## WEST NILE VIRUS:

The following was posted by Brett Savage on the pigeongenetics egroup list. It covers the disease very well. I did a search a while back and WNV can kill pigeons but very, very rarely. It is not really a concern for our bird's health. Other bird species are also more likely to infect the mosquito than pigeons. On a personal note WNV has broken out here too (Sigel, IL). 50% of the mosquitoes at 50% of the ponds are testing positive. Our clinic has seen 2 horses that we feel died from WNV in the past week. Rumor of a couple others. Testing will tell. Insect repellent and just staying inside during the evening hours seems prudent. Treating the loft and birds with an insecticide is a good idea this time of year anyway. No vaccine, except in horses.

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## The West Nile Virus and Its Implications for All Bird Breeders

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Late in the summer of '99, mysterious bird losses occurred at the Bronx Zoo and among wild crows. The cause was ultimately determined to be West Nile virus, a pathogen previously unknown in North America. Later that fall ('99), both human and horse deaths were also attributed to West Nile virus. Since the disease involved birds and was fatal to humans, pigeons and many other avian species came under very close scrutiny. The implications for the pigeon fancy, especially the flying aspect of the fancy, were obvious. The CDC's Arbovirus Diseases Branch at Fort Collins, Colorado sent researchers to investigate the possible role of pigeons and other birds in this disease. Fortunately, they found that infected pigeons play no significant role in transmitting West Nile virus. Passerine birds, such as house sparrows, are the key component in a bird-mosquito-bird transmission cycle. Bird-feeding Culex species mosquitoes spread the virus among the bird population. Humans as well as horses and other mammals are considered incidental hosts, not participating directly in the transmission cycle. That winter ('99/'00) brought a sense of relief: the disease had not spread beyond the tri-state region of New York, Connecticut and New Jersey (except for an isolated case of a single dead crow in Maryland). Nor was there any significant West Nile disease in domestic species (pigeons, poultry, cage birds, etc.). Although birds migrated south during the period that WNV was active, apparently ecological conditions in the south did not support WNV activity to our knowledge.

Unfortunately, West Nile did not die out completely; it persisted in adult mosquitoes over-wintering in underground hibernacula and returned again this past summer. Transmission of WNV through the mosquito egg to the progeny probably contributes to successful over-wintering of virus. The normal disease cycle occurs as follows: An infected mosquito feeds on a bird, virus is transferred and the bird becomes infected. The virus then multiplies and within 24 hours the infected bird carries virus particles in its blood; this condition is called 'viremia'. The bird cycle is completed when another mosquito becomes infected by biting and feeding upon this viremic bird. For many avian species studied so far, the bird appears healthy throughout this process: the viremia is usually transient and results in a solid immunity to further infection by the virus. Further exposure does not produce viremia, and the bird no longer transmits virus to mosquitoes. Notice that crows and some other species are an exception in that the disease actually occurs. How each separate bird species handles the infection varies and is still poorly understood at this point. The clinical signs of West Nile in susceptible bird species are primarily neurological (Brain/Nervous signs): Ataxia, Tremors,

Abnormal Head Postures, Circling, Convulsions, In-coordination, Wobbly Gait, Inability to Stand, Impaired Vision, and Weakness. Why do some birds develop West Nile disease, and others resist it? What about Crows? Why do they get West Nile disease? Let us recall the basic West Nile Disease Cycle: Bird => Mosquito => Bird => Mosquito, etc.

- Infected mosquito bites bird;
- Virus propagates in various tissues of the bird;
- Virus is carried in bird's blood (Viremia);
- Another mosquito bites viremic bird and becomes infected.

Let us look at what happens in the bird during the viremic phase (#3 above): two opposing processes occur simultaneously: 1) From the blood, the virus invades the cells in various tissues (nerves, heart, kidney, spleen, etc.) and propagates in these cells, destroying them in the process. 2) The immune system responds in several ways; one of these is production of blood/serum antibodies specific to West Nile Virus. A bird with such antibodies is said to be Seropositive. This is the basis for blood testing to determine a bird's exposure status. The development and progress of the disease in the bird depends on the balance and the interaction of these two processes: i.e. the progress of viral infection vs. the bird's immune response. In most species, the immune response predominates very rapidly and very decisively; the bird never exhibits any overt clinical disease.

Without showing any obvious clinical signs, the bird rapidly seroconverts. The only evidence that the bird has ever been exposed to the disease is that it is now seropositive. Obviously crows are an exception. In most crows, the virus infection overwhelms their immune system and they develop full-blown West Nile disease.

Please Note: All serology indicates is whether or not a bird has been exposed to the virus; by itself, it says nothing about the current disease status or carrier status of the bird. If the infected mosquito bites a mammal and the mammal becomes infected, the mammal may develop disease (e.g. nervous signs in a horse). However, the viremia produced in the mammal is so low that it usually cannot infect a mosquito. Mammals are "dead end" hosts because they cannot infect more mosquitoes and so cannot spread the disease further. In humans, West Nile virus produces flu-like symptoms in about 1 in 4 infected individuals. Occasionally the disease progresses to encephalitis (inflammation of the brain) and occasionally, in aged people, to death.

What about West Nile Virus specifically in Pigeons? Most of this information has been supplied by Dr. Nicholas Komar, a researcher at the CDC's Arbovirus Diseases Branch in Fort Collins, Colorado, and is still preliminary in nature; much remains to be learned about West Nile. During the initial outbreak, Dr. Komar surveyed both captive and feral pigeons in Queens New York and found about half of them were seropositive for West Nile antibodies. In 1999, 20 dead pigeons were submitted to Ward Stone for necropsy. Mr. Stone is the wildlife pathologist at the New York Department of Environmental Conservation. Brain specimens from these pigeons were sent to Dr. Komar's lab at CDC. All were negative for WNV except for one individual from Queens. In New York, the cause of death as determined by gross pathology was blunt impact trauma, possibly secondary to encephalitis. Thus pigeons are immunologically responsive to West Nile Virus, but rarely develop the disease. Thus they make very good sentinels. Dr. Komar also did some experimental infection studies in the laboratory to determine the pigeon's role in the transmission of this disease. Six pigeons were naturally infected by mosquito bite and then monitored daily to track the progress of the West Nile disease. As expected, viremia developed very soon and

reached a maximum on the second or third day after infection, and was completely cleared by the immune system by five days after infection. Neutralizing antibodies were detectable in the blood, i.e. the birds were seropositive, by the seventh day after infection. Throughout all of this, the birds appeared perfectly healthy, and did not show any signs of disease. In this study, the levels of viremia, that is how many virus particles were in the blood, were also monitored. The maximum in any bird was log 4.7 per ml, i.e. 50,000 infectious particles per ml. of blood. The average maximum for all six birds was log 4.3, i.e. 20,000 infectious particles per ml. To interpret this, viremia levels of log4 (10,000) to log 5 (100,000) are thought to be 'slightly' infectious, meaning that less that 1% of the mosquitoes that bite the bird would become infected. This means that even during their highest viremia, pigeons are extremely poor transmitters of West Nile virus. By way of comparison, House Sparrows develop an average maximum viremia in excess of log 8 (100,000,000) and are extremely infectious to mosquitoes. In addition, cage mate transmission was also studied: each of the infected birds was housed with an uninfected cage mate in rabbit hutches to simulate standard pigeon loft conditions. None of the uninfected cage mates became infected; that is: lateral transmission did NOT occur. Pigeons do NOT appear to transmit West Nile laterally. Finally, in this study some cloacal swabs of the infected birds were positive for West Nile virus. Whether this plays any role in the transmission of West Nile is still unknown. Some evidence suggesting direct (non-mosquito) transmission of West Nile virus has been found in crows under laboratory conditions.

So where does all of this leave us? Some things are obvious. 1) Mosquito control is the key to controlling West Nile; at this point, mosquitoes appear to be the major factor in its transmission. 2) Avoid any blood contact with birds: wear rubber gloves when drawing blood, etc. 3) Practice good loft hygiene and good personal hygiene when handling pigeons. 4) At this point, there is NOT a vaccine available for West Nile Disease; this has been widely discussed in scientific circles, but regulatory and technical problems have prevented its development thus far.

Reference Web Sites: www.cdc.gov
www.promedmail.org