Flu season is here: Supercomputers are a new line of defense

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Credit: University of Texas at Austin

Time to stock up on tissues.

As the days suddenly transition from summer warmth to a winter chill,

you seem to know more people who are sick, have been sick, or worse, are slowly becoming sick. Indeed, the colder months signify that seasonal bugs are in full flux—some scientists even say that this year's flu season will be especially bad.

The flu ranges from an inconvenience for some to life-threatening for others. For elderly people, pregnant women and young children, the spread of the flu is ominous. The best hope today is to regularly wash your hands and get a flu shot.

But if we knew more about these viruses, researchers believe we could learn their weaknesses and stay ahead of them. Now, scientists across the nation are using supercomputers at the Texas Advanced Computing Center to find ways to stop viruses in their tracks.

Peter Kasson, an associate professor of molecular physiology and biomedical engineering at the University of Virginia, is one of those researchers. His work combines computer science and biology to understand viral infections such as influenza and Zika.

"Viruses are these really tiny packages that encode a lot of complexity," Kasson said.

His research team observes viruses experimentally by manually tagging them with fluorescent proteins and viewing them through microscopes to understand how they affect cells. However, this is a difficult and time-consuming process with room for human error.

Enter UT's new supercomputer Frontera,the most powerful academic supercomputer in the world.

In addition to studying viruses experimentally, a supercomputer allows Kasson's team to take apart critical viral mechanisms and understand

them at the atomic level using simulations—virtual re-creations of a virus's behavior.

Supercomputers at the The Texas Advanced Computing Center. Credit: TACC

From these new insights, they want to track and combat viruses. "What we do guides the development of new antiviral therapies and also helps us assess how well vaccines work and how well people's immunity can prevent new viral threats from causing widespread disease in the U.S."

It's an intensive process requiring time and processing power—"a challenge that requires the fastest supercomputers in the world," Kasson said.

Frontera's computing speed enables researchers to use massive amounts

of experimental data to develop and refine simulations.

Researchers can even create their own programs that run simulations, examine the results, and then have programs automatically decide what to explore next so that both the simulations themselves and deciding what simulations to do next are automated. This dramatically accelerates the process and with more and more runs, creates models that are more detailed and accurate.

As one of 36 global research groups selected to participate in Frontera's early user period, Kasson's team says the process of setting up their simulations has been extremely smooth.

"We've been able to get some exciting preliminary results that we're very eager to run further," Kasson said. "In the time we've been using Frontera, our simulations are proceeding two or three times faster than on the prior supercomputers we've had access to."

Using these supercomputers could lead to new breakthroughs in understanding and fighting all types of viruses.

Perhaps a day will come when the cooler months are no longer synonymous with flu season and we can all experience seasonal change with fewer aches, coughs and sneezes.

In the meantime, just grab those tissues and hope for the best.

Provided by University of Texas at Austin