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Virology: A discipline in constant movement, emergence and discussion

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Abstract

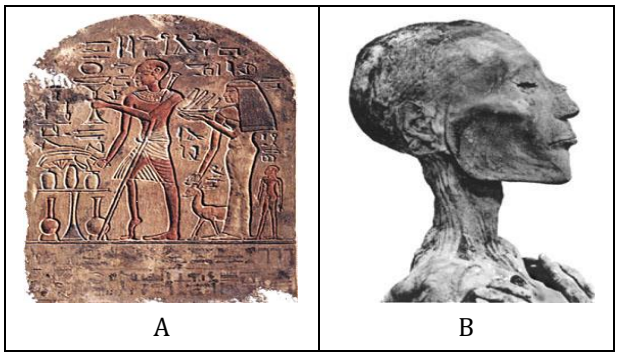
The study of viruses is vertiginous. Some have contributed to winning wars, others to fighting bacterial diseases, others have served to obtain very important enzymes, others have plagued humanity and others have put it in check. The study of viruses that includes how to detect them, how to deal with them (antivirals) presupposes time, skills and knowledge that not everyone possesses and that has caused some Nobel Prize winners to be assigned the name of eccentrics, as pointed out to Kary Mullis, the inventor of the Polymerase Chain Reaction (PCR), which today is used both for the detection and identification of SARS-CoV-2 variants. This latest invention has been so important that some point out that molecular biology is divided into a before and after PCR.

Finally, viruses are worthy of study per se and because -in addition- they cause diseases.

Keywords: PCR; Virus detection; Threat; Dominance

1. Introduction

There is evidence that viruses have been with us for a long time. For example, an Egyptian engraving dating from around 1300 BC shows a priest with a withered leg, probably due to Poliomyelitis, possibly the oldest form of the disease, caused by the poliovirus (an RNA virus; Figure 1 A). Later, there was evidence among the Egyptian pharaohs that it is probably related to a DNA virus that is now emerging in the human species, typical of the monkey (Figure 1B). It is worth mentioning that the smallpox virus was "eradicated" from the planet in 1980 according to the WHO.



A B

Figure 1 Evidence of virus presence

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In this story, special mention is made of the already mentioned virus (smallpox) for having accompanied Cortés and his collaborators in the colonization of the new world and causing the catastrophe of the native population of America at the end of 1500 BC.

The term virus appears only in the 20th century when it is shown that viruses do not follow Koch's postulates, and thanks to Mayer, Ivanosky and Benjerinc, a new discipline in biology was born: Virology [1].

Several experiments showed that one was really in the presence of a particular pathogen and another victim of the virus was the president of the United States, Franklin Delano Roosevelt, who probably contracted the virus in 1921, a time when another RNA virus also became famous: the so-called *Spanish flu* virus, which killed more people than World War II. Subsequently, one of the viruses with the greatest connotation has been the human immunodeficiency virus (HIV) and currently the SARS-CoV-2 virus that has put our humanity in check two years ago.

Viruses are viruses said André Lowff (Nobel Prize winner in 1965) many years ago and we should not be surprised by the emergence of other viruses and their variants [2].

2. Material and methods

One of the first viruses studied and that allowed us to know how they formed progeny were the bacteriophages (viruses that eat bacteria) that generally consist of a "head" and a "tail", a “head” that contains the genetic material (DNA) and a “tail” that it has proteins that anchor to the cellular receptors present in the target bacteria. The description carried out continues with the formation of each of the viral components (genome and proteins) separately, to later assemble and leave the infected cell. Without even proposing it, we have described the typical viral cycle, essential for the design of effective antivirals [3, 4].

Studies have made it possible to characterize viruses, for example through their crystallization, carried out by Stanley in 1935 or their isolation through cell culture thanks to Enders, Weller and Robins [1].

The detection of a virus can be carried out by various methodologies; however, molecular detection of a gene or part of a gene is currently preferred (knowing the sequence of the genome stored in the Genbank®) through a formidable idea of Kary Mullis [2, 5] that in theory it can amplify a section of the genome around a billion times. Formidable for viruses whose genome is DNA? But what if the virus has RNA as its genome? (*Influenza virus*, SARS-CoV-2, *poliovirus* or *canine distemper virus*). It is here where we must remember that Howard Martin Temin was an American geneticist who co-discovered in 1970, together with Renato Dulbecco and David Baltimore, the reverse transcription (RNA→DNA), for this reason he won the Nobel Prize for Medicine and Physiology in 1975 [1].

Yes, by adding a previous step to the PCR, any virus whose genome is RNA can be detected through the brilliant idea of Mr. Mullis, since basically an enzyme is added that synthesizes cDNA from viral RNA.

In the case of HIV, it is preferred to carry out a PCR directly, even though the virus is of the RNA type, since what is detected is the provirus (double-stranded DNA) in the infected lymphocyte. Subsequently, the amplified fragment can be sequenced and compared using some computer programs such as Clustal Omega, BLAST or Oligoperfect Design have provided their own in terms of nucleotide identity or the use of optimal primers for the generation of the desired fragment [6, 7, 8].

Some viruses have crossed the species barrier, being several zoonotic, such as the rabies virus (RNA virus) and among animals one of the most representative would correspond to the Canine Distemper Virus (RNA virus), which originally affected canids and which today is known to affect big cats and seals. SARS-CoV-2 is an RNA virus and the monkeypox virus is a DNA virus, as can be seen, mutations occur more frequently in an RNA virus and we have suffered from this since ancient times [3, 4].

3. Results and discussion

The study of viruses, specifically the bacteriophage ϕX174 (5,375 nucleotides), allowed the first determination of the complete sequence of a genome, thanks a Sanger and collaborators in 1977. In 1983 and only 2 years after the AIDS epidemic was declared, the HIV virus was isolated, involving Luc Montagnier and Robert Gallo in such an event.

Without a doubt, it is a dizzying story, especially if we consider SARS-CoV-2, which still has us in check, despite having synthesized some vaccines.

Viruses are viruses. The brilliant idea of Kary Mullis has made it possible to detect monkeypox virus and other viruses that affect animals, even in our laboratory [9 ,10, 11].

4. Conclusion

Indeed, virology is an autonomous and vertiginous discipline, since it studies or has special pathogens as its center of study, unlike any other, and our mission is to continue this path since we stand on the shoulders of giants, Nobel Prize winners included.

Compliance with ethical standards

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Disclosure of conflict of interest

Authors have not declared conflict of interest.

References

[1] BBC News Mundo [Internet]. BBC news ® 2021 [cited 2022 August 11]. Available from https://www.bbc.com/mundo/noticias-55597065

[2] The Nobel Prize. [Internet]. Nobelprize.org © 2022 [cited 2022 july 12]. Available from: https://www.nobelprize.org/

[3] Knipe DM, Howley PM. Fields Virology. 6th ed. Philadelphia: Wolters Kluwer; 2021.

[4] Fenner´s Veterinary Virology. [Internet]. Copyright © 2016 Elsevier Inc. [cited 2022 july 5]. Available from: https://www.sciencedirect.com/book/9780128009468/fenners-veterinary-virology

[5] Mullis, K.; Faloona, F. 1987. Specific synthesis of DNA in vitro via a polymerase catalyzed chain reaction. Methods Enzymol 155: 335-350

[6] Clustal Omega. [Internet]. Multiple Sequence Alignment. ©2022. [Cited 2022 july 4]. Available from: https://www.ebi.ac.uk/Tools/msa/clustalo/

[7] BLAST. [Internet]. Basic Local Alignment Search Tool ® 2022. [cited 2022 July 6]. Available from: https://blast.ncbi.nlm.nih.gov/Blast.cgi

[8] Oligo Perfect Design. [Internet]. Invitrogen ® 2022 Oligo Perfect Design. [Internet]. Invitrogen ® 2022 [cited 2022 July 12]. Available from https://www.thermofisher.com/cl/es/home/life-science/oligonucleotides-primers-probes-genes/custom-dna-oligos/oligo-design-tools/oligoperfect.html

[9] Vargas, M., Jara, MA., Navarro, C. 2022. Use of primer design to detect the Glycoprotein C gene of Canine Herpes Virus by Polymerase Chain Reaction. ASVS. Available from: https://actascientific.com/ASVS/pdf/ASVS-04-0337.pdf

[10] Salas, V., Pizarro, J., Navarro, C. Phylogenetic analysis of canine distemper virus detected in Chile. 2018. International Journal of Current Research, 2018; 1(08): 72402-72407

[11] Cisternas F, Navarro C, Jara MA. Feline calicivirus. Molecular detection with primers design. EC Veterinary Science 2020; 5(7): 54-72