New Technologies Provide Real-Time View of HIV on the Prowl

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A new imaging technique has allowed researchers to observe the “dance” HIV undergoes as it prepares to infect a cell, an advancement that may open doors for developing new ways of preventing infection. The study findings were described in the journal Science and were also a component of a related study in the journal Nature.

For the Science study, researchers adapted an imaging technique in which two fluorescent molecules, or “beacons,” were inserted into HIV’s outer envelope in order to measure tiny distances—in the realm of a billionth of an inch. Then they used single-molecule fluorescence resonance energy transfer imaging to visualize the beacons as they moved, thus depicting the changing formation of the viral proteins.

“Making the movements of HIV visible so that we can follow, in real time, how surface proteins on the virus behave will hopefully tell us what we need to know to prevent fusion with human cells—if you can prevent viral entry of HIV into immune cells, you have won,” Scott Blanchard, PhD, an associate professor of physiology and biophysics at Weill Cornell and one of three co-lead authors on the Science study, said in a release.

The researchers studied the motion of gp120 and gp41 proteins, or “trimers,” that open like a blossom when HIV is in the presence of a CD4 cell. This exposes the subunit of the gp41, which is a key factor in the chain reaction required for the virus to infect the immune cell. There are about 10 to 20 trimers on the surface of each HIV particle. The fact that they mutate rapidly makes it challenging for the immune system to fight the virus and for researchers to develop vaccines that target the trimers.

Challenging the belief of many scientists that the trimers remain static when not in the presence of a CD4 cell, the researchers in this study found that the particles actually change shape constantly.

The researchers saw that antibodies that have shown some effectiveness against the virus prevented gp120 from opening. This reaction was linked to a lowered capacity for HIV to infect cells. Similar effects took place when the scientists tested a small molecule being developed as a means of preventing HIV infection.

“What we have shown in the Science study is that we now have the means to obtain real-time images of processes happening on the surface of intact HIV particles, which we now plan to use to screen the impact of drugs and antibodies that can shut it down,” said Blanchard, who is also an author on the Nature paper.

Researchers in the Nature study used X-ray crystallography to capture a three-dimensional image of one of the configurations uncovered through the methods described in the Science paper.

To read the Science abstract, click here.

To read the Nature abstract, click here.

To read the press release, click here.

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