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## **Polymeric Peptide Pigments with Sequence-encoded Properties**

**Abstract**

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Melanins are a family of heterogeneous polymeric pigments that provide ultraviolet (UV) light protection, structural support, coloration, and free radical scavenging. Formed by oxidative oligomerization of catecholic small molecules, the physical properties of melanins are influenced by covalent and noncovalent disorder. We report the use of tyrosine-containing tripeptides as tunable precursors for polymeric pigments. In these structures, phenols are presented in a (supra-)molecular context dictated by the positions of the amino acids in the peptide sequence. Oxidative polymerization can be tuned in a sequence-dependent manner, resulting in peptide sequence-encoded properties such as UV absorbance, morphology, coloration, and electrochemical properties over a considerable range. Short peptides have low barriers to application and can be easily scaled, suggesting near-term applications in cosmetics and biomedicine.

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