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Electric characterization by current-voltage curves in samples of human DNA with human immunodeficiency virus (HIV)

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Abstract We have developed electrical characterizations by current-voltage measures at room temperature in human DNA samples extracted of sanguineous cells in patients with Human Immune Deficiency Virus (HIV) and this were compared with I-V curves for DNA samples of healthy people. The plots show a disorderly behavior, reflected in abrupt changes of concavity for human DNA samples with HIV. Nevertheless, the responses for DNA samples without HIV present an uniform and predictable behavior (Figure 1 and 2).

DNA (deoxyribonucleic acid) is the molecule that define the genetic characteristics of all living organisms, including many diseases that affect human health directly, such as the Syndrome Acquired Immune Deficiency AIDS, which is a pandemic disease caused by the retrovirus HIV (Human Immune Deficiency Virus). The main characteristic of this type of virus its genome, which is composed of ribonucleic acid (RNA) instead of DNA, unlike other viruses. To infect the blood cells, retroviruses must translate its RNA into DNA and insert into the DNA of the cell to infect. In this process of integration, the genetic code is further positioned within the DNA chain of the host cells [1]. This alteration in the order of thousands of base pairs causes changes in the physicochemical properties of DNA, including its electrical conduction properties.

The research focuses on studying the change in the charge transfer within material caused by the insertion of not desirable retrovirus HIV DNA inside the DNA of human blood cells, which can be observed using current - voltage curves, with current stimulation in the order of nanoamperes.
Electrical characterization was performed by means of current-voltage at room temperature in independent samples of human DNA (biologically inactive) extracted from blood cells in HIV-infected patients (without medical treatment) and that responses were compared with the curves obtained in Human DNA from a person without HIV (Control). There were substantial differences in the obtained curves. The responses of control presents a uniform and predictable behavior, while the curves of DNA with HIV showed a disorderly behavior, reflected in abrupt changes of concavity. This would imply that HIV alters directly the properties of charge conductivity, opening the possibility for using the electrical characterization like a system for the detection of human immunodeficiency virus.

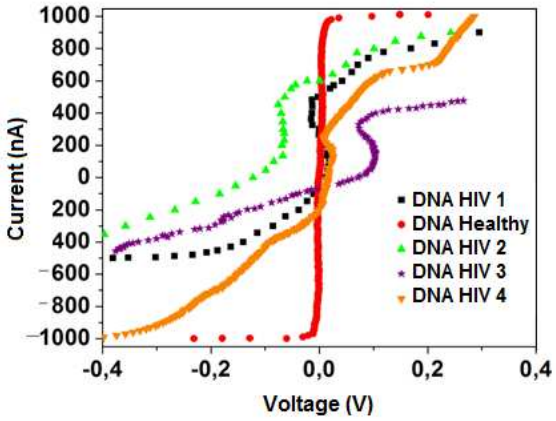

Figure 1: I-V curves for Human DNA without HIV (red curve) and Human DNA with HIV.

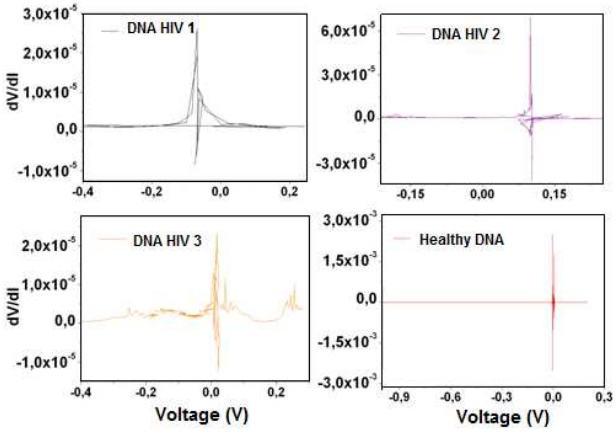

Figure 2: dV-dI curves for Human DNA without HIV (red curve) and Human DNA with HIV.

References

[1] Blankson JN, Persaud D, Siliciano RF. 2002. The challenge of viral reservoirs in HIV-1 infection. *Annu. Rev. Med.* 53: 557– 93.