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Science Flash 09

Boosting plastic degradation by a novel enzymatic paradigm

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Our undeniable dependency on plastics is justified by their technological versatility in different sectors of our societies. However, since their birth on our planet, it was noticed their lack of degradability under ambient conditions. Today's production worldwide has overcome 350 million tonnes and this amount has created a global crisis known as plastic pollution. We plan to show the steps towards the design of a new enzymatic paradigm for plastic degradation. Our project envisions to stop the progress of the plastic pollution crisis and to make it fully part of the circular economy. Our approach will employ a rational design of a novel enzymatic complex not reported before in nature in analogy with plant cell wall-degrading enzymes. The key feature of such nanomachine is the process of binding of several plastic-degrading enzymes to a protein-scaffolding. It will be composed of multiple proteins that serve to integrate the enzymes and a substrate-binding module. In contrast to the current paradigm, "free enzyme" which is dominated by a non-concerted degradation process, we expect our novel system to exploit the effect of having the enzymes very close to the plastic substrate and their synergy. Moreover, the modular character of our approach and the vast information in the field of hydrolases (endoglucanases) will boost the search for novel enzymes.