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Material Programming and 4D-Printing across Scales

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This lecture presents an alternative approach to conventional design and fabrication. Material, structure, and function are tightly intertwined in nature. The movement of plants, for instance, is often encoded through the structuring of tissue materials, allowing plants to change shape over a range of spatial-temporal scales when powered by environmental stimuli. The bioinspired interplay of biobased materials, mesostructures, and adaptive response is managed through a computational fabrication framework, resulting in hygromorphic 4D-printed systems powered by the free-flowing moisture inputs of the environment. This framework is generalizable to diverse materials and processes, as showcased through the upscaling of the methods to an industrial robot platform for the construction of self-shaping hybrid materials systems. Furthermore, the framework's applicability is proven through the transfer of design principles from biology to self-adjusting wearables for the body and weather-responsive facades for buildings – demonstrating the wide-ranging potential of bioinspired 4D-printing across scales and disciplines.

Tiffany is a computational designer from Taiwan with a background in architecture and robotic fabrication. Interested in the intersections between computation, materials, and robotics, her research focuses on the creation of digital workflows that allow mass-customization of material properties, behavior, and performance. Tiffany graduated from Harvard University with a Master in Design Studies (Technology). Prior, she earned her Bachelor of Architecture from the University of Southern California. She has practiced with Studio Fernando Vazquez, designing projects ranging from transportation hubs and bike facilities to architecture and interior design across the United States and Japan. Tiffany has also worked as a researcher with the MaP+S Group at Harvard GSD, developing novel material-informed digital fabrication strategies for bespoke carbon-fiber systems. At the ICD, Tiffany researches responsive and self-shaping material systems enabled by 4D-printing by developing the complimentary hardware and software tools that can program materials to behave like plants.

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