New imaging device combines education and microbial research

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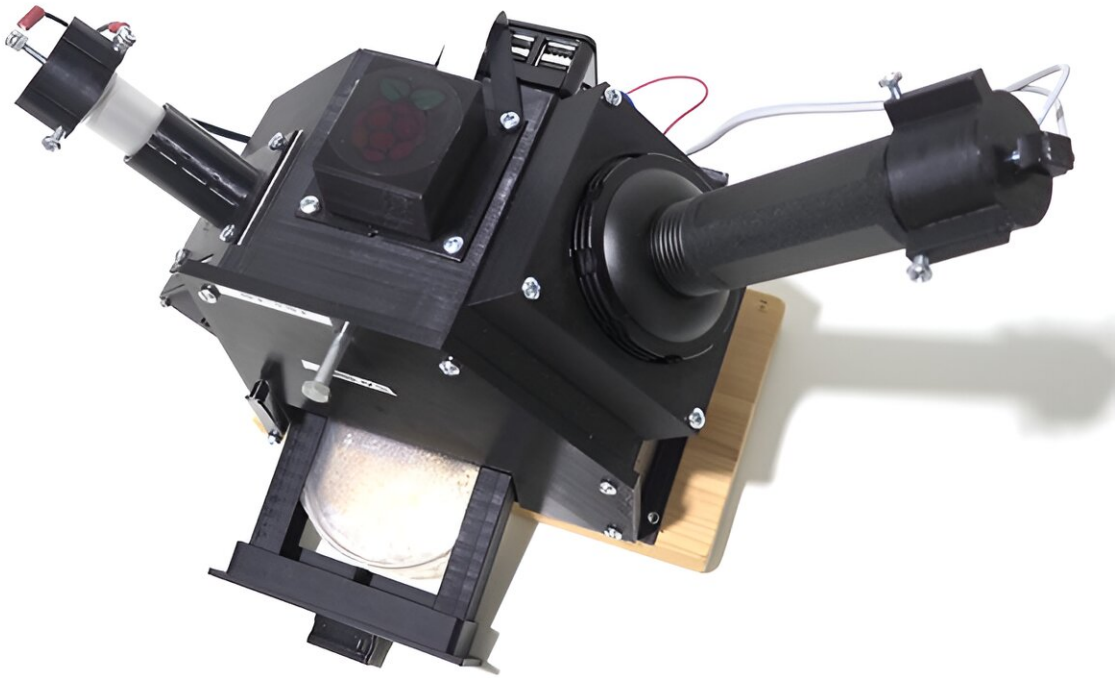


The 3D-printed device "NIRis" enables schools to observe and study natural phenomena. Credit: Project researcher Ole Franz from the University of Jyväskylä.

Researchers at the University of Jyväskylä have developed an imaging device for schools and research centers to study microbes. The 3D-printed device "NIRis" enables schools to observe and study natural phenomena. Researchers will gain useful and new knowledge about the

light-activated bacteria.

The study is published in the journal *PLOS ONE*.

The "Shared Light" (Jaettu Valo) project at the University of Jyväskylä aims to understand the role of photosynthetic bacteria inside plants and utilizes citizen science.

"Seven different high-schools across Finland, from Utsjoki to Turku, collected hundreds of plant samples for the researchers who then isolated bacteria from the plants," says project researcher Ole Franz from the University of Jyväskylä.

High-quality instrument for research

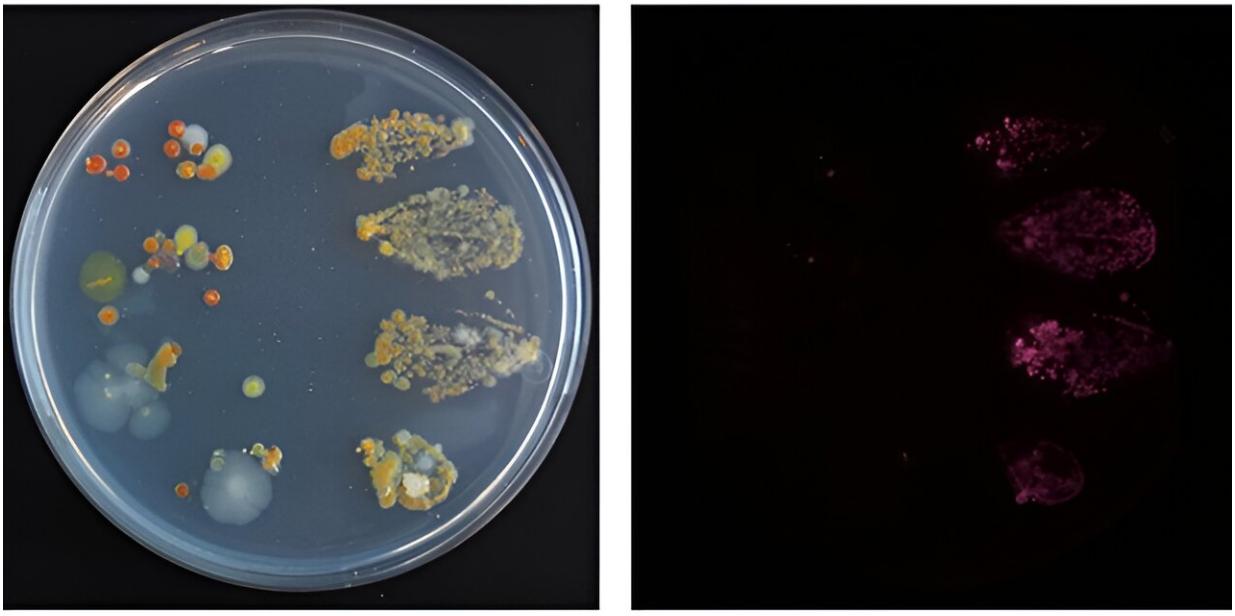
In order to facilitate fast detection of the bacteriochlorophyll-containing bacterial colonies of interest, the researchers developed a low-cost imaging device, a "Near-infrared imaging system" (NIRis) to analyze bacteria. NIRis has two imaging modes resulting in an overlay of all bacteria colonies and selectively identified near-infrared fluorescent colonies.

The identified bacteria can then be easily isolated for further studies. The 3D-printed device houses regular flashlights and detects bacterial colonies with a small raspberry pi computer and camera module.

"The aim was to keep the costs low and make it easy to operate. The low costs—less than a thousand euros—and easy operation allowed production of multiple devices so they could be sent to high schools participating in the project," says Heikki Häkkänen, the main designer of NIRis from the University of Jyväskylä.

Practical experience for schools

NIRis makes it possible to realize new types of multidisciplinary research and teaching at schools and research institutes. Teachers could utilize the device, for example, in biology, physics, programming, material design or even art education.



Prints of lingonberry leaves on growth medium reveal the diversity of associated bacteria. The fluorescence image on the right, taken with NIRis, shows only the phototrophic bacteria colonies in purple. Credit: Project researcher Ole Franz from the University of Jyväskylä.

"This is a great opportunity for teachers to link regular courses to relevant academic research and investigate materials collected from nature," says Kati Heikkilä-Huhta, the coordinating teacher from Oulu

Steiner school.

The project is looking forward to continuing developing courses and research projects which utilize this type of device.

New information on phototrophic bacteria

As of now, the Shared Light research group has used NIRis to isolate over 1,000 new strains of phototrophic bacteria from a variety of plants in different seasons and locations.

"The easy detection allowed sampling of large collections and accelerated our research considerably. This is especially exciting as the prevalence of this type of bacteria in and on plants has been very little studied, especially with cultivation-based approaches," explains Riitta Nissinen, University lecturer from University of Turku.

"As a phenomenon, this is highly interesting if one thinks that inside (photosynthetic) plants exist bacteria which also perform bacterial photosynthesis. Here, they do not produce sugars, but only chemical energy utilizing light energy," says professor in nanosciences Janne Ihalainen from University of Jyväskylä.

More information: Ole Franz et al, NIRis: A low-cost, versatile imaging system for near-infrared fluorescence detection of phototrophic cell colonies used in research and education, *PLOS ONE* (2024). DOI: 10.1371/journal.pone.0287088

Provided by University of Jyväskylä