Watching viruses 'friend' a network

EurekAlert

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From SARS to swine flu, virus outbreaks can be unpredictable — and devastating. But now a new application through the ubiquitous social networking site Facebook, developed in a Tel Aviv University lab, is poised to serve as a better indicator of how infections spread among populations.

Dr. Gal Almogy and Prof. Nir Ben-Tal of the Department of Biochemistry and Molecular Biology at TAU's George S. Wise Faculty of Life Sciences have developed a Facebook application called PiggyDemic, which allows users to "infect" their friends with a simulated virus or become infected themselves. The resulting patterns will allow researchers to gather information on how a virus mutates, spreads through human interaction, and the number of people it infects. Their research was recently presented at the annual retreat of the Safra Bioinformatics Program.

Programming a social disease

Currently, scientists use mathematical algorithms to determine which virus will spread and how, but this method has some flaws. It assumes that a virus has equal distribution across populations, but that is simply not the case, the researchers say. Patterns of social interaction must also be taken into account. "HIV is concentrated in Africa; certain types of flu are widespread in North America and Asia," explains Dr. Almogy. "Adding the element of human interaction, and looking at the social networks we belong to, is critical for investigating viral interaction."

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Facebook, notes Dr. Almogy, is an ideal tool for such an undertaking. The social networking site's digital interactions simulate in-person interactions. Viral infections like the flu are a social phenomena, he explains.

Once added to a user's Facebook account, PiggyDemic follows the user's newsfeed to determine the people they interact with. Users are deemed "susceptible," "immune" or "infected" with various simulated viruses, and can pass them on to their online contacts. Researchers then follow these interactions using network visualization software, and watch the links between users as the "viruses" are passed on.

According to Dr. Almogy, accurate modeling of viral dynamics is critical for developing public health policy. Issues such as the use of vaccinations, medications, quarantine and anti-viral procedures will be better informed if we are able to predict more accurately the course of infection.

Taking your vitamin C

More than a research tool, PiggyDemic is also a game (users try to infect as many of their friends as possible), a teaching tool (users make choices that help them live a healthy life), and potentially a method for high-resolution, real-time tracking of virus outbreaks.

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"People who have this software can report if they are actually ill," says Dr. Almogy. "If we know who their friends are and the sequence of the infecting virus, we can figure out which virus they have and how it passes from one person to another." If the network is large enough, he explains, they might be able to post warnings of possible outbreaks to Facebook networks, letting people know when it's time for a hefty dose of vitamin C.

The application has already provided a signficant finding, the researchers report. Flu's peak period, winter, is usually attributed to environmental conditions. But the researchers' findings suggest there are other forces at work.

PiggyDemic's viruses are not explicitly programmed to have a seasonal pattern, and yet like the real-life flu, they also display recurrent peaks of infection. Though researchers are not yet certain what drives these periodic peaks in the PiggyDemic eco-system, they indicate that a simple viral strategy superimposed on the basic structure of human society has a strong tendency to display periodic bursts of viral activity regardless of environmental conditions. "The flu doesn't maintain itself at a steady rate of infection," explains Dr. Almogy. "Yearly peaks of infection may serve instead as 'seeding periods,' similar to the 'blooming' process we see in flowering plants."

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