Biomimetic Synthesis of Nanoparticle Catalysts

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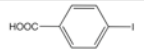
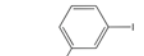
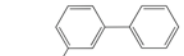
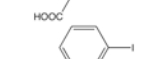
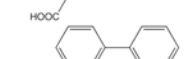
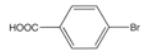
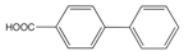
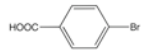
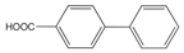
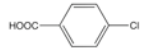
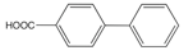
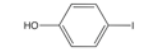
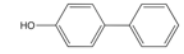
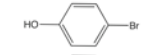
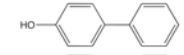
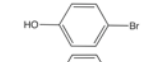
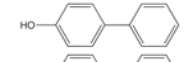
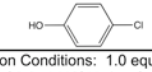
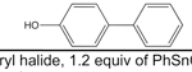
Our research has employed peptides for the production of catalytically active Pd nanoparticles (bottom right). The Pd4 peptide (TSNAVHPTLRHL) binds to the Pd surface via the H-residues in a kinked fashion to expose a significant fraction of the metallic surface. Catalytic Stille C-coupling (top right) was studied in water at room temperature for quantitative yields at Pd loadings of ≥0.005 mol% (bottom right). The nanoparticles were also active across a variety of halides and functional groups (Table). These materials may serve as models to study structure/function relationships of eco-friendly catalysts.

Entry	Aryl Halide	Product	Yield
1			100
2			100
3			0
4[b]			7.9 (43.2)[c]
5[d]			40.0 (84.7)[c]
6[b]			0
7			100
8[b]			6.23 (26.8)[c]
9[d]			12.8 (48.4)[c]
10[b]			0

[a] Reaction Conditions: 1.0 equiv of aryl halide, 1.2 equiv of $PhSnCl_3$, 0.05 mol % Pd, 8.0 mL of 2.25 M KOH, 25 °C, t = 24 h; [b] 0.1 mol % Pd; [c] t = 72 h or 168 h in parenthesis; [d] 0.5 mol % Pd.