Researchers Discover Unique Structure of Feathers Responsible for Dramatic Color Changes in Bird of Paradise Displays

Researchers from the Netherlands, Australia, and the UK, studying the use of color in avian mating displays discovered a feather structure unique to the bird of paradise called the Lawes' parotia (*Parotia lawesii*). This unique feather structure, they believe, is responsible for the incredible color displays the male Lawes' parotia is best known for.

Applied Spectroscopy: Researchers Discover Unique Structure of Feathers Responsible for Dramatic Color Changes in Bird of Paradise Displays

Researchers from the Netherlands, Australia, and the UK, studying the use of color in avian mating displays discovered a feather structure unique to the bird of paradise called the Lawes' parotia (*Parotia lawesii*). This unique feather structure, they believe, is responsible for the incredible color displays the male Lawes' parotia is best known for.

Feather pigmentation presents, normally, in one of two ways: either a spongy keratin matrix which reflects diffused light and appears as an ordinary pigmented material, or through layers of melanin 'rodlets' arranged in a keratin matrix, which reflect light at their interfaces and appear iridescent. The Lawes' parotia, researchers discovered, present with a unique modification of the anatomical structure of the male's breast feathers that allow this bird to produce stunningly colorful mating displays.

In other birds with iridescent feathers, the barbules, microscopic filaments that make up the individual barbs of a feather, are normally a flattened oval shape providing a single-directional, mirror-like reflection from the regularly arranged melanin rodlets. Researchers publishing their findings in the Proceedings of the Royal Societydescribe the barbules of the breast feathers of the male Lawes' parotia as having a distinctive "boomerang," or convex, shape. This unique shape, formed by the arrangement of melanin rodlets in the keratin matrix, acts like three colored mirrors, a yellow or orange reflector along the same plane as the feather surface, and two blue/green colored mirrors set at 30° angles. This unique shape allows the male birds to create dramatic color shifts beyond what is possible from normal iridescence.

Researchers tested the reflective properties of this unusual barbule structure with an imaging scatterometer capturing images of light reflected in a 180° hemisphere perpendicular to the plane of the feather barbule. They further measured the reflected spectra from different angles using a bifurcated fiber-optic probe. Capturing the reflected light with the AvaSpec-2048-2 photodiode array spectrometer from Avantes allowed researchers to confirm assumptions about the arrangement of melanin rodlet layers in the keratin matrix. Experiments produced paired beams of bluish light reflected at angles of +60° and -60° correlating with the angle of reflection produced by the 30° planes observed in the barbule structure of this bird's unique plumage.

The findings of this research provide ornithologists and biologists with insight into the evolutionary role of color in mating displays and may already be inspiring practical applications in commercial industries such as cosmetics and material manufacturing.