Coming Events

2017

Novel Techniques in Microscopy
April 2–5, 2017
San Diego, CA
www.osa.org/en-us/meetings/global_calendar/events/novel_techniques_in_microscopy_%281%29

253rd ACS National Meeting & Exposition
April 2–6, 2017
San Francisco, CA
www.acs.org/content/acs/en/meetings/nationalmeetings/meetings.html

Focus on Microscopy 2017
April 9–12, 2017
Bordeaux, France
www.focusonmicroscopy.org

2017 MRS Spring Meeting & Exhibit
April 17–21, 2017
Phoenix, AZ
www.mrs.org/spring2017

Experimental Biology 2017
April 22–26, 2017
Chicago, IL
http://experimentalbiology.org/2017/Home.aspx

EMAS 2017 and IUMAS VII
May 7–11, 2017
Konstanz, Germany
www.microbeamanalysis.eu/events

Microscopy & Microanalysis 2017
August 6–10, 2017
St. Louis, MO
www.microscopy.org

2018

Microscopy & Microanalysis 2018
August 5–9, 2018
Baltimore, MD
www.microscopy.org

2019

Microscopy & Microanalysis 2019
August 4–8, 2019
Portland, OR
www.microscopy.org

2020

Microscopy & Microanalysis 2020
August 2–6, 2020
Milwaukee, WI
www.microscopy.org

2021

Microscopy & Microanalysis 2021
August 1–5, 2021
Pittsburgh, PA
www.microscopy.org

2022

Microscopy & Microanalysis 2022
July 31–August 4, 2022
Portland, OR
www.microscopy.org

More Meetings and Courses
Check the complete calendar near the back of this magazine.

Carmichael's Concise Review

A Microscopic Structure to Capture Dim Light

Stephen W. Carmichael
Mayo Clinic, Rochester, MN 55905

carmichael.stephen@mayo.edu

Most plants are green because chlorophyll, the pigment commonly utilized for photosynthesis, absorbs blue (and some red) light for energy to drive photosynthesis, therefore reflecting green light. However, in extreme shade there is not enough energy available in the blue light so another mechanism is needed to provide energy for plants in this challenging environment. Recently Matthew Jacobs, Martin Lopez-Garcia, O.-Phart Phrathep, Tracy Lawson, Ruth Oulton, and Heather Whitney revealed microscopic organelles in leaves that may function as photonic crystals to enhance capturing energy from light [1]. Photonic crystals are periodic nanoscale structures that interact with light, resulting in a number of optical phenomena including light-harvesting. Photonic structures are widespread in nature where they are typically associated with structural color. A striking example of structural color is iridescent blue leaves as seen in a diverse range of tropical plants adapted to deep forest shade conditions. Jacobs et al. may be the first to present direct evidence of a function for this structural color in photosynthesis.

Blue iridescent leaves have been described in some species of the genus *Begonia* (see Figure 1). Unusual plastids containing highly ordered internal structures called iridoplasts have been observed in the surface tissue of leaves from these plants and could be the source of the blue coloration. However this has not been proven, and the biological significance has not been determined. To explore this, Jacobs et al. examined the micro- and nano-scopic morphology of the iridoplast in quantitative detail to

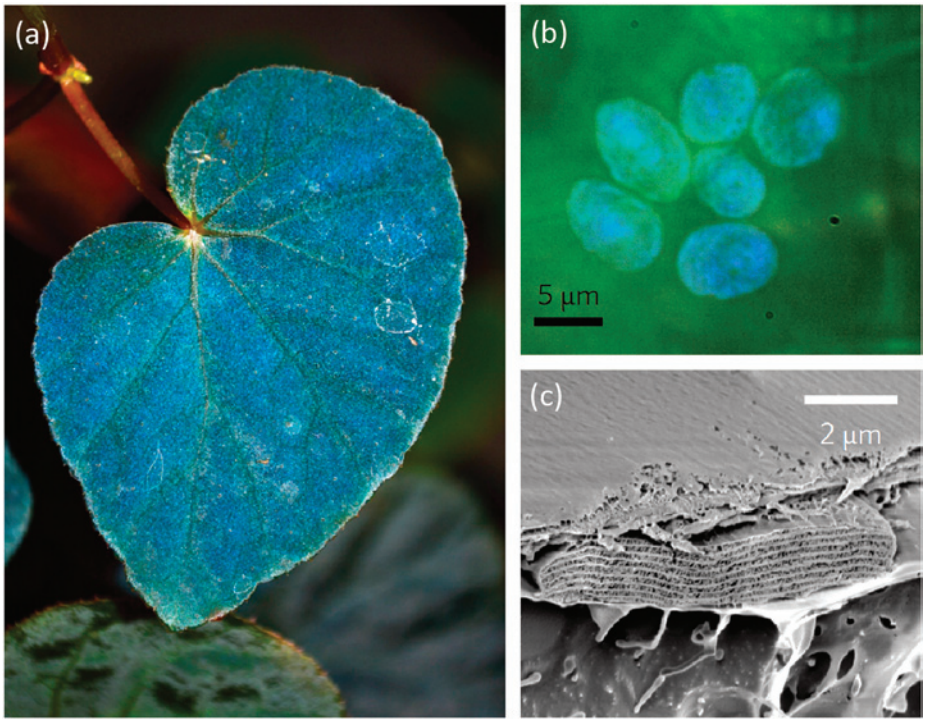
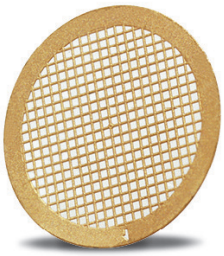


Figure 1: Blue leaf iridescence and iridoplasts in *Begonia*. (a) Photograph of a leaf of B. grandis × B. pavonina (G×P). (b) Microscopy image showing iridoplasts in an epidermal cell under brightfield epi-illumination. (c) Cryo-SEM image of a single iridoplast in *Begoni* G×P. Adapted by permission from Macmillan Publishers Ltd: *Nature Plants* 2 (11) Article number 16162 (2016).

doi:10.1017/S1551929517000165

The C-flat™ Advantage



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- Automated TEM analysis

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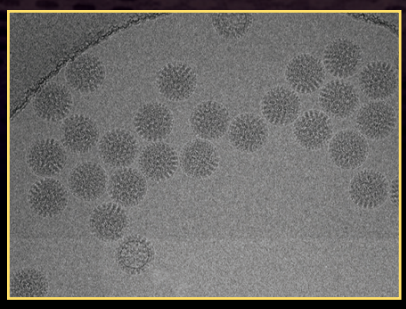

Frozen-hydrated Bacteriophage Capsid (data acquired on CF-1.2/1.4-4C).

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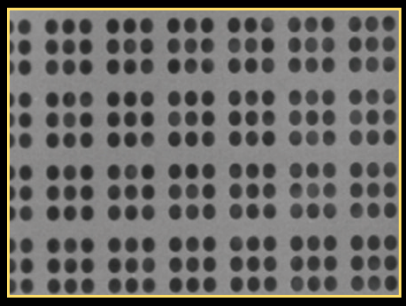

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determine if it could be an optical model of the absorption and reflectance of the structure. Transmission electron microscopy (TEM) and scanning electron microscopy of frozen specimens (cryo-SEM) revealed a photonic crystal structure formed by a periodic arrangement of light-absorbing thylakoids. Thylakoids are membrane-bound compartments that are the site of the light-dependent reactions of photosynthesis. This structure enhances photosynthesis in two ways: by increasing light capture at the predominately green wavelengths available in shade conditions and also by absorbing the diminished light.

Iridoblasts therefore both reflect blue light and enhance green and red light absorption. This is vital to begonias that can be found in natural shade conditions where light can be attenuated more than a million-fold. Moreover, the spectral distribution of available light is shifted to the green wavelengths. Enhanced absorption of green light may therefore be a way to scavenge residual light. These and other factors suggest that iridoplasts are particularly adapted for low-light conditions where other plants would struggle to grow. Not only is this possibility significant for blue leaves that allow these plants to survive in shade, but it could also be applied to the design of synthetic structures to enhance light gathering in devices for solar energy production.

Reference

[1] M Jacobs et al., *Nature Plants* 2 (11) Article number 16162 (2016) doi: 10.1038/NPLANTS.2016.162.

MT

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