

PLOS Science Wednesday: Hi reddit, I'm Neus and the results of my PLOS Pathogens study show that one influenza virus may protect against later infections caused by other viruses of different subtypes in mallard ducks – Ask Me Anything!

PLOSScienceWednesday ¹ and r/Science AMAs¹

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Hey Neus, fairly specific application of your area of knowledge (flu virus effects in ducks); how did you end up using ducks as your model species?

[uptown_funk](#)

Mallards ducks are the most common and widespread duck species and carry a great diversity of influenza viruses.

Could this protection be inserted at some point in the future into flu shots, so the benefit, if possible in humans, would transfer?

[cluelessquared](#)

Yes, that's one of the lines of investigations for universal vaccines that the flu research community is exploring. Parts of the Hemagglutinin proteins are most conserved between subtypes and antibodies are highly cross-protective.

Can your conclusions carryover to other species such as humans?

Why did you choose ducks as the host for influenza and not another type of animal?

[Jaicobb](#)

Yes, similar patterns associated with the level of relatedness have found for other species. Much less was studied for birds and during the last 10 years the key role of wild birds has been recognized. I a studying ducks because Influenza A viruses have the capacity to infect many different hosts, from birds to mammals including us humans and have zoonotic potential (i.e. can jump from wild or domestic animals to humans). Influenza A viruses are characterized by the Hemagglutinin (HA) and



Neuraminidase (NA) proteins, critical for virus replication, and that are exposed to recognition by the host immune system. In humans few subtypes are circulating H1-H3 while in wild birds; specially ducks, gulls and shorebirds; many subtypes are naturally circulating H1-H16. The virus diversity from birds can be seeded into other hosts. Ducks often carry influenza and for instance up to 25% of ducks during fall migration have active infections caused by subtypes H1-H12 and N1-N9. There are risks of transmission between species like from wild birds to poultry and later to humans. A recent study from Gostic et al. Science 2016 reported in humans strong protection induced by influenza infection during childhood. The authors investigated the fatality rate of infections With Highly pathogenic influenza a virus (HPIAV)(H5 and H7) for different human age classes or cohorts based on the seasonal strains circulating during childhood. They could found that infections during childhood protected against mortality by related HPIAV subtypes.

For dengue viruses, re-infection with a new sub-type sufficiently different from the original strain can actually cause worse symptoms because of antibody dependent enhancement of the viral infection into host cells.

Have you explored the possibility of this with influenza as well, when multiple sequential infections are involved?

[lab32132](#)

Hi there, Although also cross-reactivity occurs between antibodies flu subtypes there are no evidence that it is enhancing individuals experiencing sequential infections would have increased susceptibility or severity of infection. Pre-exposure to flu seems to be beneficial and induce partial immunity.

Flu shot: Good or not?

[evilkenevil](#)

Flu shot good! The efficiency varies sometimes as the vaccine composition is based on a predictions and depends at the moment on a good match between vaccine strain and actual circulating strains.

I've read that presence of active rhinovirus boosts immunity against influenza by increasing the antiviral activity of the immune system. While an antibody mediated response can last more long-term, is it possible to use this boosted activity to prevent susceptibility to viruses in a broader spectrum? Would there be consequences to continually activating this system on purpose to prevent the spread of more harmful viruses such as dangerous strains of Influenza A?

[Keem_Beam](#)

What we found related to boost is that re-infection with a related subtype induce a boost in the antibody response to the virus "seen" first. That is know as Original Antigenic Sin, other called it antigenic seniority. Even asymptomatic infections could boost this responses and be beneficial.

Hi Neus!

1. Would you say your findings in mallards are similar to results Peter Palese discovered in [lab animals and humans](#)? Are there any noticeable differences?
2. What are the advantages of re-challenging with heterologous strains instead of just screening the

serum with a wide panel of HA ELISAs after the first challenge? Is it possible to measure body weight/survival rate in mallards?

[hiimsubclavian](#)

1-Yes, our results are going on the same direction. It was believed the ducks didn't mount protective/robust long-term immune responses, but actually they are quite good at it! 2- In ducks these viruses are Low Pathogenic and does not cause mortality. Weight was followed during the challenge. In the trial food was provided ad libitum and no trends on weight were found. In wild mallards we found some differences in body mass between infected and not infected when corrected by size (Latorre-Margalef et al. 2009 Proc B).

Can your conclusions carryover to other species such as dangerous strains of Influenza A?

[momura](#)

The virulence of a strain (or "how bad a strain" is) will depend on preexisting immunity in the population.

How did the virus types "compete"?

[Accio-Books](#)

the circulation of one virus and infections caused will determine the fitness of the others influenza subtypes

What sort of implications does this have for and/or relate to the Hoskins effect (aka [original antigenic sin](#)).

[midnitte](#)

Boosting of antibodies to the primary infection with H3 in ducks due to the secondary with H4 indicated OAS and may imply a putative strategy of virus evasion.

Enhorabona per haver haver trobat un lloc on investigar, encara que sigui lluny.

My question is the same as many others: is this one specific virus or a generic 'influenza viruses protect against later infections'? What are the implications?

[kuroze01](#)

Gràcies! A primary infection will induce partial to total protection and influence the outcome of infection (duration and intensity of infection) by host recognition of shared features between viral proteins. Cross-immunity may be the driver of antigenic diversity as new variants that could escape immune recognition (are more different/divergent to the virus causing the primary infection) can be selected.

how do you collect influenza viruses from ducks?

Do you think you can use these primary infections for a flu vaccine?

[patb2015](#)

We have been sampling ducks for influenza during banding/ringing and taking oropharyngeal and cloacal swabs.

Hey Neus! Firstly, thanks for doing this AMA; it's great to see information on viral infections to gain interest on Reddit.

Since a segmented viral genome is a dangerous factor in the pathogenicity of a virus, does it specifically affect the process of your influenza study?

[archimedes_principle](#)

Good point! Coinfections are common in ducks and the subsequent potential for mix and new match of gene segments and reassortment. In ducks we found that there is linkage between the subtypes of HA and NA, that some combinations are more common than others, indicating there is no random reassortment. So pre-existing immunity in a population could determine the rates of reassortment.

What advice would you give to a nursing student who has fallen in love with microbiology?

[OhioTry](#)

look for an internship in a microbiology lab during the summer.