Transgenic chickens glow green, block spread of bird flu

By John Timmer | Published January 14, 2011 1:13 PM

So far, the avian flus that have proven fatal to some people haven't started spreading within the human population. But that risk, along with the flu's often fatal effects on the chickens themselves, have led governments to kill millions of chickens in order to prevent its spread. Vaccination is a possibility, but suffers from the same problems that human vaccines do: the vaccines only cover a limited number of strains, and the virus will frequently mutate to a form that is no longer recognized. Now, researchers have created a genetically modified chicken that expresses an RNA designed to block a broad range of avian flu viruses. Oddly, the antiviral transgene doesn't seem to help the birds that carry it, but somehow limits the spread of the virus.

The researchers adopted a rather clever technique to target the flu virus. The virus uses its own enzyme to make copies of its genome for translating into proteins. This enzyme recognizes a short RNA sequence near each of the genes in order to start this copying process. The authors simply created a short, decoy version of this RNA sequence; if chicken cells express enough of it, it should interfere with the enzyme's ability to recognize the real thing on the virus, limiting the production of new viruses. As they point out, this makes it very hard for the virus to evolve around the decoy, since any changes to the enzyme that prevented its recognition of the decoy would also block the recognition of the viral sequences that it needs to work with.

They next inserted the decoy into the chicken genome. To track it, they added a gene for a fluorescent protein, which also meant that all the transgenic chickens would glow green when exposed to UV light. The authors bred a population of transgenic birds and exposed them to high levels of the flu virus. They all died. But, when more moderate levels of virus were used, a few of the transgenic chickens survived the challenge. Perhaps more significantly, however, those that survived shed less of the virus into the environment while infected.

This really paid off when the birds were housed with other chickens. When infected normal chickens were present, all the other birds housed with them died, even if they had the transgene. When infected transgenic chickens were present, however, the majority of the other birds in the cage survived, even if they didn't carry the transgene. Thus, although the transgene doesn't help birds survive significant exposure to the virus, it does limit the virus' ability to spread within a population.

Although this transgenic construct isn't enough to keep all birds from dying, it may significantly change the dynamics of the infection, reducing the risk to humans and the need to do wholesale culling of flocks with infections. It could also be improved on—the decoy RNA couldn't even be detected using standard techniques, so increasing its expression should be possible. The transgene was also small, so it could easily be combined with other genes that target the virus in different ways. Overall, it looks like a promising approach to limiting the bird flu.

Science, 2011. DOI: 10.1126/science.1198020 (About DOIs).