Pioneering Biomaterials:
Academia and Industry Convergence

Ground eggshell pressed into bricks, pioneeringbiomaterials.com

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By
Dawn Lorence

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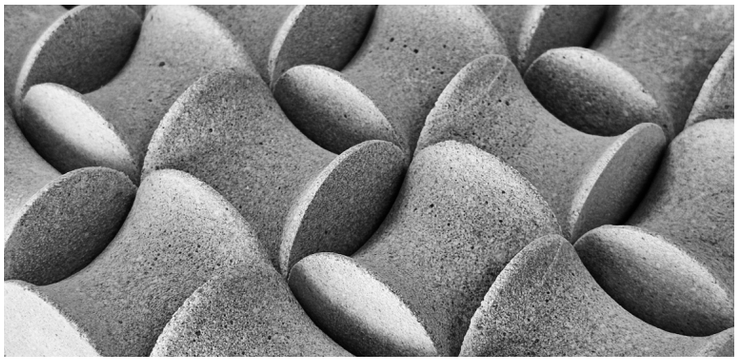


Ground eggshell pressed into bricks, https://pioneeringbiomaterials.com/

What are biomaterials? The term "*biomaterials*" can have different meanings in different contexts, but in the world of architecture, biomaterials refer to building materials created from organic matter, such as plants, fungi, and animal products. I personally became interested in the topic a year ago when I went to see the research being presented by CCA students in the Nave Presentation Space. Watching these passionate students talk about their ideas on how to create new building materials that could replace conventional ones—from discarded egg shells and sea urchins—I knew that I wanted to find a way to join in the conversation.

Poster by Dawn Lorence and Ali Farajmandi in collaboration with Arup and Stop Waste

Why are biomaterials important? According to the Environmental Protection Agency, approximately 145 millions tons of debris are sent to landfills each year within the construction and demolition industry. These industries have incredibly detrimental effects on the environment, and as an aspiring architect, I find that to be frankly disturbing. However, biomaterials can be introduced (or in some cases, reintroduced) as interventions which allow for buildings to biodegrade at the end of their life cycles. For example, commonly used insulation, such as spray foam, is not easily biodegradable and goes straight to the landfill after demolition. In contrast, there is a promising biomaterial alternative called Hempcrete, which is a bio-composite insulating material made from mixing hemp shives (the woody core of the hemp plant) with water and lime. This insulation is easy to make from a recipe, and is biodegradable, non-toxic, and even flame resistant.

Hempcrete being deployed at the human scale, https://natural-building-alliance.org/hempcrete/

Pioneering Biomaterials Exhibition at the Novack Gallery
Photography courtesy of Nicholas Lea Bruno

Over the last six months, I had the pleasure of helping organize CCA's Pioneering Biomaterials Symposium as a member of the Architectural Ecologies Lab Research Team alongside Dr. Negar Kalantar, Margaret Ikeda, Alexander Schoffield, and Evan Jones. The event officially opened on January 22 with a two week exhibition at CCA's Novack Gallery, featuring work from academic and industrial labs across the country. In addition to the work done by CCA students in collaboration with UCSF, there was exciting work shown by Jenny Sabin Lab (Cornell), DumoLab Research (UPenn), Nasa Ames Research, Autodesk Research, and many other contributors. The event culminated in a two day symposium on February 13th and 14th, with keynote speeches from Jenny Sabin and Dr. Lynn Rothschild, as well as three panel discussions about the academic side of research, the industry side of deployment, and how these two worlds converge. The symposium also featured hands-on laboratory demonstrations, where I participated in the Hempcrete workshop.

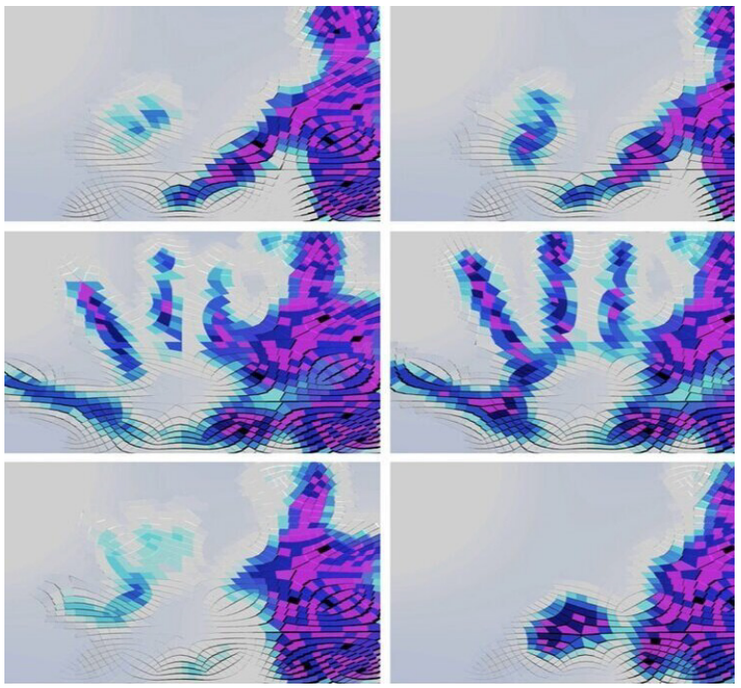
Photo showing processed hemp for hempcrete workshop at the Biomaterial Symposium

Much of the work shown in the symposium attempts to mimic patterns and forms found in nature. Throughout the conference, there was a continuous emphasis on how we, as designers and builders, can learn from nature.

Personally, I was incredibly impressed with Jenny Sabin's keynote speech. I learned a great deal about how architects can collaborate with biologists to create beautiful and fascinating design work. One quote in particular stood out to me: "Nature is resilient, not efficient." I believe this refers to how living things adapt to match their environments, but that these mutations are not necessarily streamlined in the same way that people attempt to optimize the world around us. Therefore, there needs to be space for productive failures in the scientific process as well as design.

[1] Featuring: Cornell University, Jenny Sabin Studio; University of Pennsylvania, Dumo Lab; University of Colorado Denver, Wild Futures Lab, LoDo Lab; Newcastle University, Hub for Biotechnology in the Built Environment; Genspace, Microbi Design; UC Davis, Department of Design; Northumbria University, Living Construction Group; ARUP, San Francisco; StopWaste; NASA Ames Research, Redhouse Architecture; Autodesk Research, AEC Industry Futures; BAMCORE; Mango Materials, Berkeley Wood Lab; CCA Design Division, CCA Interior Design, CCA Architectural Ecologies Lab, CCA Digital Craft Lab

Out of all the work Sabin showed, one project stood out to me above the rest. The project titled “eSkin,” which developed a material with adaptive building skins which could be theoretically applied to facades, was visually fascinating. Sabin’s talk began with a quick lesson in cellular biology with compelling video footage at a microscopic scale showing cell division. She went on to explain how butterfly wings work on a nanoscale, and how pigments visible to our eyes are created by the orientation of miniscule scales manipulating the visible light spectrum. Using the same principles, Sabin’s lab attempted to scale up this concept to create a thin film which could be applied to buildings and react to humans as they pass.



eSkin, https://www.sabinlab.com/eskin.

Overall, this symposium provided an opportunity to meet with and hear from so many incredible people in this emerging field. Biomaterials are increasingly relevant, as they offer a renewable and sustainable approach to both production and end of life planning. In our current world, this perspective is critical, and nature’s unbelievable resilience serves as a source of inspiration. Through cross pollination between the sciences and design, we can drive innovation in a way that reflects the interconnectedness of the natural world. The future is never certain, but our capability to change certainly is.

If you are interested in learning more, please visit:
instagram.com/architecturalecologieslab

Cynthia Lorence looking at a sea urchin shell through a microscope at the Exhibition

Dawn Lorence (MArch 2026) is a biomaterial researcher and an aspiring architect hoping to utilize adaptive reuse in design.

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