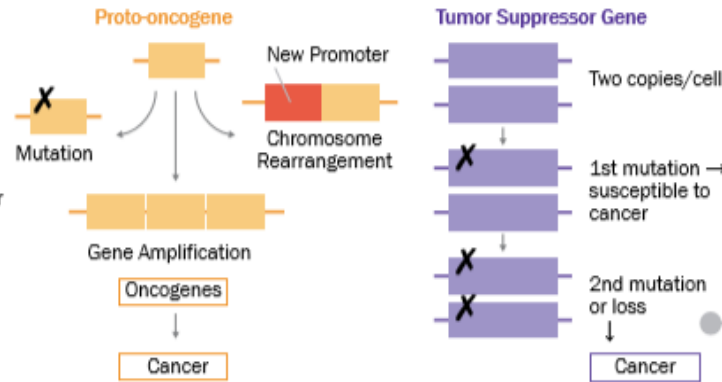


1983

1983-1984 Harald zur Hausen shows that two strains of the human papillomavirus (HPV) cause most cases of cervical cancer, a discovery for which he was awarded jointly the Nobel Prize in Physiology or Medicine in 2008, along with Luc Montagnier and Françoise Barré-Sinoussi, who discovered HIV.

1988

1988 Ed Harlow and David Livingston demonstrate that viruses can promote cancer either by activating the products of cellular proto-oncogenes or by inactivating the products of cellular tumor suppressor genes.

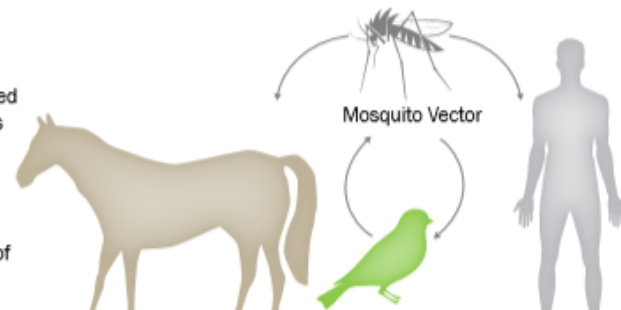


1989

1989 Michael Houghton and his colleagues at Chiron Corporation along with Dan Bradley at the CDC discover the hepatitis C virus (HCV). Chronic HCV infection is found to be associated with hepatocellular carcinoma (HCC).

1999

1999 The first documented cases of West Nile Virus (WNV) infection in the Western Hemisphere are recorded in New York City in August of this year, following reports of a number of severe cases of encephalitis and avian deaths. During August and September, 59 patients are hospitalized with WNV infection. This initial outbreak is followed by years of progressive spread of the virus throughout the U.S., with the largest annual epidemic of WNV in North America occurring in 2003.



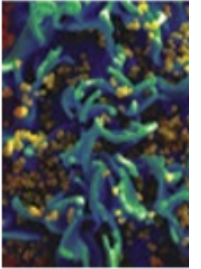
1981



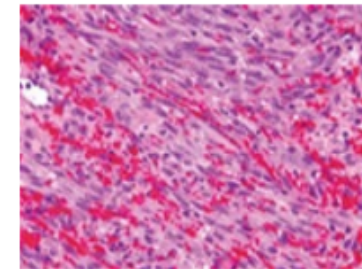
1981 The U.S. Food and Drug Administration (FDA) licenses Maurice Hilleme virus (HBV) vaccine, known as Heptavax-B, which was developed at Merck. Hilleman made the vaccine by purifying a HBV surface protein called the Aus blood collected from HBV-infected donors that had been heat- and formaldehyde inactivate the virus. In 1986, a recombinant HBV surface antigen vaccine is safety and cost concerns associated with the first vaccine. This vaccine is produced based on recombinant DNA technology.

1984

1984 Luc Montagnier and Françoise Barré-Sinoussi discover the human immunodeficiency virus (HIV), a retrovirus that attacks lymphocytes, which is later shown to be the causative agent of AIDS. Luc Montagnier and Françoise Barré-Sinoussi are awarded jointly the Nobel Prize in Physiology or Medicine in 2008 for their discovery, along with Harald zur Hausen, who identified the link between human papillomaviruses and cervical cancer.



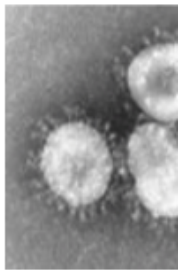
1994

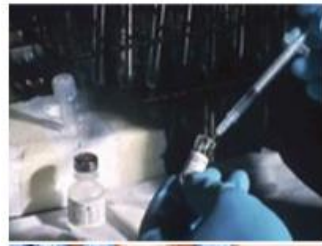


1994 Yuan Chang and Patrick Kaposi's sarcoma herpesvirus Kaposi's sarcoma tissue from . In addition to being the causat Kaposi's sarcoma, KSHV is als with Castleman's disease, prin lymphoma, and KSHV inflamm cytokine syndrome.

2003

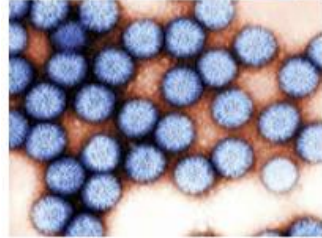
2003 The Centers for Disease Control and Prevention and Canada's National Microbiology Laboratory identify the severe acute respiratory syndrome (SARS) coronavirus genome, which is later confirmed to be the causative agent of SARS.





2006

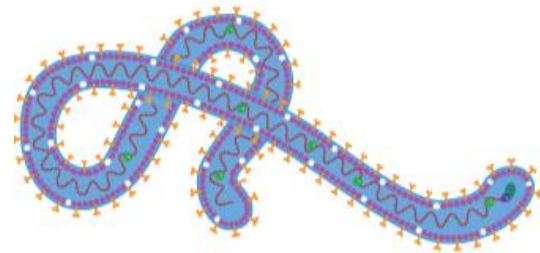
2006 A vaccine protecting against the two cancer-causing strains of human papillomavirus (HPV) is approved by the U.S. Food and Drug Administration. While more than 100 HPV types have been identified, HPV 16 and HPV 18 are the two strains that have been found to cause 70% of cervical cancers. The HPV vaccine approved in this year targets both of these strains and two other low-risk HPV types, HPV 6 and HPV 11.



2006 The U.S. Food and Drug Administration approves a vaccine for preventing rotavirus, a double-stranded RNA virus that is easily spread among children. Infection with rotavirus can have devastating complications including severe diarrhea, abdominal pain, vomiting, and even death, particularly in developing countries.

2011

2011 Rinderpest, a contagious viral disease of ruminant mammals, primarily cattle, is declared to be fully eradicated by veterinary epidemiologists, making it only the second disease in history following smallpox to be globally eradicated.



2014

2014 The largest Ebola outbreak in history occurs in West Africa, resulting in the death of more than 11,300 people in Guinea, Liberia, and Sierra Leone. In September of this year, the CDC confirms the first laboratory-confirmed case of Ebola to be diagnosed in the U.S., which was found in a man who had traveled from Liberia to Texas.

2005

2005-2006 A severe Chikungunya outbreak occurs on the islands of Mauritius and Réunion in the Indian Ocean with more than 272,000 cases being reported. This outbreak is followed by an outbreak in India in 2006 and 2007 during which more than 1,500,000 cases of Chikungunya or dengue fever are reported. In 2007, a localized outbreak occurs in northern Italy, the first cases to ever be reported in Europe. Chikungunya is found for the first time in the Americas in late 2013 on islands in the Caribbean.



2009



2009 The World Health Organization declares the H1N1/Influenza A, or swine flu, outbreak that occurs in this year to be a global pandemic. The H1N1 virus responsible for the outbreak is found to have a unique combination of swine, avian, and human genes that had not been seen before. Although the 2009 pandemic was caused by human-to-human transmission, it was called "swine flu" because genetic analysis of the virus showed that it was most similar to H1N1 viruses with swine origins. President Obama declared the swine flu outbreak in the U.S. to be a national emergency in October of this year.

2012

2012 The first case of Middle East Respiratory Syndrome (MERS) is reported in Saudi Arabia. It is found to be caused by Middle East Respiratory Syndrome coronavirus (MERS-CoV), which is thought to have come from an animal source, possibly camels, in the Arabian Peninsula.



2016

2016 Due to the rapid spread of the Zika virus across Latin America and the Caribbean along with the dramatic increase in the number of reported cases of prenatal microcephaly and adult neurological disorders such as Guillain-Barré syndrome in Brazil and other areas affected by the virus, the World Health Organization declares a public health emergency of international concern.



2019 new coronavirus (2019-nCoV) Wuhan, China





Questions

1. How was the virus discovered?
2. When did Virology begin?
3. Who is the father of virology?
4. Who gave the term virus?
5. What was the first human virus to be discovered?
6. What was the first human virus to be discovered?
7. Mention two significant events in the field of virology?



TAKE HOME MESSAGES

- Everyone makes mistakes, nobody is perfect. Accept it, learn from it, and move on

الجميع يرتكب أخطاء لا يوجد شخص مثالي بدون أخطاء تقبل اخطائك وتعلم منها وانطلق

- Hard study + Plans +Dedication = 100% Success

الدراسة الجادة + والتخطيط السليم + التفاني = نجاح 100%



بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ
الْحَمْدُ لِلَّهِ الَّذِي
خَلَقَ الْمَوْتَئِدَ وَالشَّجَرِ
الَّذِي تُسْقَى تِلْكَ
الْمَوْتَئِدُ وَالشُّجَرُ
وَالَّذِي جَعَلَ لَكُمُ
الْأَنْهَارَ تَجْرِي مِن تَحْتِهَا
وَالَّذِي جَعَلَ لَكُمُ
الْبُرْجُ وَالسُّبْحَانَ
وَالَّذِي جَعَلَ لَكُمُ
الْأَنْهَارَ تَجْرِي مِن تَحْتِهَا
وَالَّذِي جَعَلَ لَكُمُ
الْبُرْجُ وَالسُّبْحَانَ



broc2Alain