Stable production of the antimalarial drug artemisinin in the moss Physcomitrella patens -
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Malaria is a real and constant danger to nearly half of the world’s population of 7.4 billion people. In 2015, 212 million cases were reported along with 429,000 estimated deaths. The World Health Organization recommends Artemisinin-based Combinatorial Therapies (ACTs), and the artemisinin for this purpose is mainly isolated from the plant Artemisia annua. However, the plant supply of artemisinin is irregular, leading to fluctuation in prices. Here we report the development of a simple, sustainable, and scalable production platform of artemisinin. The five genes involved in artemisinin biosynthesis were engineered into the moss Physcomitrella patens via direct in vivo assembly of multiple DNA fragments. In vivo biosynthesis of artemisinin was obtained without further modifications. A high initial production of 0.21 mg/g dry weight artemisinin was observed after only three days of cultivation. Our study shows that P. patens can be a sustainable and efficient production platform of artemisinin that without further modifications allow for industrial scale production. A stable supply of artemisinin will lower the price of artemisinin-based treatments, hence become more affordable to the lower income communities most affected by malaria; an important step towards containment of this deadly disease threatening millions every year.

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