



The Extended Specimen

Media Specimens in Collections-based Ornithological Research

Dr. Edwin Scholes

The **Cornell** Lab  of Ornithology
Macaulay Library



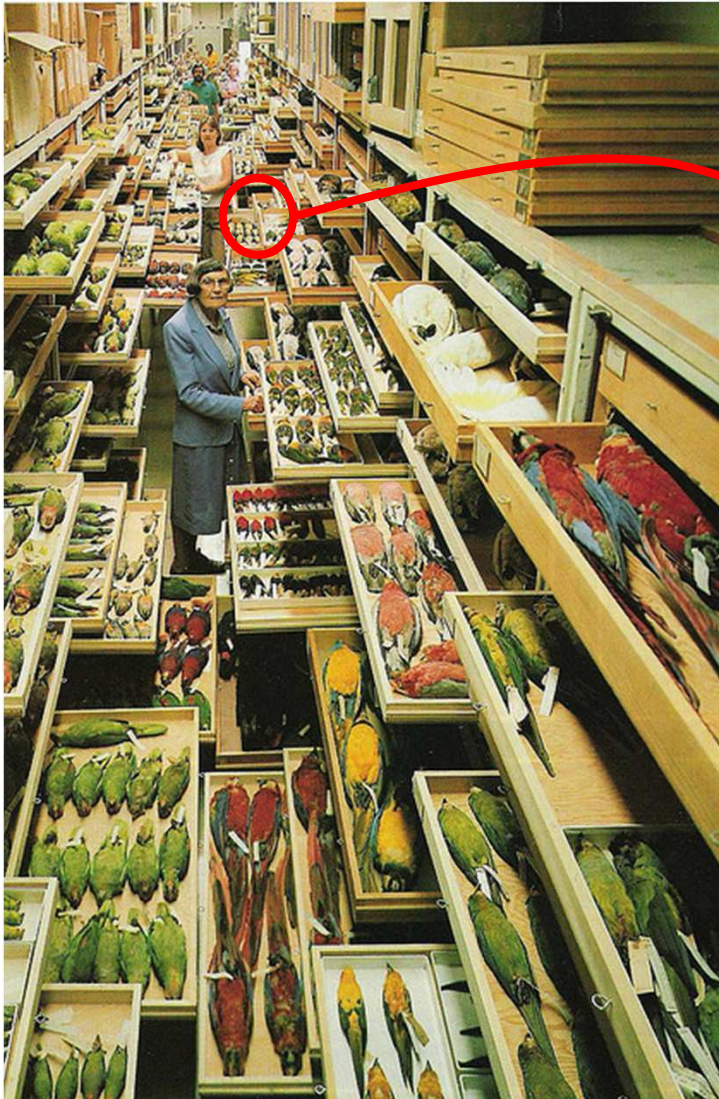
I. Extended Specimen: **Media**

(Mike Webster, Macaulay Library Director)

II. Use Case: **Media Specimens** in Ornithological Research

(E Scholes, TA Harvey, KS Bostwick, TG Laman and S Marschner)

Specimens Capture Phenotype

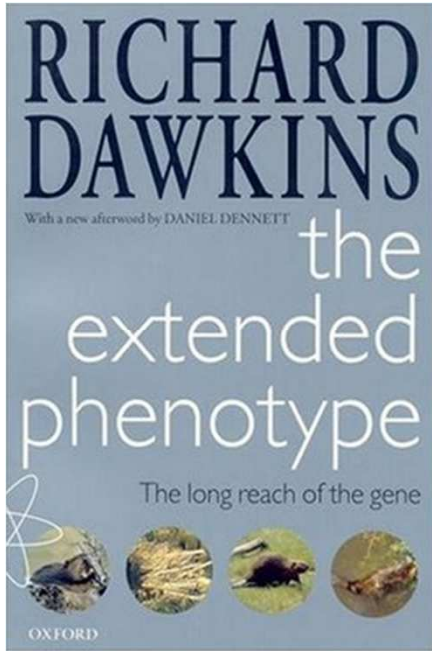


Smithsonian NMNH bird collection, photo by Chip Clark

Specimens: teach us about patterns of biodiversity & the processes that govern them

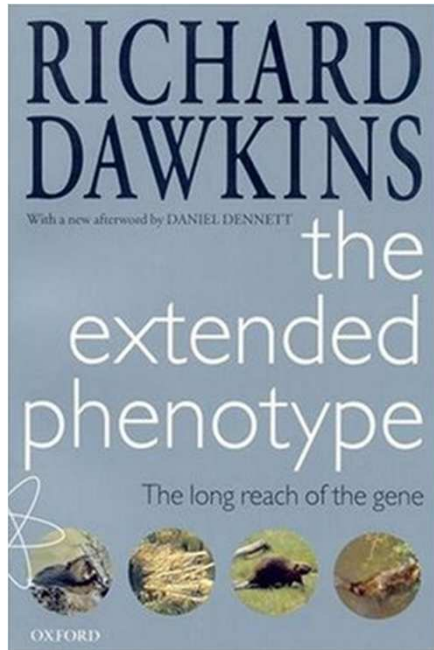


Specimens Capture Phenotype



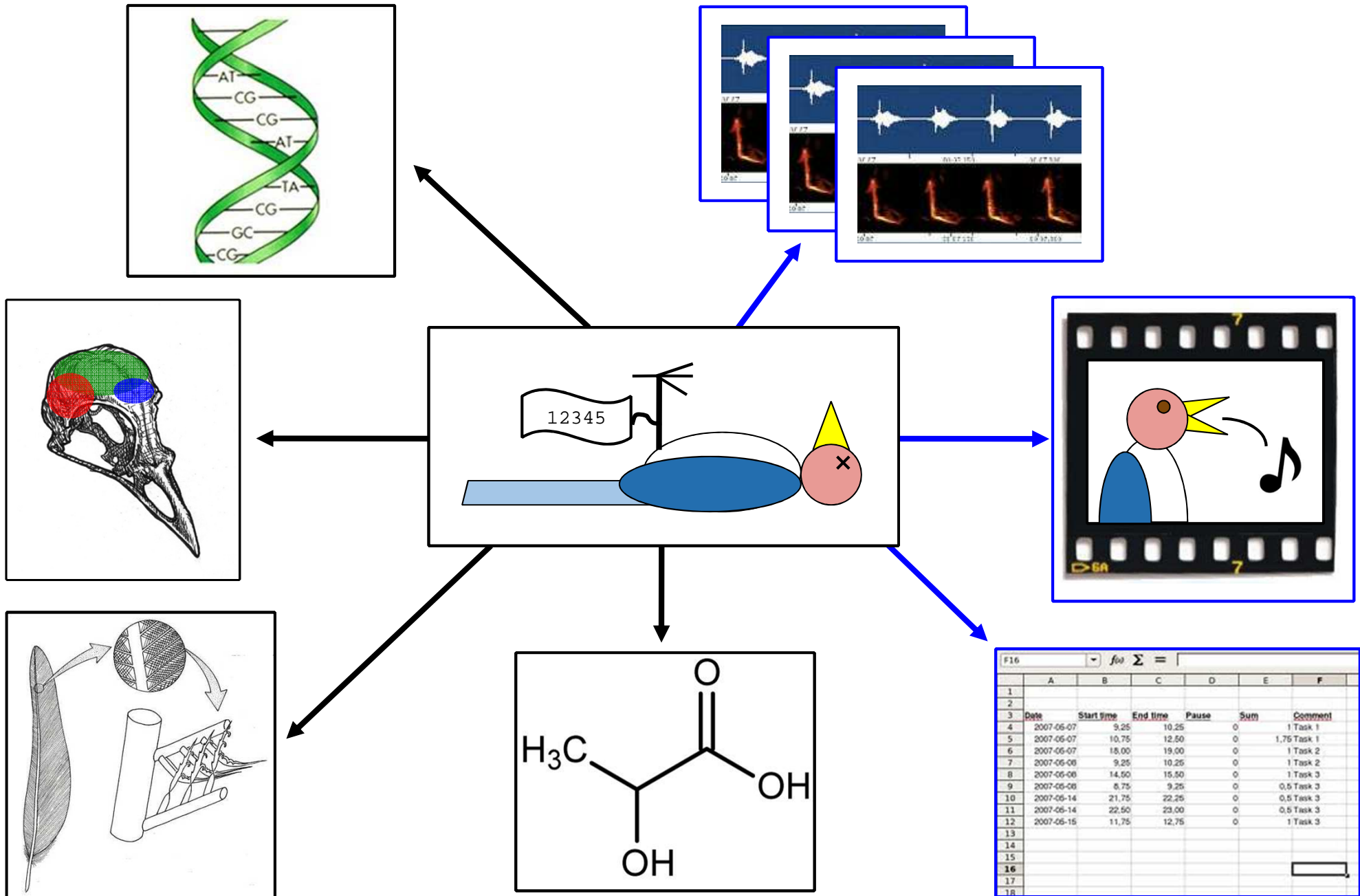
Vogelkop Bowerbird (*Amblyornis inornata*)
Painted by John Gould

Specimens Capture Phenotype



Macaulay Library #455179, Vogelkop Bowerbird (*Amblyornis inornata*)
Irian Jaya, Arfak Mountains, 2009 - Tim Laman

The Extended Specimen



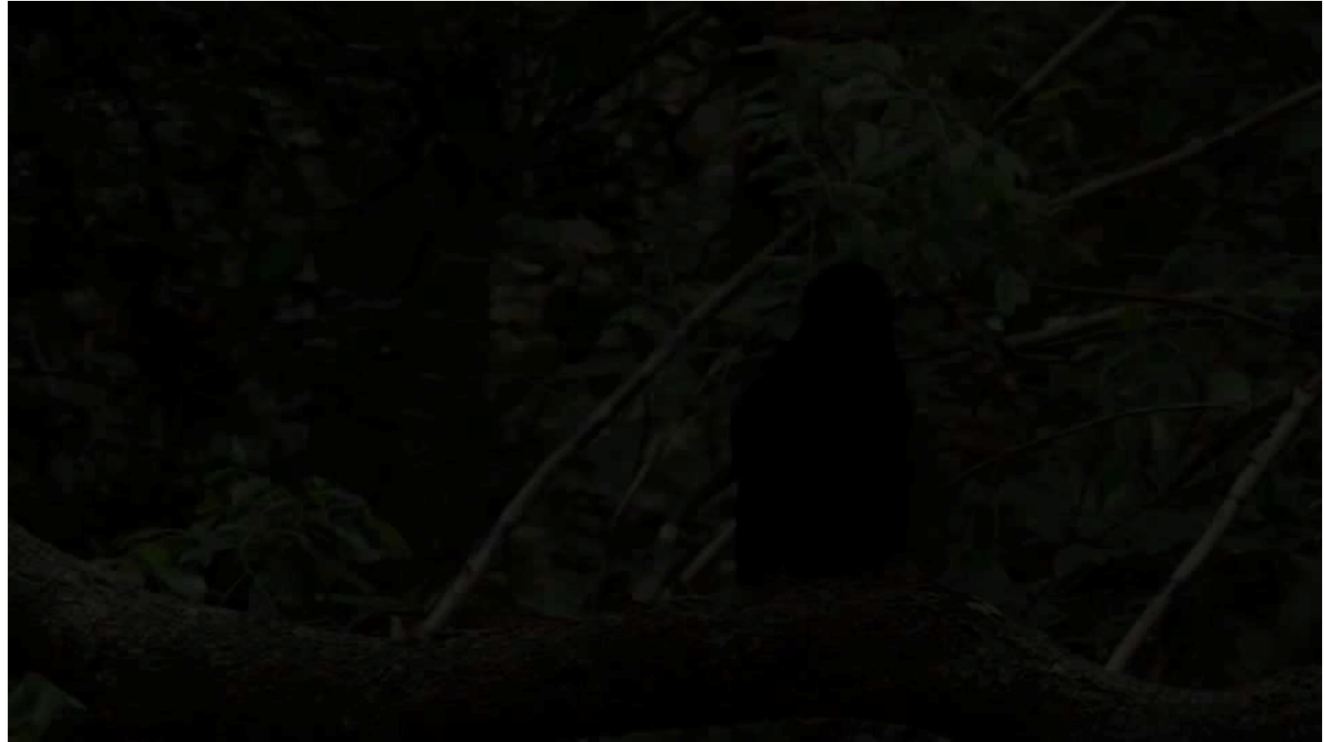
The Extended Specimen



Magnificent Riflebird
(*Ptiloris magnificus*)

Specimens at the Netherlands Centre
for Biodiversity Naturalis

The Extended Specimen

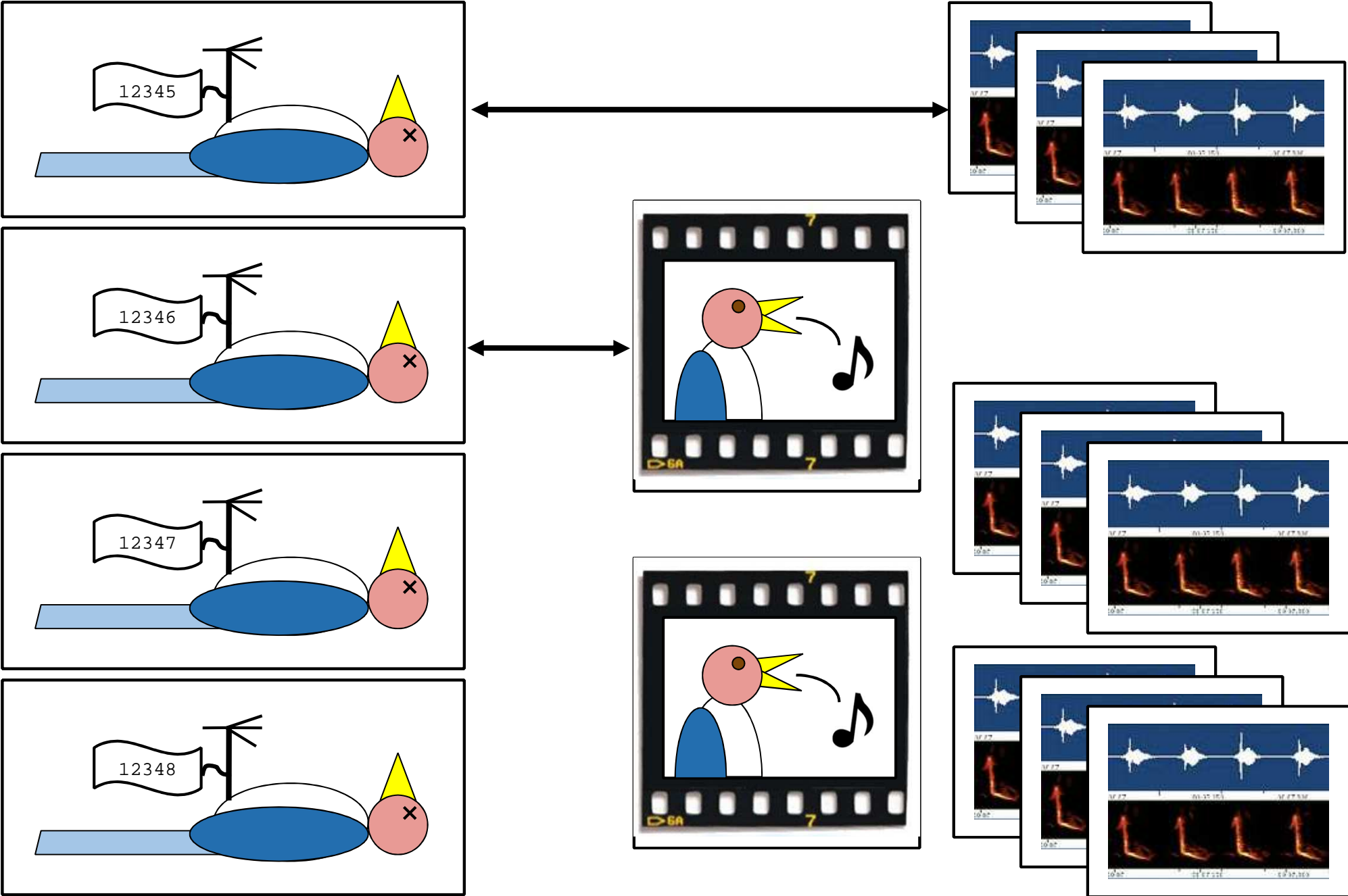


Video & audio - Ben Clock & Emma Greig (being archived at Macaulay Library)

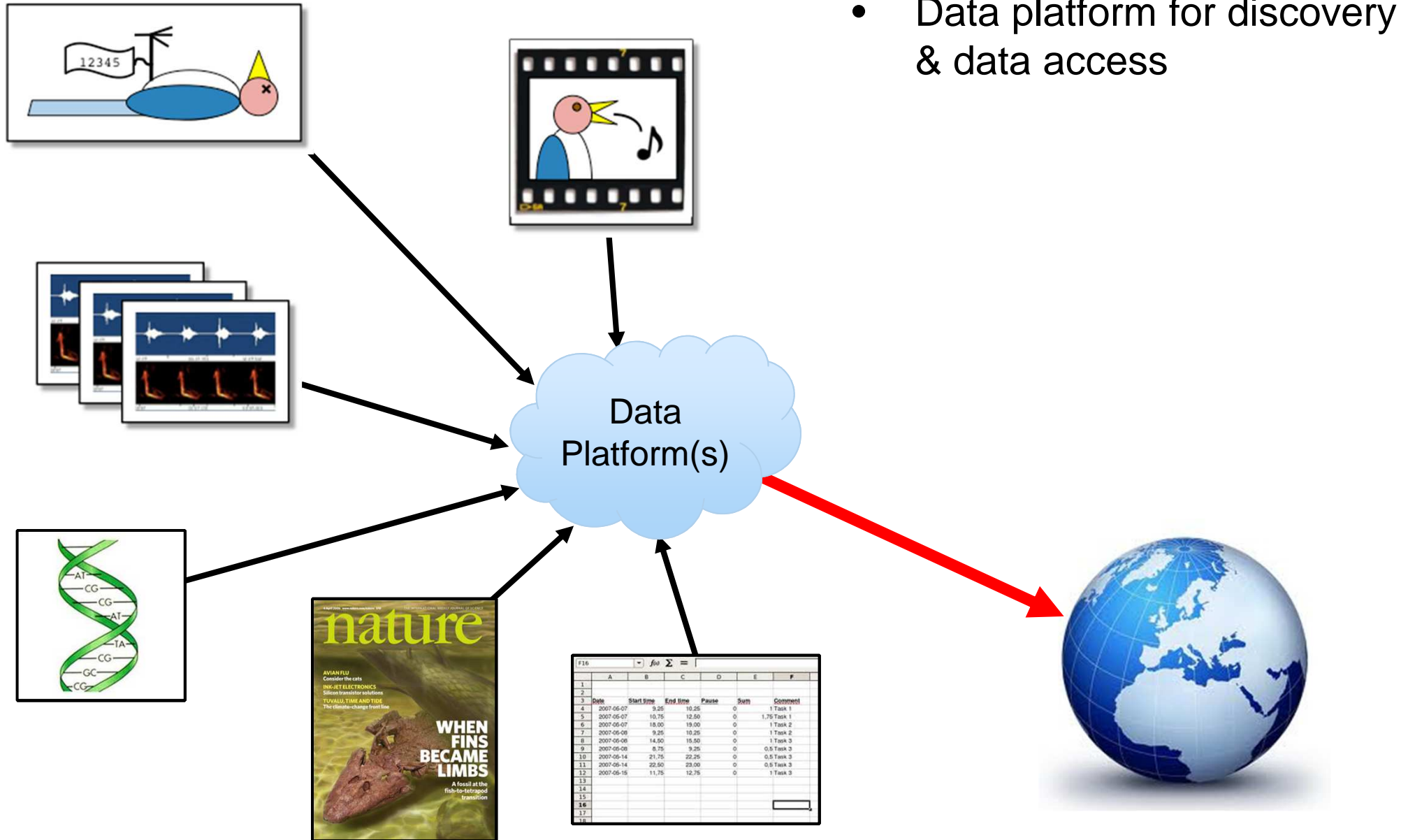
Magnificent Riflebird
(*Ptiloris magnificentus*)

Specimens at the Netherlands Centre
for Biodiversity Naturalis

Collecting

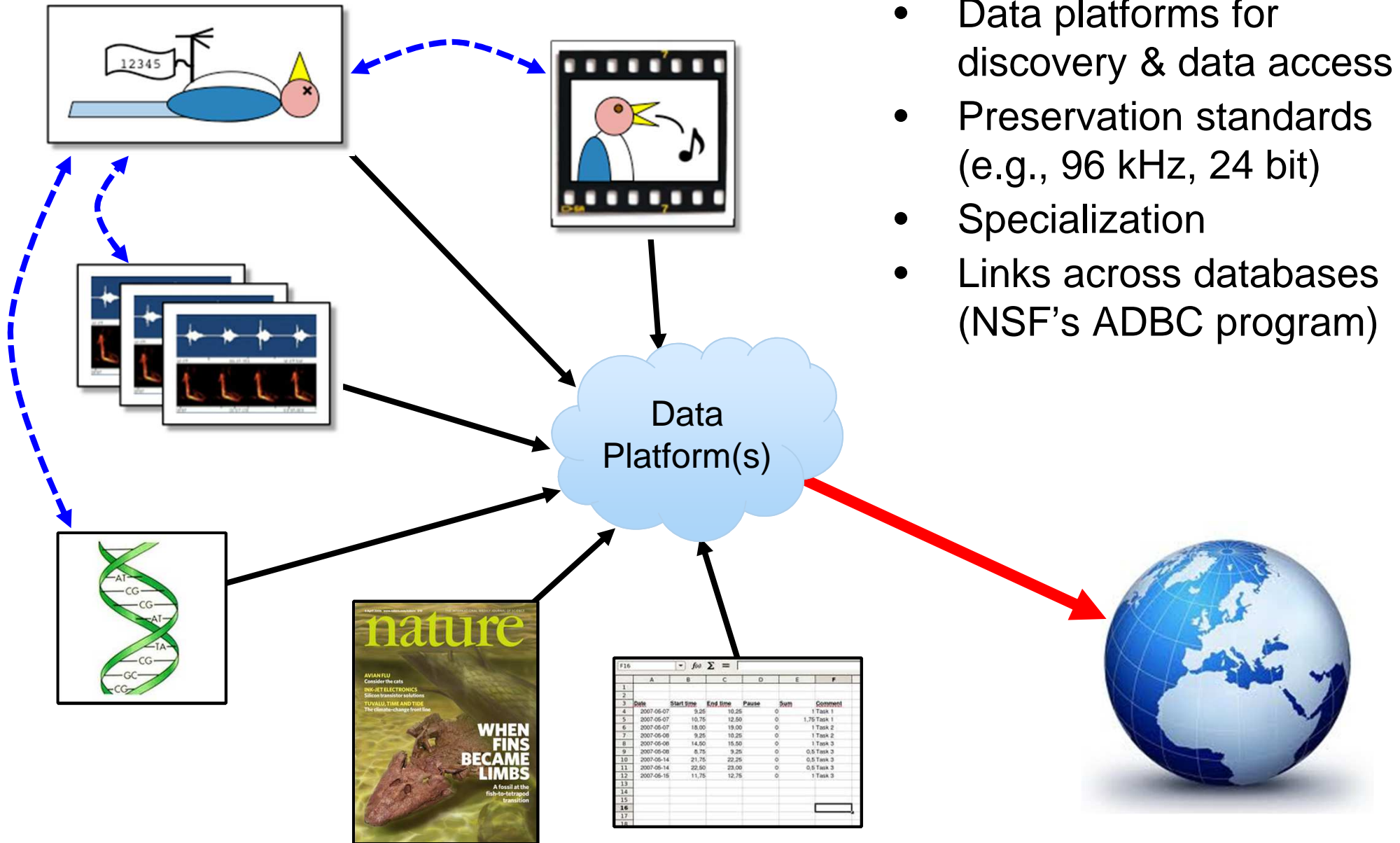


Preservation & Accessibility



- Data platform for discovery & data access

Preservation & Accessibility



II. Use Case: Media Specimens in Ornithological Research



Tim Laman, 2011

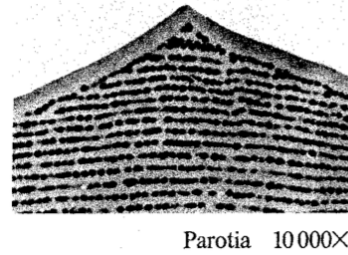


KU Ornithology # 93603 - Brett Benz, 2001

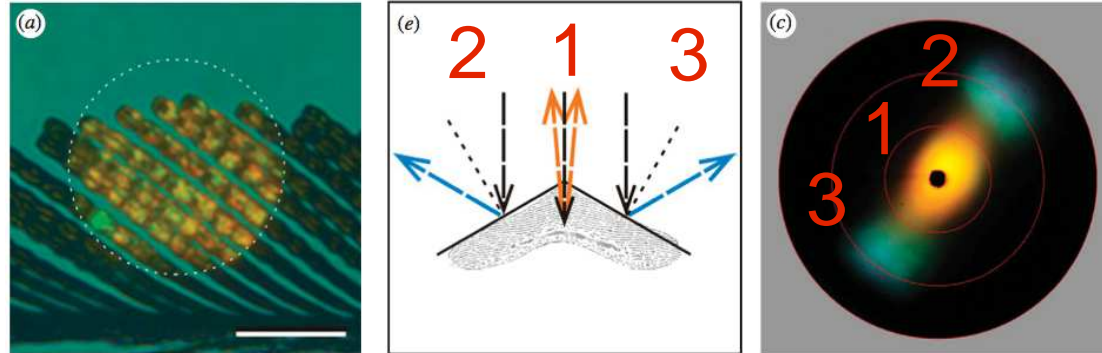
Parotia wahnesi

Breast feathers have unique mechanism of color production

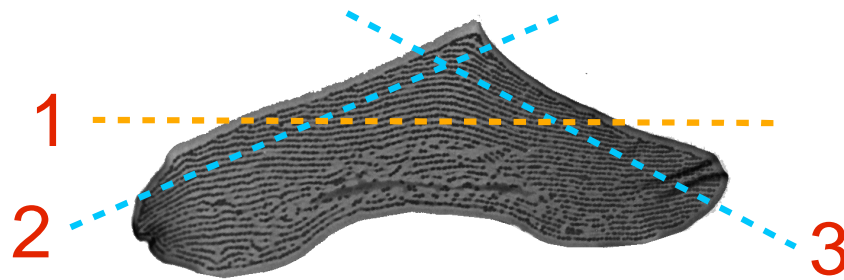
Durrer, 1977



(Stavenga et. al., 2010.)



(in prep)



Parotia wahnesi, 2013



Ballerina Dance - courtship phenotype



video frame grab from ML # 469251 - T Laman & E Scholes

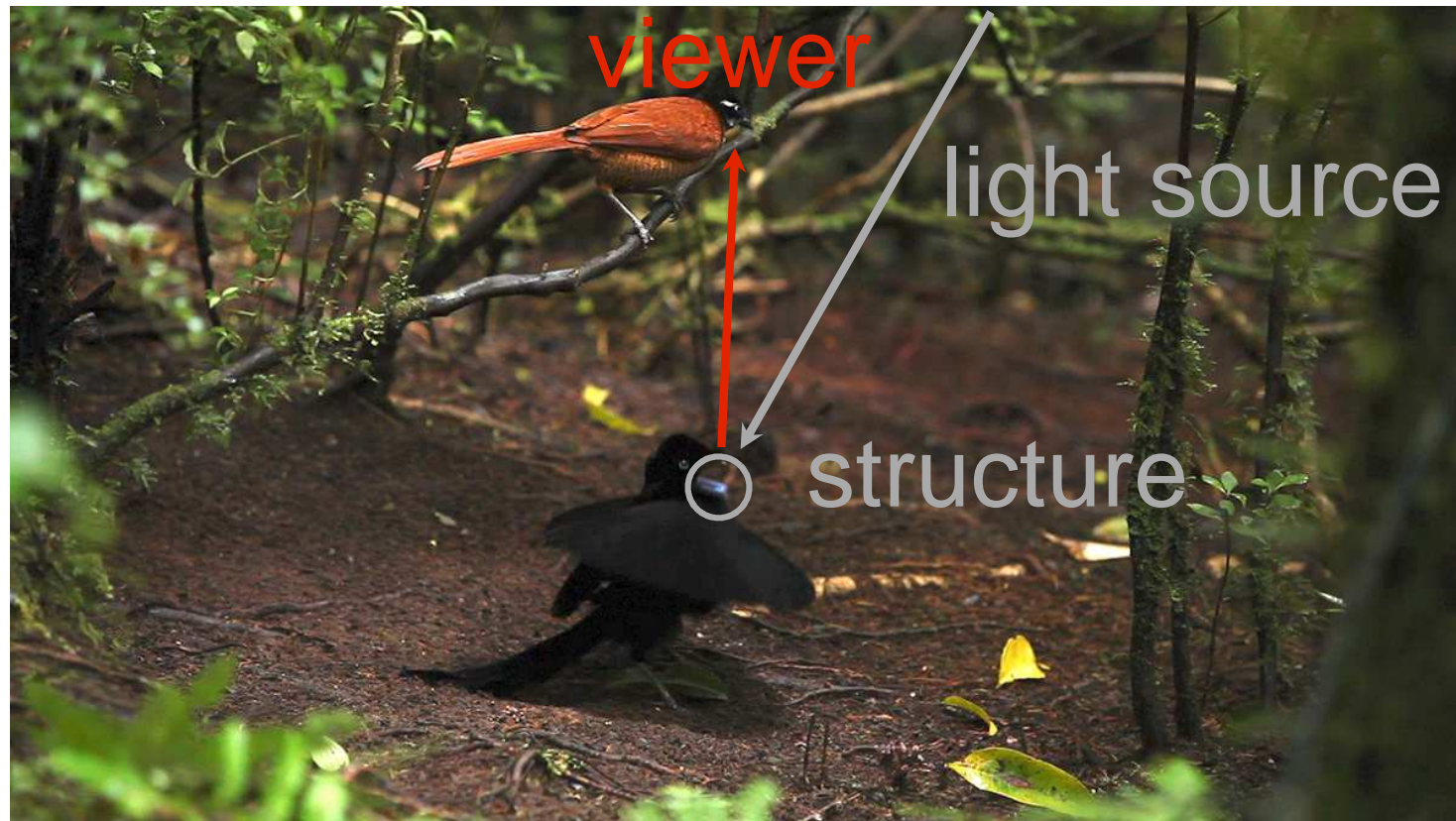
Ballerina Dance - courtship phenotype



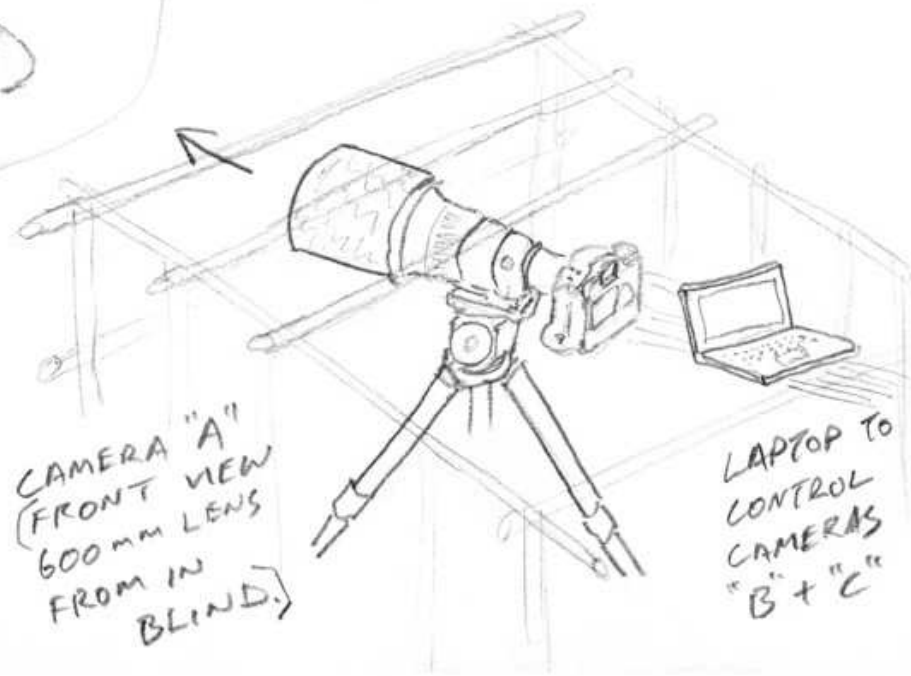
ML # 469255 - T Laman & E Scholes

Courtship Phenotype Appearance: viewer

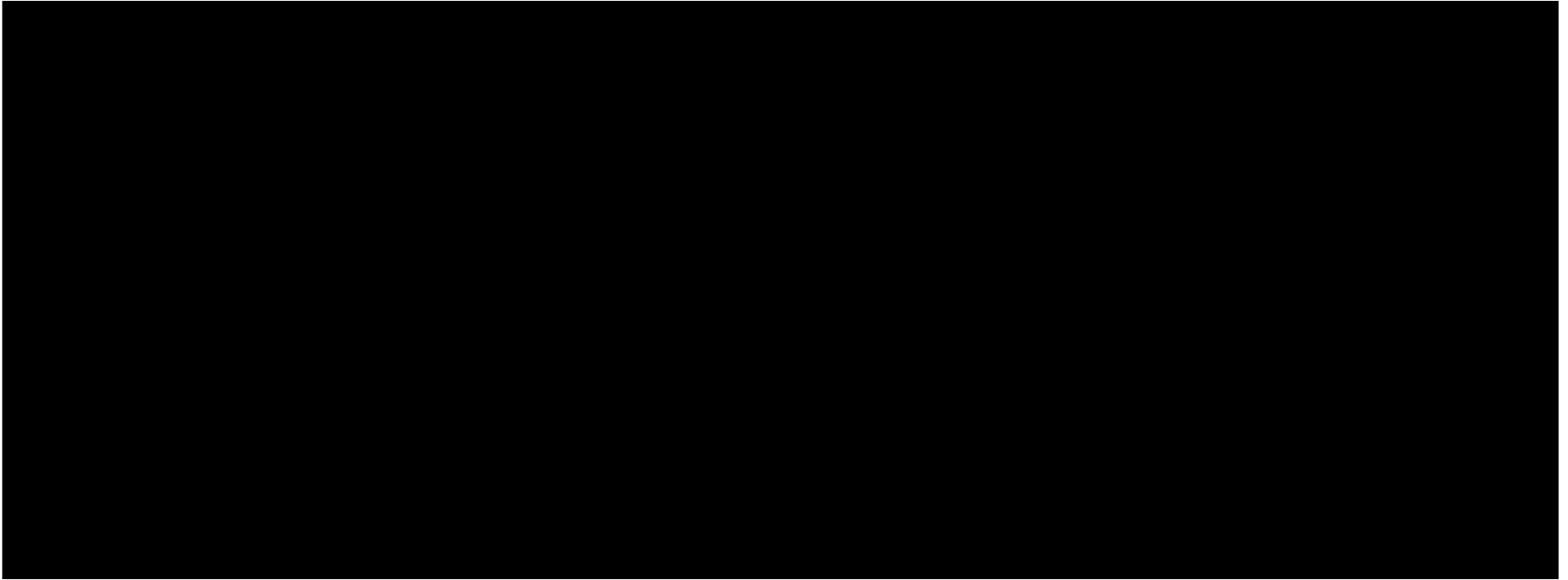
- What is the appearance of ballerina dance from the female's perspective?



ML # 469255 - T Laman & E Scholes



Courtship Phenotype Appearance: viewer



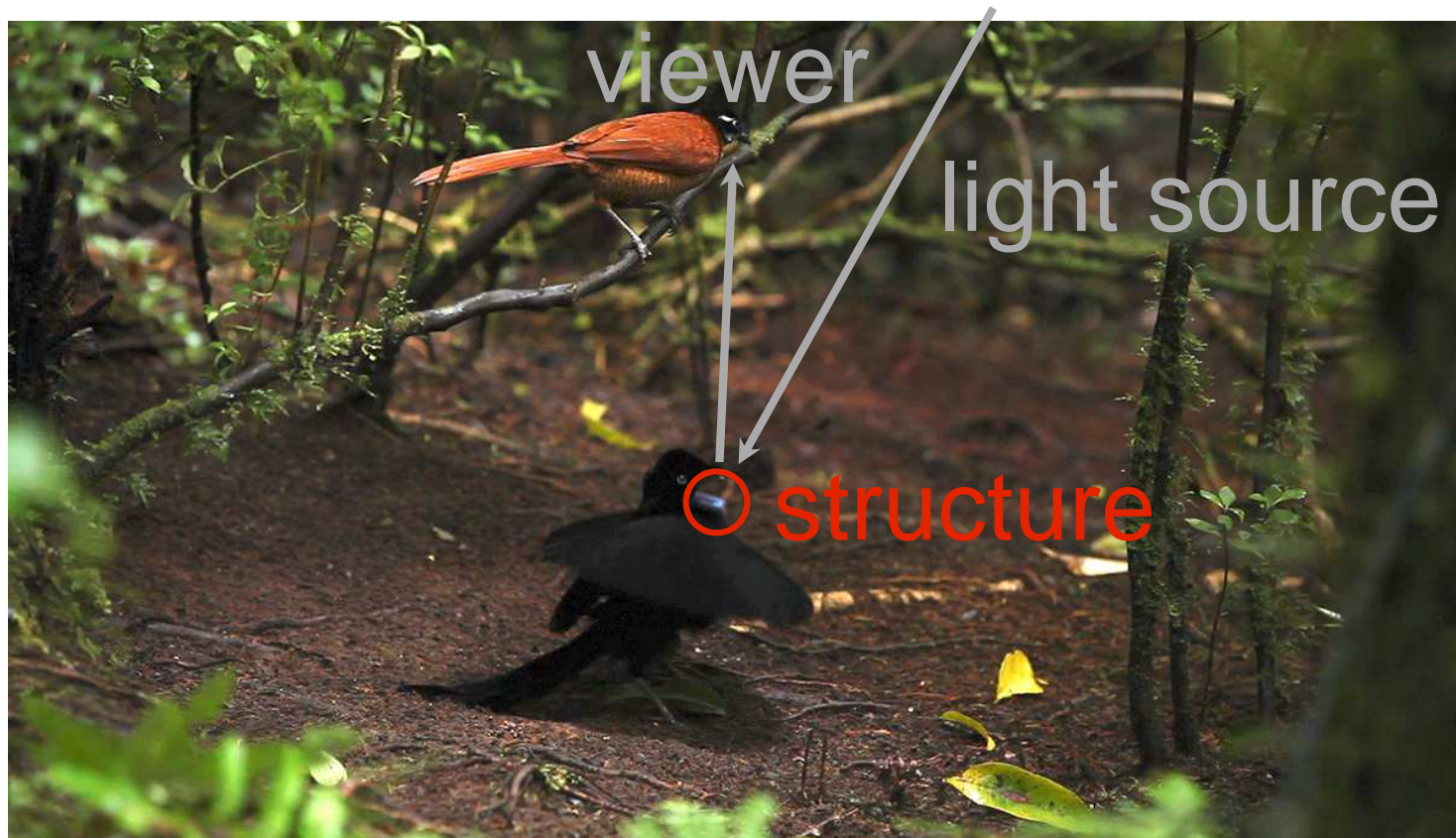
Side View (camera "B")

Top View (camera "C")

ML # 469264 - T Laman & E Scholes

Courtship Phenotype Appearance: structure

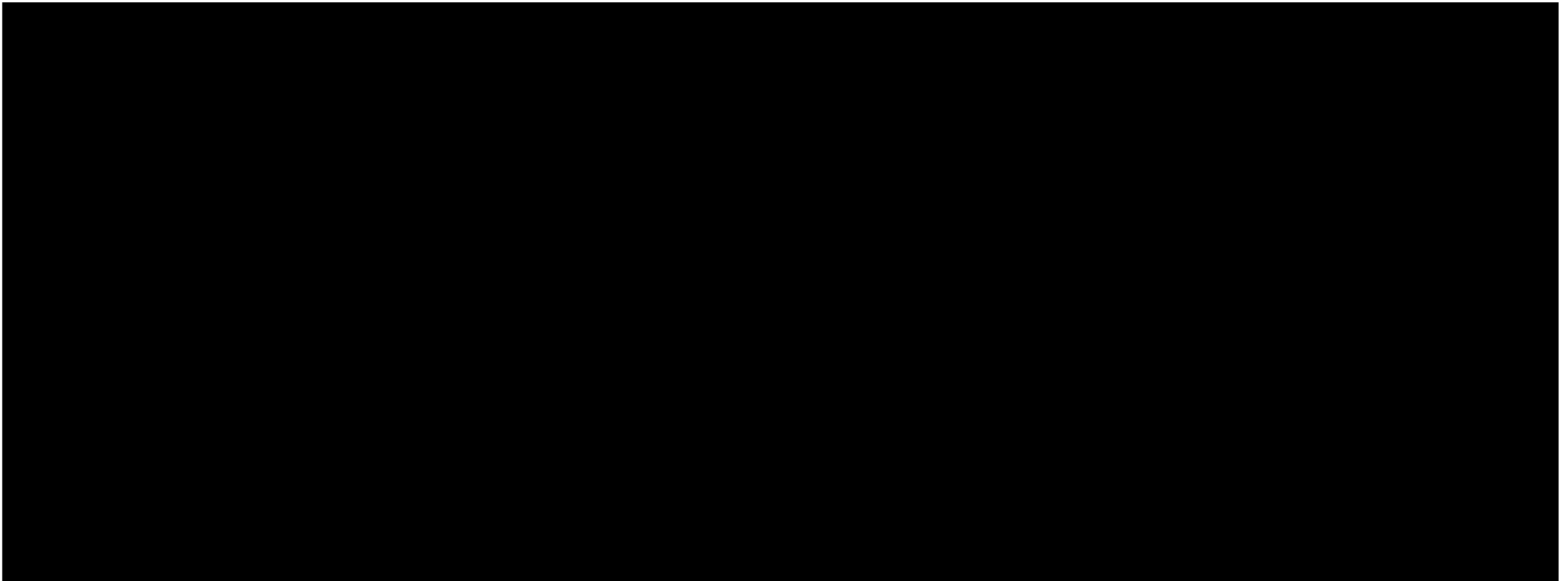
- How does the breastplate appear during the “ballerina” dance?



ML # 469255 - T Laman & E Scholes

Courtship Phenotype Appearance: structure

- How does the breastplate appear during the “ballerina” dance?

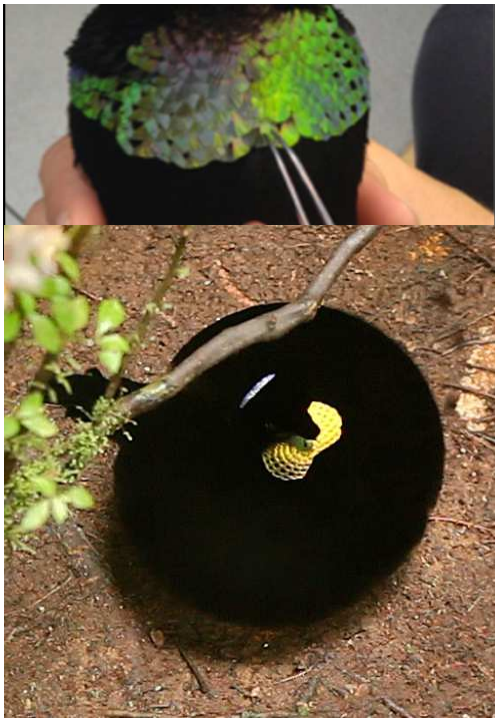


Side View (camera “B”)

Top View (camera “C”)

Directional reflectance of the breastplate across a hierarchy of structural scales.

Organism-scale

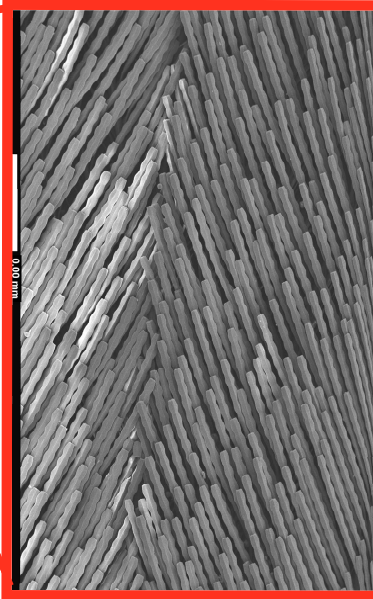


color patches and patterns

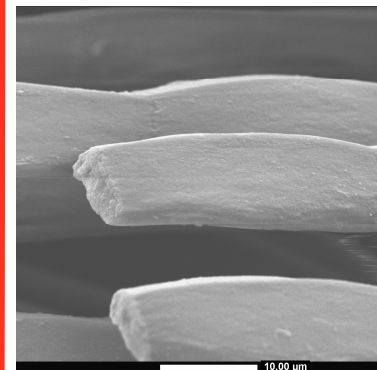
Macro-scale



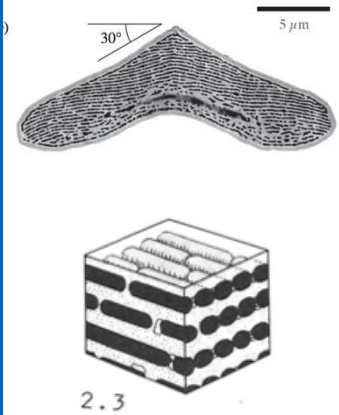
Milli-scale



Micro-scale



Nano-scale



produces color

blurs, broadens and shifts direction of reflectance

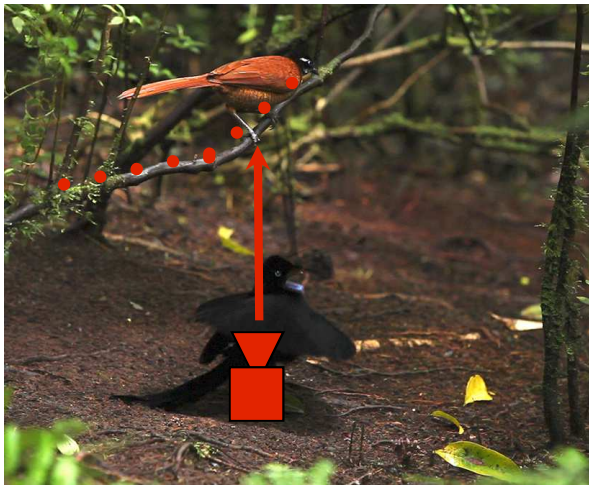
Courtship Phenotype Appearance: light source

- What about the incident light from the environment?

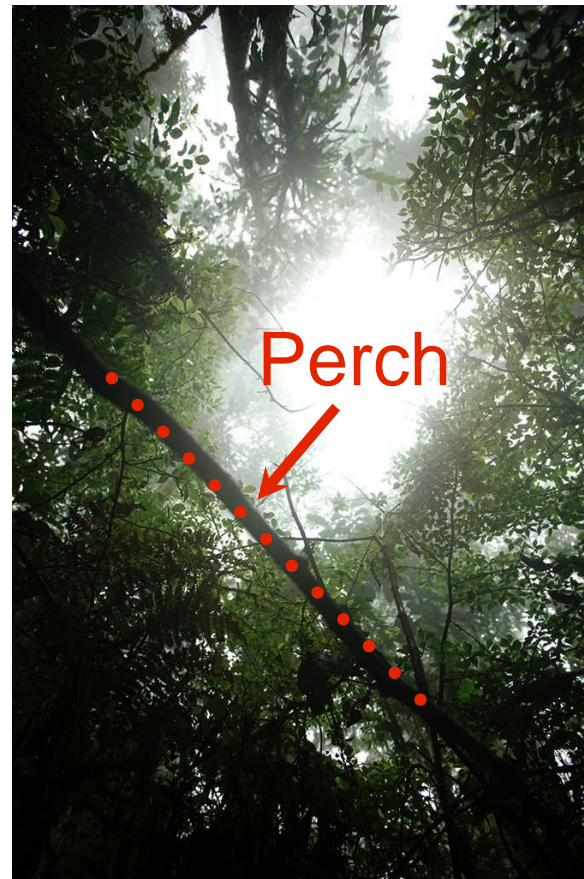


ML # 469255 - T Laman & E Scholes

Courtship Phenotype Appearance: light source (direction)



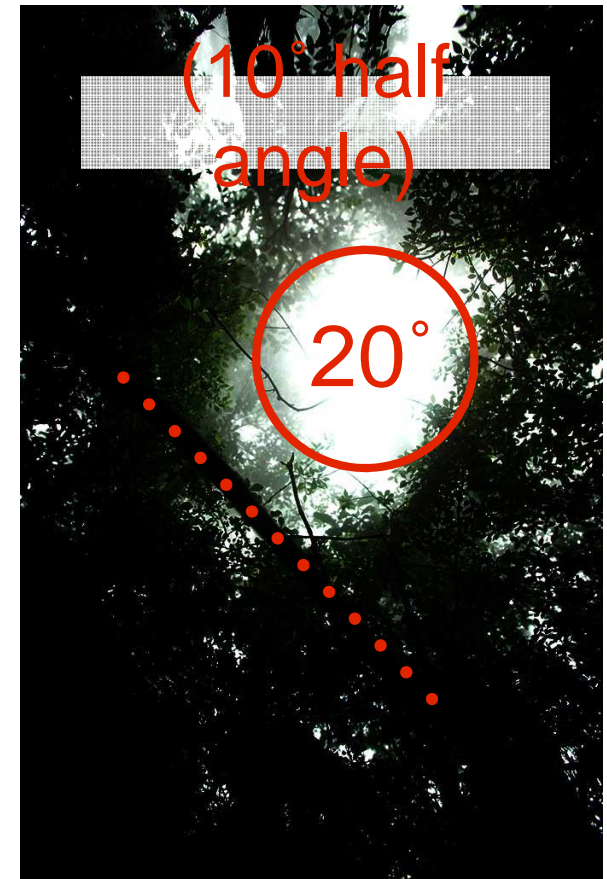
Camera position and aim



g 0.5

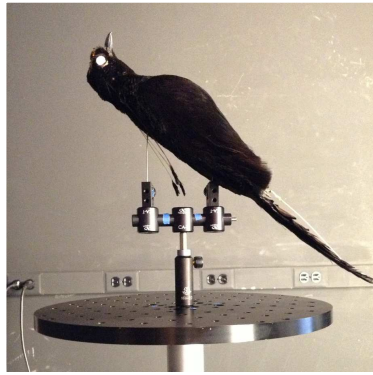
Wide-angle photographs of forest canopy

g 0.125

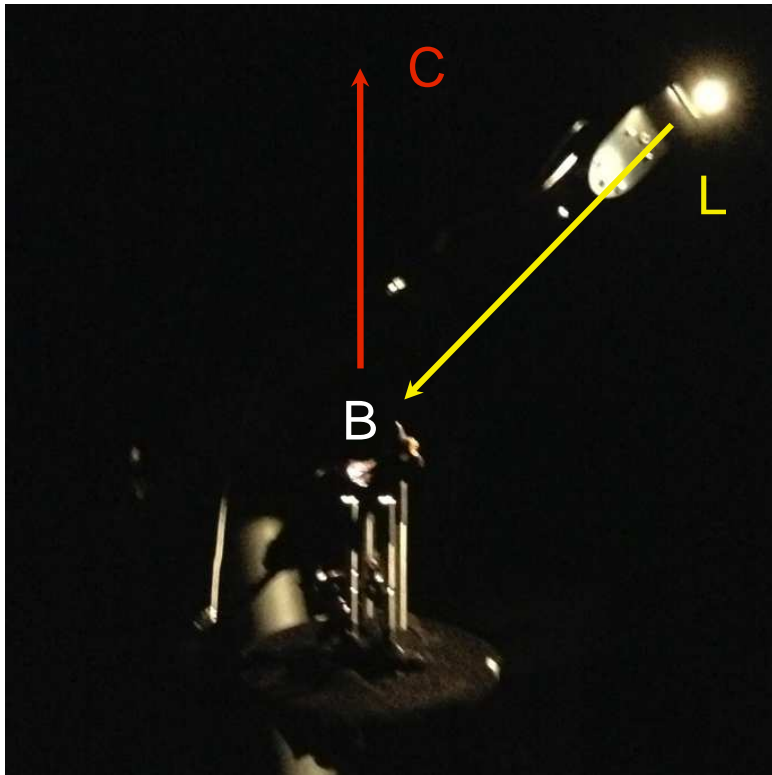
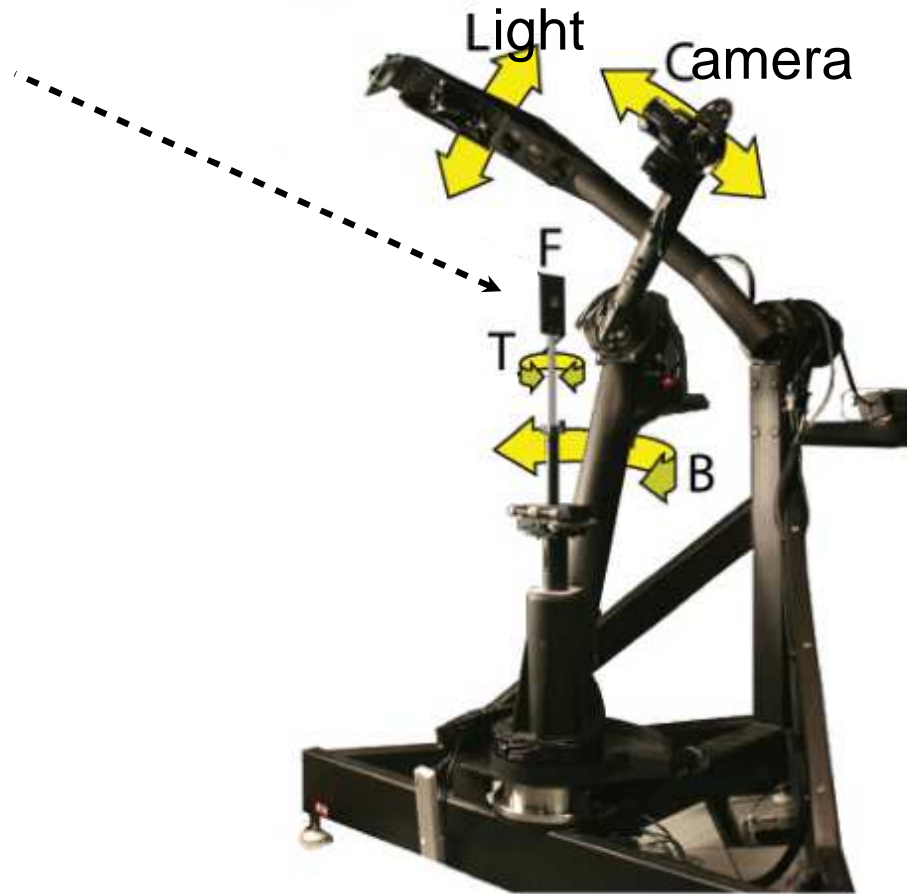


20° solid angle of incident light illuminates Parotia in his court

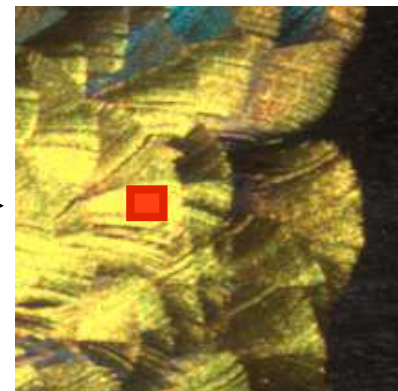
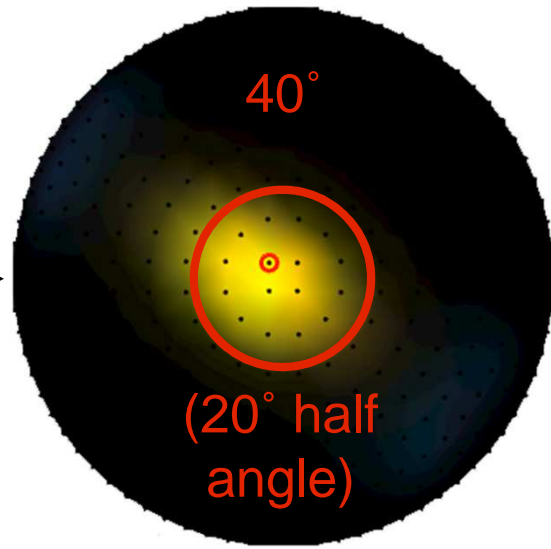
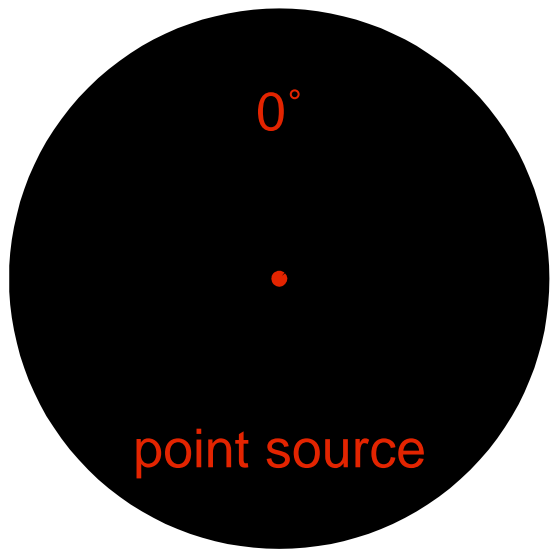
Measuring Directional Reflectance



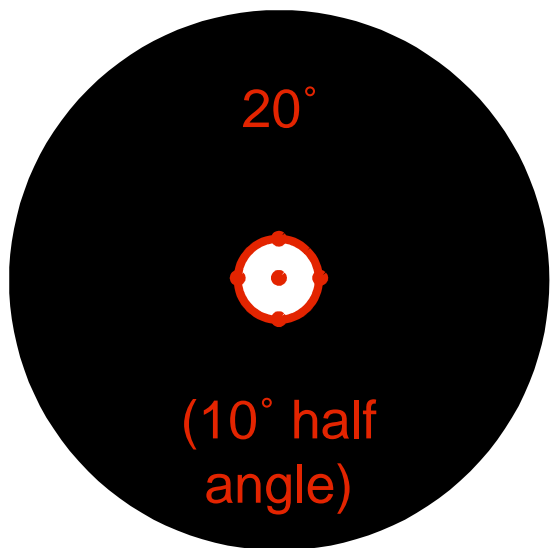
KU Ornithology # 93603 - Brett Benz



Cornell Spherical Gantry

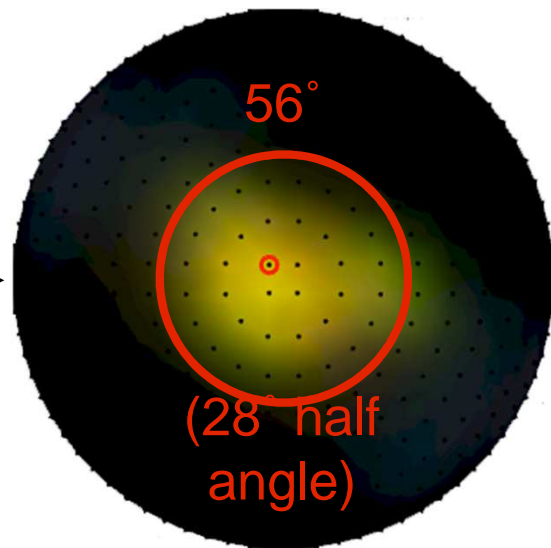


KUNHM # 93603 - Brett Benz



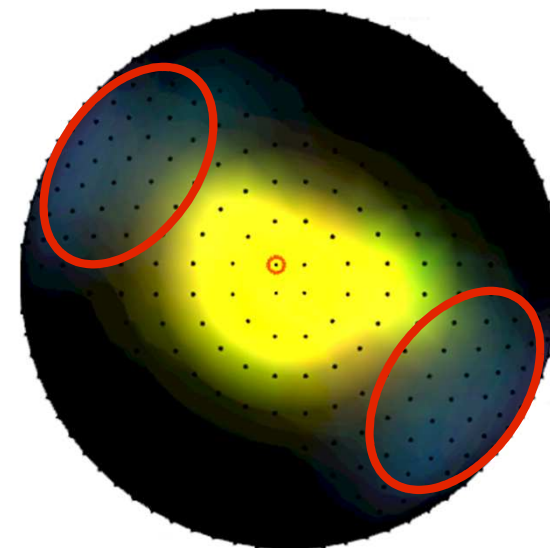
incident
solid angle

$\text{incident} = \text{atand}(4.5 \cdot .5 / 13 \cdot 1) \cdot 2 = 20 \text{ deg FW}$



reflected
solid angle

$\text{exitant} = \text{atand}(30 \cdot .5 / 40.5 \cdot 1) \cdot 2 = 40 \text{ deg FW}$



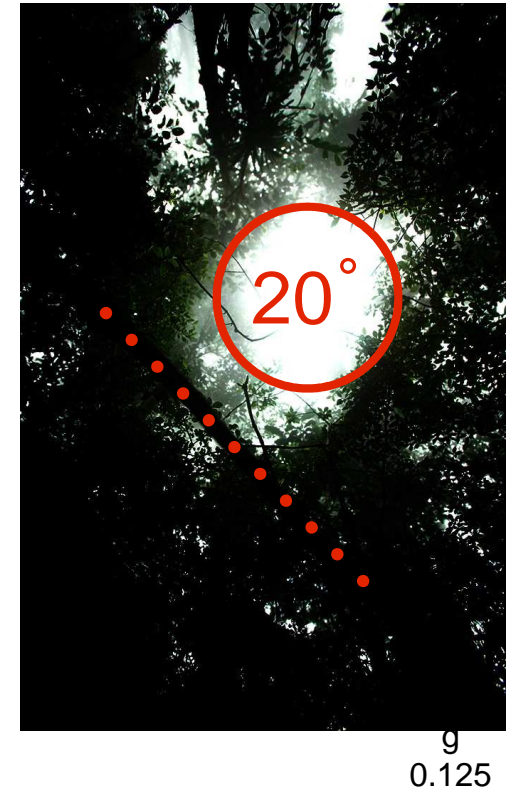
blue
(+3 exposure)

Reconstructing the functional morphology of appearance: geometry



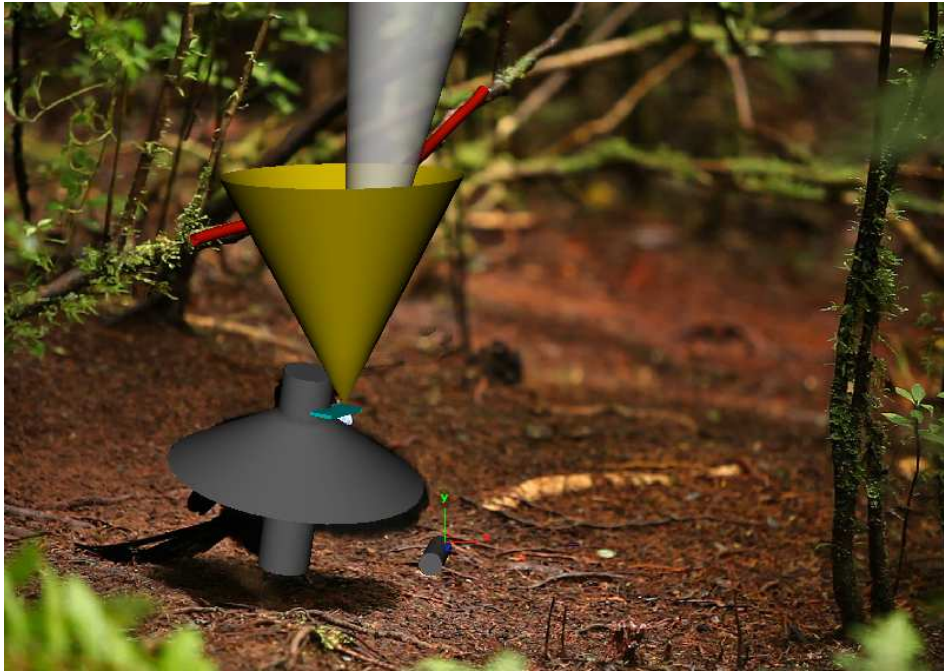
multi-perspective video to build 3D scale model

Reconstructing the functional morphology of appearance: geometry + light

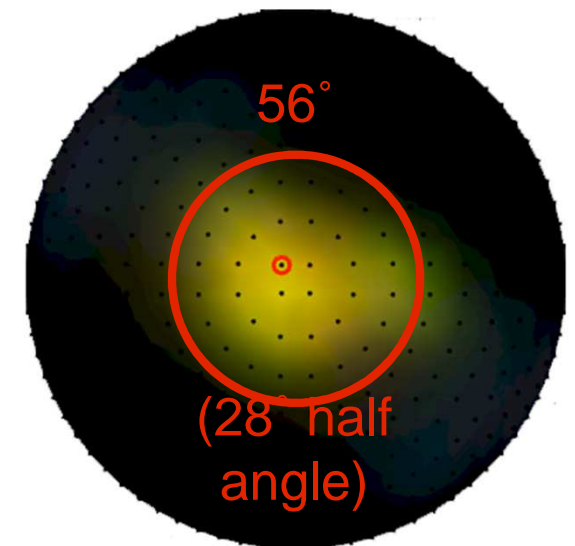


20° incident light cone relative to the breastplate

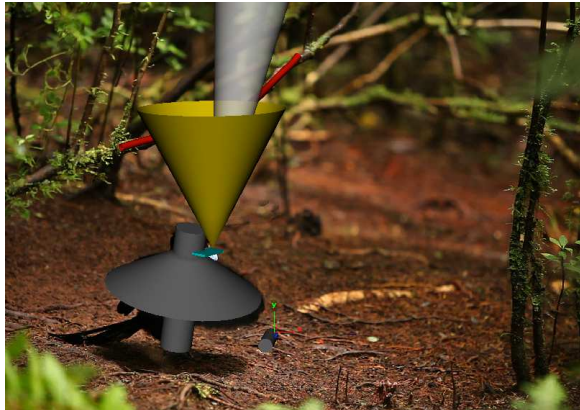
Reconstructing the functional morphology of appearance: geometry + light + reflectance



56° reflectance cone relative to the
breastplate and perch



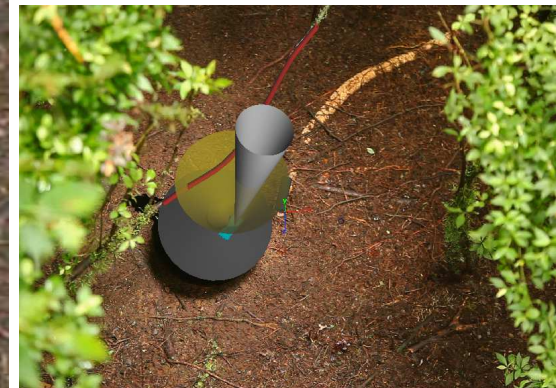
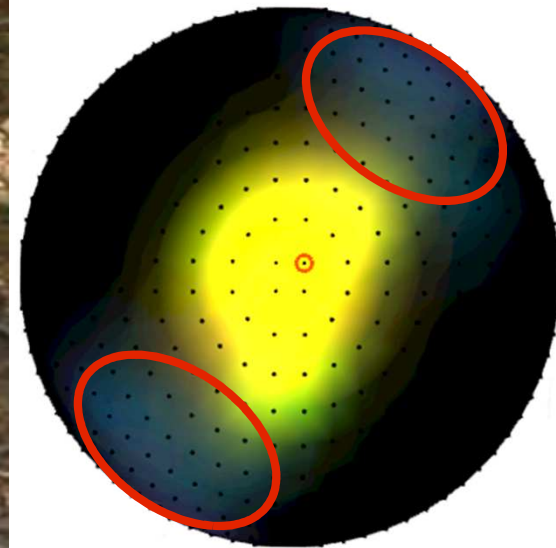
A view inside, and outside, of the 60° reflectance cone

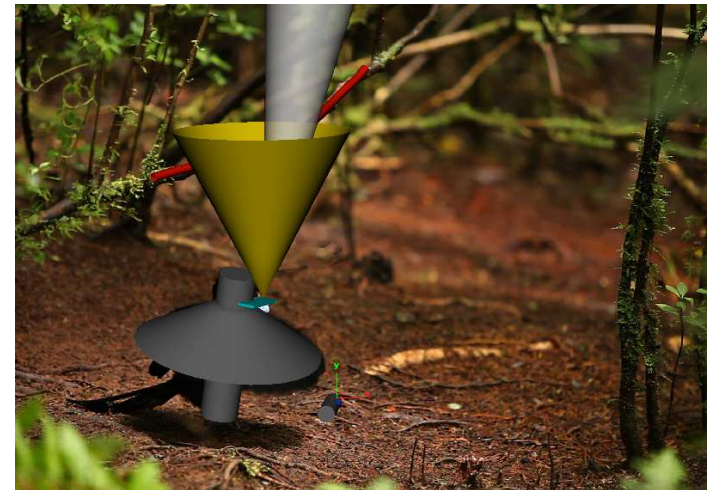
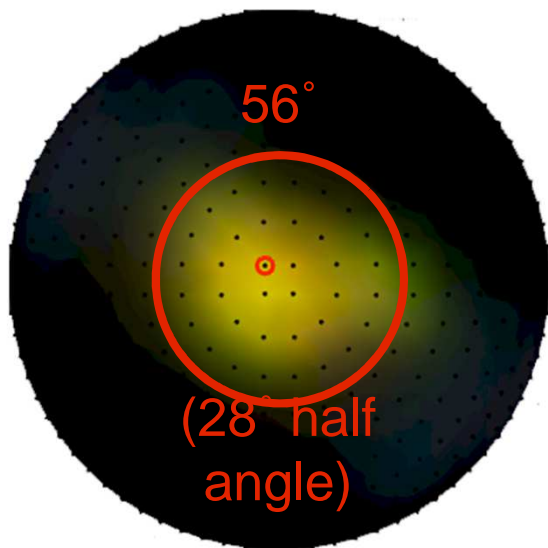
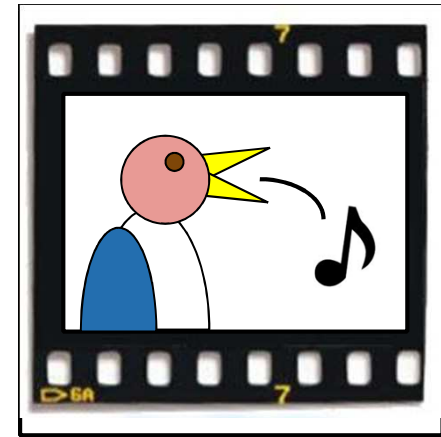
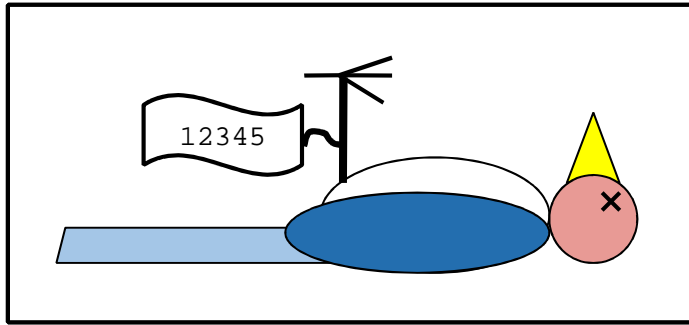


Side View (camera "B")



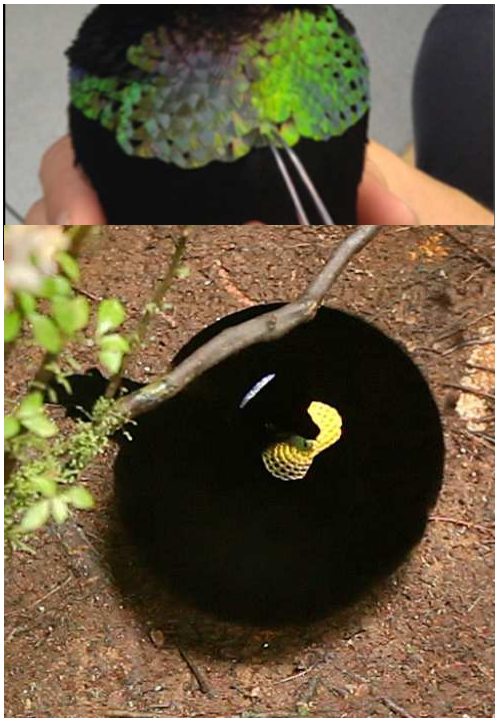
Top View (camera "C")





Directional reflectance of the breastplate across a hierarchy of structural scales.

Organism-scale

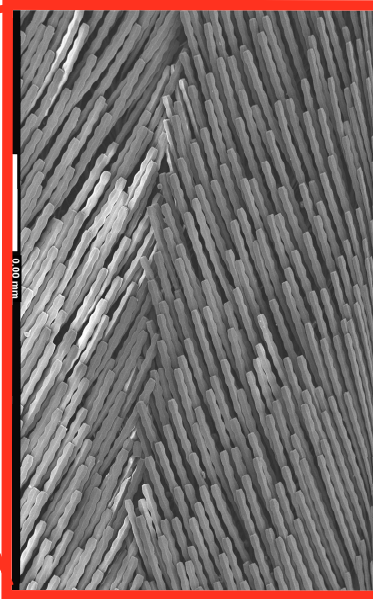


color patches and patterns

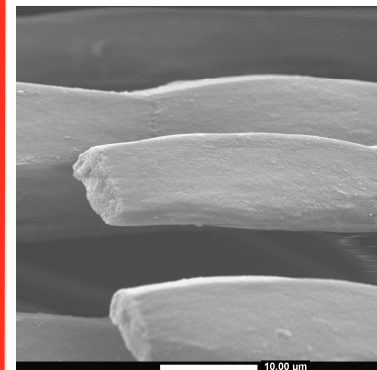
Macro-scale



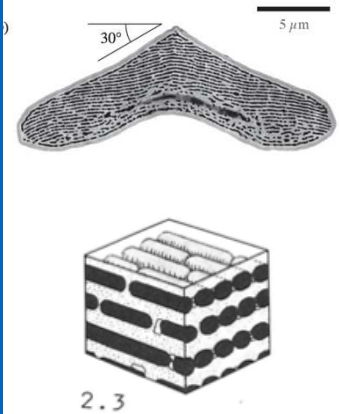
Milli-scale



Micro-scale



Nano-scale

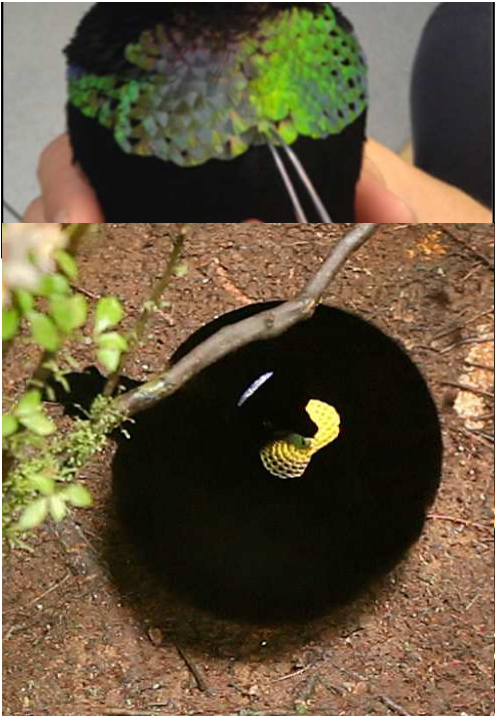


produces color

blurs, broadens and shifts direction of reflectance

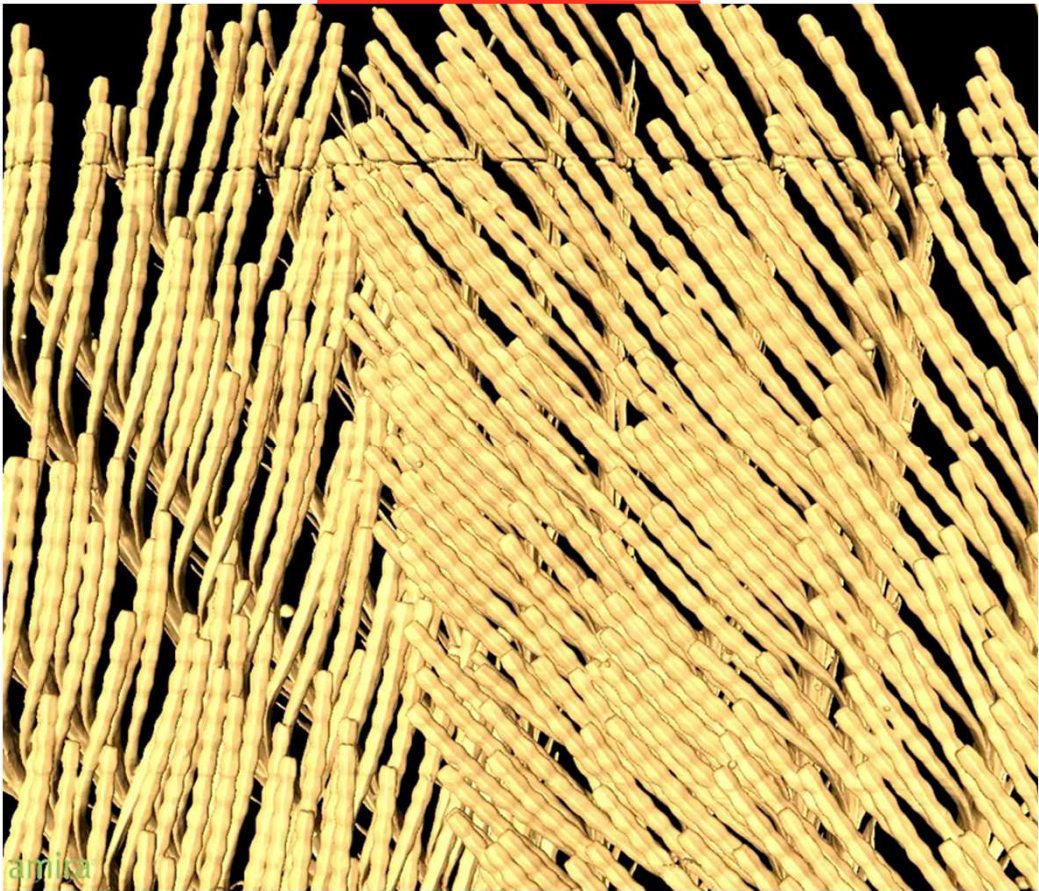
Directional reflectance of the breastplate across a hierarchy of structural scales.

Organism-scale



color patches and patterns

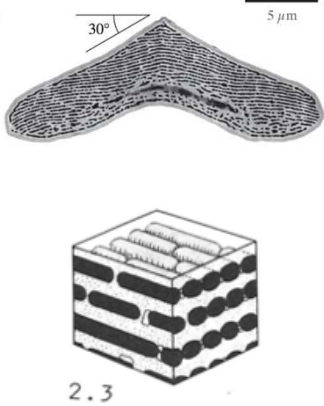
Macro-scale



Milli-scale

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produces color