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Self-assembled peptide nanowires on single-layer graphene and MoS_2 with biomolecular doping effect[1] YUHEI HAYAMIZU, CHRISTOPHER R. SO, MEHMET SARIKAYA, Genetically Engineered Materials Science and Engineering Center, Materials Science and Engineering, University of Washington — Developing elegant hybrid systems of biological molecules on atomic single layers (ASLs), such as graphene, is a key in creating novel bio-nanoelectronic devices, where versatile biological functions are integrated with electronics of ASLs. Biomolecules self-assembling into ordered structures on ASLs offer a novel bottom-up approach, where organized supramolecular architectures spatially govern the ASL electronics. Despite the potential in bridging nano- and bio-worlds at the molecular scale, no work has yet realized a way to control electronic and optical properties of ASLs by the biomolecular structures. Here, we demonstrate that engineered dodecapeptides self-assemble into supramolecular networks of peptide nanowires on single-layer graphene and MoS_2. Peptide nanowires introduce electric charge into these ASLs *via* biomolecular doping. Abrupt boundaries of nanowires create electronic junctions in graphene, which manifest themselves within the single-layer as a self-assembled electronic network. Furthermore, the designed peptides modify both conductivity and photoluminescence of single-layer MoS_2. Controlling nano-electronics through engineered peptides potentially opens up new avenues in self-assembly of nanodevices for future bioelectronics.

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