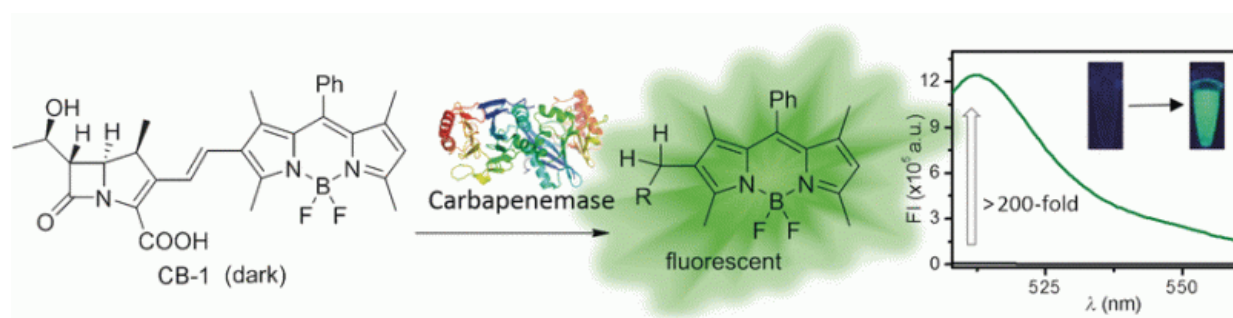


# A fluorogenic probe can detect the activity of multidrug-resistant pathogens in an assay system

March 24 2017



Credit: Wiley

Carbapenems are among the "antibiotics of last resort" and can fight infections for which other drugs have long lost their effectiveness. However, even carbapenem-resistant pathogenic strains have emerged over the last decades. To find out whether a pathogen contains carbapenem-cleaving enzymes, the carbapenemases, Chinese scientists have developed a simple and fast assay based on a fluorescent probe and optical detection. They introduce their approach in the journal *Angewandte Chemie*.

Carbapenems are a class of  $\beta$ -lactam [antibiotics](#) similar to cephalosporins and penicillins. Although some bacterial strains have

found powerful strategies to resist  $\beta$ -lactam antibiotics by producing a class of cleaving enzymes, the  $\beta$ -lactamases, most  $\beta$ -lactamases cannot affect the carbapenems. Therefore, these substances, which are called "antibiotics of last resort," are the drug of choice for several diseases such as urinary-tract and abdominal infections as well as hospital-acquired pneumonia, if they are caused by multidrug-resistant bacteria. But there is growing evidence of even [carbapenem](#) resistance, and some pathogens were found to produce carbapenem-cleaving enzymes, the carbapenemases. Now, Hexin Xie at East China University of Science and Technology and his team have set up a strategy to identify those pathogens that carry the carbapenemases.

The researchers developed a molecule that has the same structure as the carbapenems but has a fluorogenic dye attached. If this carbapenem-mimicking compound, CVB-1, is recognized by a carbapenemase, for example, in a bacteria extract, CVB-1 is cleaved and undergoes spontaneous degradation. As this destroys the electronic interaction of the attached dye with the carbapenem compound, the dye turns into a green fluorescent molecule, which means, if it is irradiated with light of a certain wavelength, it emits intense green light. Thus, the assay in principle works as follows: If there is an active carbapenemase present, for example, in a bacteria extract, a couple of minutes later the sample glows green upon excitation. Xie and his colleagues said: "CVB-1 [...] is essentially non-fluorescent [...], and the addition of [the carbapenemase] triggers the turn-on of the fluorescent signal upon excitation [...] with over 200-fold enhancement ratio."

This technique allows the detection of antibiotic resistance activity by fluorescence. Thus, using this fluorescence-based assay system, it would be possible to find out in very short time whether carbapenem-resistant bacteria (such as certain Enterobacteriaceae and *Klebsiella pneumoniae* strains) are indeed present during an infection. More specific treatment strategies could be designed and an overuse of noneffective drugs could

be avoided. The scientists have performed several tests to prove that their CVB-1 assay is specific, that the detection limit is low, and that it can indeed be used in live systems. This fast and simple fluorescence-based assay is certainly a remarkable approach in the ongoing and urgent fight against the fast spread of antibiotic resistance.

**More information:** Wuyu Mao et al. Detection of Carbapenemase-Producing Organisms with a Carbapenem-Based Fluorogenic Probe, *Angewandte Chemie International Edition* (2017). [DOI: 10.1002/anie.201612495](https://doi.org/10.1002/anie.201612495)

Provided by Wiley

Citation: A fluorogenic probe can detect the activity of multidrug-resistant pathogens in an assay system (2017, March 24) retrieved 25 April 2024 from <https://phys.org/news/2017-03-fluorogenic-probe-multidrug-resistant-pathogens-assay.html>

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