Birds migrate away from diseases

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In a unique study, researchers at Lund University in Sweden have mapped the origins of migratory birds. They used the results to investigate and discover major differences in the immune systems of sedentary and migratory birds. The researchers conclude that migratory species benefit from leaving tropical areas when it is time to raise their

young, because moving away from diseases in the tropics enables them to survive with a less costly immune system.

Analysing the genealogy of over 1300 songbird species enabled the researchers to establish that both sedentary birds, which do not leave northern Europe in the winter, and migratory birds, which breed in Europe but spend the winter close to the equator, originate from Africa.

The researchers then studied the immune system in three different groups: sedentary birds in tropical Africa, European sedentary birds, and migratory birds. Their findings show that African sedentary birds have a more varied and extensive immune system than either European sedentary birds or migratory birds.

Evolution has quite simply ensured that bird species migrating to Europe were equipped with a much less variable immune system, as Europe has far fewer diseases than the tropics. The African sedentary species probably need a more advanced immune system to deal with the richer flora of pathogens to which they are exposed.

"What really surprises me is that the immune systems of migratory birds show a similarly low variation to that of European sedentary birds. After all, migratory birds don't only need to resist diseases in Europe, but also during their migration and in the tropics," says Helena Westerdahl, one of the researchers.

To explain the surprising result, the researchers propose the idea that the costs associated with a strong, complex immune system could be much higher than anyone previously thought. Examples of these costs could be autoimmunity and other immune system diseases such as chronic inflammation.

Despite the migratory birds having to deal with pathogens both in

Europe and tropical Africa, they have thus lost much of the variation and complexity in their immune systems compared to their African ancestors. According to the researchers, this indicates that dealing with pathogens is most difficult for the birds the first time they are exposed to them. For migratory birds, this happens in Europe where they raise their young and there are not as many different pathogens.

"When the migratory birds breed, they have moved away from many diseases and therefore do not need an immune system that is equally varied. Another advantage is that the risk of damage caused by the immune system drops considerably if the immune system is less complex," says researcher Emily O'Connor.

All vertebrates, including human beings, have immune systems built up in a similar way to those of birds. The Lund biologists therefore believe their findings could also be significant in a broader perspective.

More information: The evolution of immunity in relation to colonization and migration, *Nature Ecology & Evolution* (2018) doi:10.1038/s41559-018-0509-3

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