

# New research reveals that a species of bird 'paints' its own eggs with bacteria which protect the embryo

January 13 2015

---



A hoophoe Credit: JC BALLESTEROS

Researchers from the University of Granada and the Higher Council of Scientific Research (CSIC) have found that hoopoes cover their eggs with a secretion produced by themselves, loaded with mutualistic bacteria, which is then retained by a specialized structure in the eggshell and which increases successful hatching. So far this sort of behaviour has only been detected in this species of birds, and it is a mechanism to protect their eggs from infections by pathogens.

Through an experiment published in the *Journal of Animal Ecology*, scientists from several research groups precluded several female hoopoes from impregnating their eggs with this substance, which they produce themselves inside the so-called uropygial gland. The research groups involved in this project were the following: Animal Behaviour and Ecology, Microorganism-Produced Antagonistic Substances, both from the UGR, and Evolutionary Ecology and the Behaviour and Conservation groups from the Dry Areas Experimental Station (Almería, CSIC)

By doing so they confirmed that the amount of pathogen [bacteria](#) that could be found inside the eggs which failed to hatch was higher in those nests in which they had experimentally precluded the females from using their [secretion](#) than in those where they were allowed to use this substance. They concluded that this secretion provides a barrier for the entry of pathogens towards the interior of the egg.

## **Presence of enterococci**

On the other hand, not just the secretion as a whole, but particularly the bacteria that did produce bacteriocins (small antimicrobial proteins) in that secretion, the enterococci, are beneficial for the developing embryos, since successful hatches were directly related to the amount of these enterococci in the egg shells and in the secretions of the females. The more enterococci they had, the higher the rate in their successful

hatching.

As UGR zoology professor, Manuel Martín-Vivaldi, one of the authors of this research underlines, during the last few years the field of evolutive ecology has acknowledged "the important role played by bacteria, not just as infectious agents capable of producing diseases, but also as allies of animals and other living creatures in their struggle against disease, due to their extraordinary capacity to synthesise compounds with antimicrobial properties"

In the case of the hoopoe's uropygical gland, scientists have confirmed that its components are very different from those of other birds. This is to a large extent due to the action of the bacteria present in this particular gland.

This research has also revealed that hoopoes have developed an exceptional property in their eggs—which has not so far been found in any other species of bird. This consists in the presence in the surface of many small depressions that do not completely penetrate the shell, and whose function appears to be the retention of this bacteria-carrying secretion that covers the egg.

## **Bacteria in the eggshell**

"With this experiment, we have been able to establish that if the females can use their secretion, towards the end of the incubation period, those tiny craters are full of a substance saturated with bacteria. If we preclude the use of this secretion, these tiny craters appear empty towards the end of the hatching process", said professors Martín-Vivaldi.

These results prove that in this particular species of bird, "its reproductive strategy has evolved hand in hand with the use of bacteria which may be beneficial for the production of antimicrobial substances,

which they cultivate in their gland and then apply upon [eggs](#) which are particularly endowed to retain them"

These scientists are currently working to determine the specific composition of the bacterial community within the gland, how these symbionts are acquired, and the types of antimicrobial compounds which synthesize these bacteria, capable of protecting the embryos which are undergoing development.

Further research along these lines will facilitate a better understanding of the way in which mutualistic interactions function between animals and [beneficial bacteria](#), and also to detect new antimicrobial substances with a potential to be used in medicine or for food preservation.

This study is the result of the following two projects: "Nests, parasites and bacteria: a multidisciplinary approach to the study of adaptation for breeding in high parasitism risk environments", funded by the Ministry of Science and Innovation, and "Biodiversity and acquisition mechanisms in the bacterial community within the uropygial gland of hoopoes (*Upupa epops*)."

**More information:** "Special structures of hoopoe eggshells enhance the adhesion of symbiont-carrying uropygial secretion that increase hatching success." *Journal of Animal Ecology* 2014 [DOI: 10.1111/1365-2656.12243](#)

Provided by University of Granada

Citation: New research reveals that a species of bird 'paints' its own eggs with bacteria which protect the embryo (2015, January 13) retrieved 23 April 2024 from <https://phys.org/news/2015-01-reveals-species-bird-eggs-bacteria.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.