

Title: Iridescence of rock dove's neck feather

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Abstract: Iridescence is observed in various kinds of animals that utilize optical interference phenomenon of microstructures to produce their brilliant colors. In general, the iridescence appears owing to the interference condition that relates the wavelength of the reflected light with the angle of view or incidence. However, the neck feather of rock dove has a very peculiar iridescence: the color change is limited only in two colors, green and purple, and the change occurs very suddenly by only slightly shifting the viewing angle. We have performed microscopic and optical measurements to clarify the origin of this peculiar iridescence. It is found that it is produced by the surprisingly simple physical mechanism - thin-layer interference. The peculiarity lies in the fact that the higher-order interference condition is satisfied. This causes the sophisticated correspondence in the spectral line shape between the reflectance and the visual color sensitivities of human eye, and results in the two-color nature of the iridescence. The correspondence can be also seen with the absorption maximum of the visual pigments in the rock dove's vision. In addition, we have constructed a simple optical system, which can modulate the spectrum of white light to have an arbitrary line shape, in order to further investigate optical and visual effects of thin-layer interference. It is found that the thickness of the thin layer found in the rock dove's feather is very optimized to cause the two-color nature of the iridescence.