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UCSF researchers identify virus behind mysterious parrot disease

Researchers at the University of California, San Francisco, have identified a virus behind the mysterious infectious disease that has been killing parrots and exotic birds for more than 30 years.

The team, led by UCSF professors Joseph DeRisi, PhD, and Don Ganem, MD, also has developed a diagnostic test for the virus linked to Proventricular Dilation Disease, or PDD, which will enable veterinarians worldwide to control the spread of the virus.

Results of the study will be published in “Virology Journal” and will appear online in August. The findings also will be presented in full at the August 11 annual meeting of the Association of Avian Veterinarians, in Savannah, GA.

The new virus, which the team named Avian Bornavirus (ABV), is a member of the bornavirus family, whose other members cause encephalitis in horses and livestock. Working with veterinarians on two continents, the group isolated this virus in 71 percent of the samples from infected birds, but none of the healthy individuals.

“This discovery has potentially solved a mystery that has been plaguing the avian veterinary community since the 1970s,” said DeRisi, a molecular biologist whose laboratory aided in the 2003 discovery of the virus causing Severe Acute Respiratory Syndrome, or SARS, in humans. “These results clearly reveal the existence of an avian reservoir of remarkably diverse bornaviruses that are dramatically different from anything seen in other animals.”

The discovery could have profound consequences on both domesticated parrots and in the conservation of endangered species, according to DeRisi and Ganem, both Howard Hughes Medical Investigators at UCSF. Those species include the Spix’s Macaw, currently one of the most endangered birds in the world, whose number has dwindled to roughly 100 worldwide and whose continued existence is threatened by PDD.

The research was spearheaded by Amy Kistler, a postdoctoral fellow in the DeRisi and Ganem labs. Together with veterinarians Susan Clubb, in the United States, and Ady Gancz in Israel, Kistler analyzed affected birds using UCSF’s ViroChip technology.

The ViroChip, which DeRisi and Ganem developed, is a high-throughput screening technology that uses a DNA microarray to test viral samples. The team was able to recover virus sequence from a total of 16 diseased birds from two different continents. The complete genome sequence of one isolate was captured using ultra deep sequencing.

The virus they identified is highly divergent from all previously identified members of the “Bornaviridae” family and represents the first full-length bornavirus genome ever cloned directly from avian tissue. Analysis of the Avian Bornavirus genome revealed at least five distinct varieties.

PDD is a fatal disease that causes nervous system disorders in both domesticated and wild birds in the psittacine, or parrot, family worldwide. The disease has been found in 50 different species of parrots, as well as five other orders of birds, and is widely considered to be the greatest threat to captive breeding of birds in this family, the researchers said.

The disorder often leads to the birds' inability to swallow and digest food, with resulting wasting; many birds also suffer from neurologic symptoms such as imbalance and lack of coordination. Regardless of the clinical course the disease takes, it is often fatal.

Scientists have theorized for decades that a viral pathogen was the source of the disease, but until now, no one had been able to identify the likely culprit.

"This provides a very compelling lead in the long-standing search for a viral cause of PDD," Ganem said. "With the development of molecular clones and diagnostic tests for ABV, we can now begin to explore both the epidemiology of the virus and how it is linked to the disease state."

Co-authors on the paper include Amy L. Kistler, Peter Skewes-Cox, Kael Fisher, Katherine Sorber, Charles Y. Chiu and Alexander Greninger, from the Howard Hughes Medical Institute and Department of Biochemistry, Microbiology and Medicine at UCSF; Ady Gancz, from The Exotic Clinic, Herzlyia, Israel; Susan Clubb, Rainforest Clinic for Birds and Exotics, Loxahatchee, Fla.; Avishai Lublin, Sara Mechani and Yigal Farnoushi, of the Division of Avian and Fish Diseases, Kimron Veterinary Institute, bet Dagan, Israel; and Scott B. Karlene, of the Lahser Interspecies Research Foundation, Bloomfield Hills, MI.

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The DeRisi Laboratory is part of the California Institute for Quantitative Biosciences, known as QB3, a cooperative effort among private industry and more than 180 scientists at UCSF, UC Berkeley and UC Santa Cruz. The collaboration harnesses the quantitative sciences to integrate and enhance scientific understanding of biological systems at all levels, enabling scientists to tackle problems that have been previously unapproachable.

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