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Discotic amphiphile supramolecular polymers for drug release and cellular activation with light

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The limited efficacy shown by drug delivery systems so far prompts to develop new molecular approaches to release drugs in a controlled and selective manner and with lower adverse effects. **Light** is a privileged stimulus for delivery because it can be applied in sharp spatiotemporal patterns and is orthogonal to most biological processes in animals. Supramolecular polymers form molecular nanostructures whose robustness, versatility, and responsivity to different stimuli have generated wide interest in materials chemistry, energy, and medicine[1]. However, their application as **drug delivery vehicles** has received little attention. We have built supramolecular polymers based on discotic amphiphiles that self-assemble in linear nanostructures in water[2,3]. They can integrate diverse amphiphilic bioligands and release them upon illumination, acutely producing functional effects in physiological conditions. We devised **two strategies** for **drug incorporation** into the photoswitchable nanofibers. In the first one, discotic monomers with and without conjugated bioligands were **co-assembled** in helicoidal supramolecular fibers and evaluated by transmission electron microscopy and circular dichroism. In the second approach, we integrated Iperoxo-azo[4], a potent agonist of muscarinic receptors into the discotic polymer by means of noncovalent **stacking** interactions and showed that it can be released on demand with light *ex situ* and *in situ*, rapidly activating the target receptor in living cells and triggering intracellular responses. These novel discotic supramolecular polymers can be used as light-driven drug delivery systems for small, planar, and amphiphilic drugs.

References:

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