

# Bioengineering Natural Sunscreens

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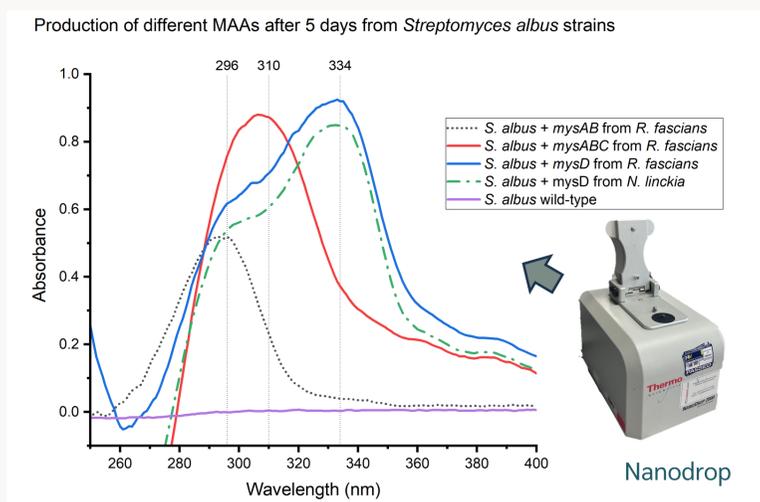
## INTRODUCTION

- Some commercial sunscreens are toxic to aquatic life, for example, they can cause coral bleaching<sup>[1]</sup>.
- Mycosporine-like amino acids (MAAs) are a group of natural products that can absorb UV radiation for several organisms in the environment such as cyanobacteria, red algae, and fungi<sup>[2]</sup>.
- Streptomyces* bacteria are heterologous hosts, well-known for providing high yields of products.<sup>[3]</sup> Hence, it could be used as a sustainable platform to produce industrial-scale environmentally-friendly MAAs.

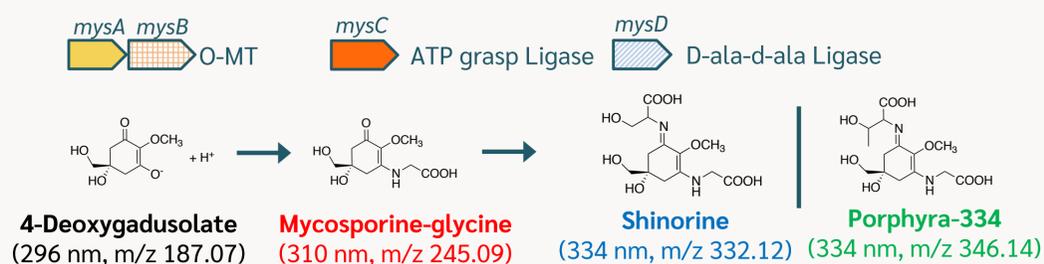


## KEY RESULTS

- Streptomyces albus* J1074 with MAA genes was found to produce and secrete various types of MAAs covering both UV-A (315-400 nm) and UV-B (280-315 nm) regions for up to 150 mg/L.
- By integrating *mysAB* and *mysABC* genes from *Rhodococcus fascians* D188, *S. albus* could produce **4-Deoxygadusolate** and **Mycosporine-glycine**, respectively.
- The addition of the *mysD* gene from *Rhodococcus fascians* D188 resulted in the production of **Shinorine** and another *mysD* gene from *Nostoc linckia* NIES-25 generated **Porphyra-334**.



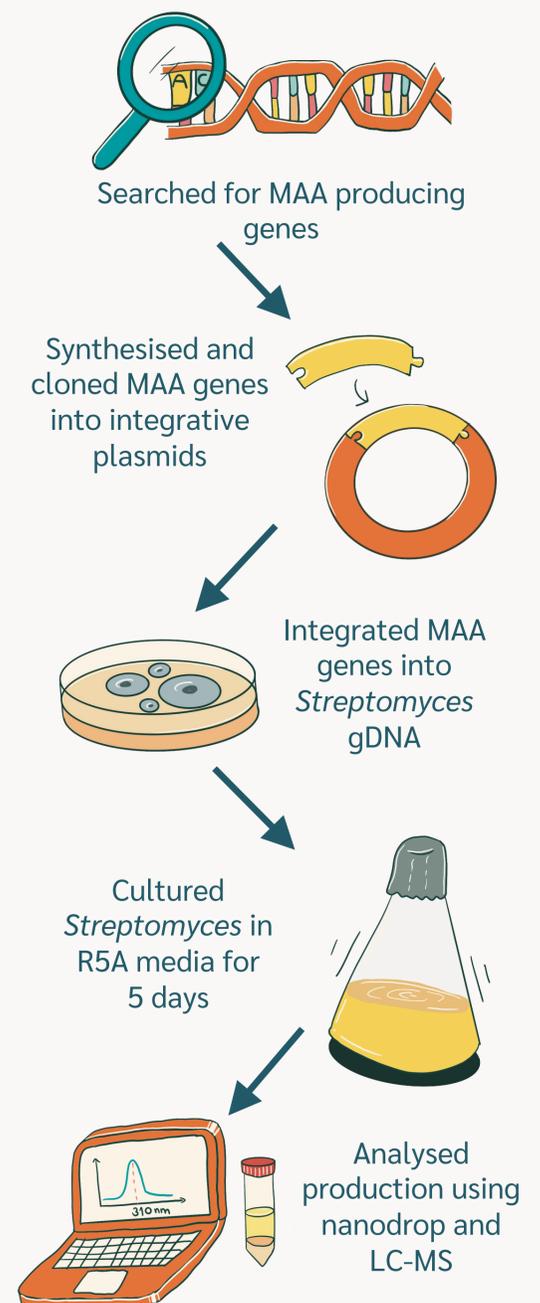
### MAA Biosynthesis Pathway



## REFERENCES

- [1] Danovaro, R., et al. (2008). Sunscreens cause coral bleaching by promoting viral infections. *Environmental health perspectives*, 116(4), 441-447.
- [2] Miyamoto, K. T., Komatsu, M., & Ikeda, H. (2014). Discovery of gene cluster for mycosporine-like amino acid biosynthesis from Actinomycetales microorganisms and production of a novel mycosporine-like amino acid by heterologous expression. *Applied and environmental microbiology*, 80(16), 5028-5036.
- [3] Gomez-Escribano, J. P., & Bibb, M. J. (2014). Heterologous expression of natural product biosynthetic gene clusters in *Streptomyces coelicolor*: from genome mining to manipulation of biosynthetic pathways. *Journal of Industrial Microbiology and Biotechnology*, 41(2), 425-431.

## METHODS



## FUTURE PROSPECTS

- Involve different *mysD* genes from other organisms to produce novel MAAs.
- Find out which transporters are involved in exporting MAA
- Explore other potential applications of MAAs, for example, protection of light-sensitive compounds such as the antifungal preservative natamycin from photodegradation.

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