

**University of Minho** School of Engineering

## Innovative Approaches to Polyphenol Synthesis: Combinatorial Biosynthesis Unveiled



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**Polyphenols Biological Extraction from Plants Heterologous Production** CENTRE OF **Activities** BIOLOGICAL & Chemical Synthesis & Synthetic Biology ENGINEERING Antioxidant Low amounts/yields/purity • Growth in inexpensive substrates Anti-aging Anti-inflammatory Limited by seasonality/ regional Rapid production cycles • Anti-diabetic Anticancer variations/pests/ extreme weather Higher purity • Estrogenic • Would healing High land/water investment Higher amounts • Menopause treatment Anti-viral Environmentally unfriendly Cholesterol lowering... Cheaper \$3.3 billion • Anti-septic Expensive downstream processes Sustainable by 2032 Skin treatment disorders Complex Not limited by seasonality ŃΗ<sub>2</sub> tyrosine Flavonoids naringenin OCH<sub>3</sub> **Furanocoumarins** Coumarins  $R_1=H$ ,  $R_2=H$ , psoralen R₁=H umbelliferone OH R<sub>1</sub>=OH, R<sub>2</sub>=H, xanthotoxol R<sub>1</sub>=OCH<sub>3</sub> scopoletin R<sub>1</sub>=H, R<sub>2</sub>=OH, bergaptol R₁=OH esculetin R<sub>1</sub>=OCH<sub>3</sub>, R<sub>2</sub>=H, xanthotoxin Curcuminoids Prenylflavonoids H<sub>3</sub>C<sup>-</sup> `СН<sub>2</sub> H<sub>2</sub>C<sup>2</sup> CH  $R_1=H$ ,  $R_2=OCH_3$ , bergapten Prenylflavonoids  $R_1 = R_2 = OCH_3$  curcumin xanthohumol 8-prenylnaringenin  $R_1=R_2=H$  bisdemethoxycurcumin  $R_1=H$ ,  $R_2=OCH_3$  demethoxycurcumin

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