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'Junk DNA' can sense viral infection

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Once considered unimportant "junk DNA," scientists have learned that non-coding RNA (ncRNA) — RNA molecules that do not translate into proteins — play a crucial role in cellular function. Mutations in ncRNA are associated with a number of conditions, such as cancer, autism, and Alzheimer's disease.

Now, through the use of "deep sequencing," a technology used to sequence the genetic materials of the human genome, Dr. Noam Shomron of Tel Aviv University's Sackler Faculty of Medicine has discovered that when infected with a virus, ncRNA gives off biological signals that indicate the presence of an infectious agent, known as a pathogen. Not only does this finding give researchers a more complete picture of the interactions between pathogens and the body, but it provides scientists with a new avenue for fighting off infections.

His findings have been published in the journal *Nucleic Acid Research*.

Another battleground between pathogen and host

"If we see that the number of particular RNA molecules increases during a specific viral infection, we can develop treatments to stop or slow their proliferation," explains Dr. Shomron.

In the lab, the researchers conducted a blind study in which some cells were infected with the HIV virus and others were left uninfected. Using the deep sequencer, which can read tens of millions of sequences per experiment, they analyzed the ncRNA to discover if the infection could

be detected in non-coding DNA materials. The researchers were able to identify with 100% accuracy both infected and non-infected cells — all because the ncRNA was giving off significant signals, explains Dr. Shomron.

These signals, which can include either the increase or decrease of specific ncRNA molecules within a cell, most likely have biological significance, he says. "With the introduction of a pathogen, there is a reaction in both the coding and non-coding genes. By adding a new layer of information about pathogen and host interactions, we better understand the entire picture. And understanding the reactions of the ncRNA following infection by different viruses can open up the battle against all pathogens."

Finding an "Achilles heel" of infections

The researchers believe that if an ncRNA molecule significantly manifests itself during infection by a particular pathogen, the pathogen has co-opted this ncRNA to help the pathogen devastate the host — such as the human body. To help the body fight off the infection, drugs that stop or slow the molecules' proliferation could be a novel and effective strategy.

This new finding allows researchers to develop treatments that attack a virus from two different directions at once, targeting both the coding and non-coding genetic materials, says Dr. Shomron. He suggests that ncRNA could prove to be the "Achilles heel" of pathogens.

Dr. Shomron and his team of researchers developed new software, called RandA, which stands for "ncRNA Read-and-Analyze," that performs ncRNA profiling and analysis on data generated through deep sequencing technology. It's this software that has helped them to uncover the features that characterize virus-infected cells.

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