Using fungus feeding on a woody waste product to create living building blocks

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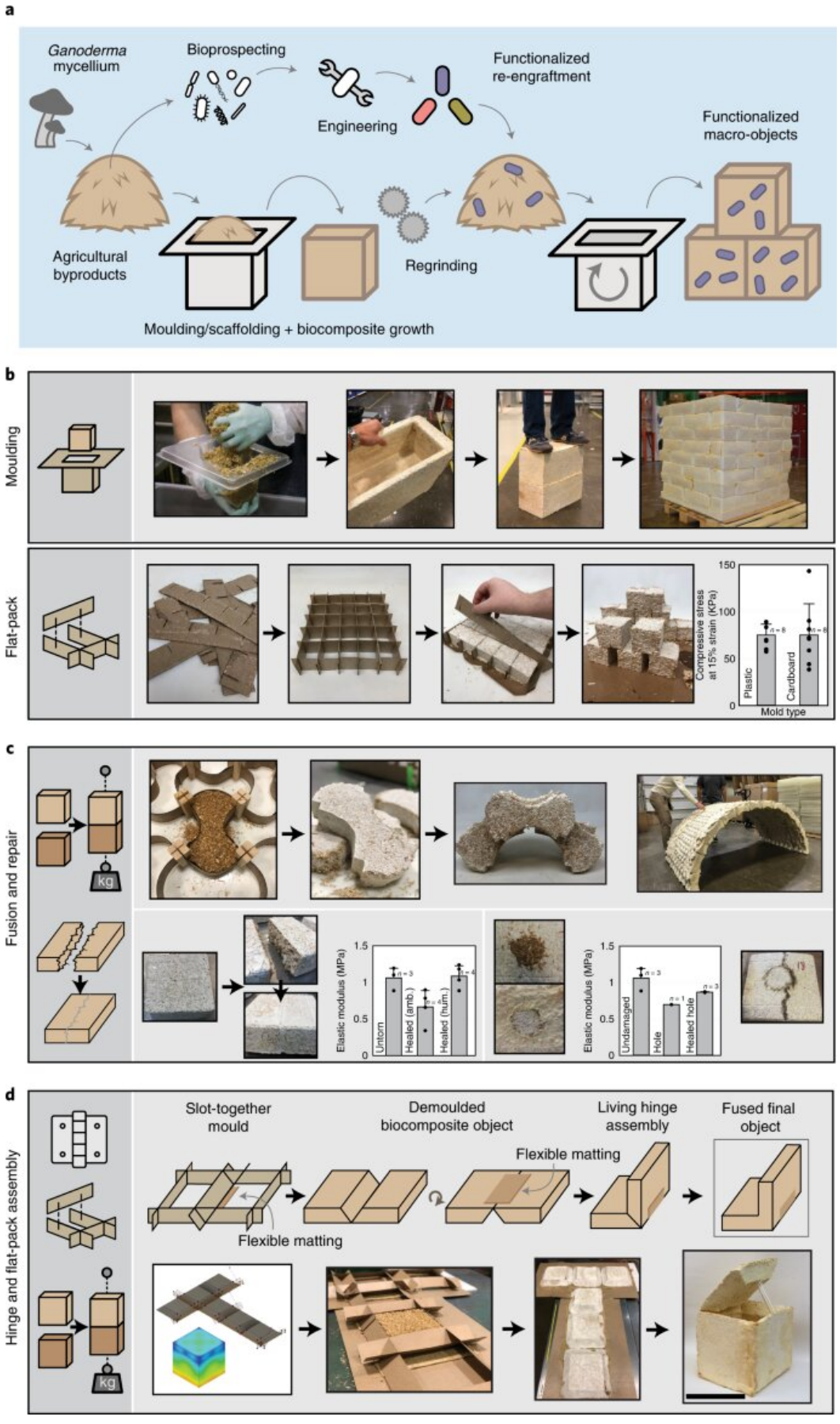
a
Ganoderma mycellium
Bioprospecting
Engineering
Functionalized re-engraftment
Functionalized macro-objects
Agricultural byproducts
Regrinding
Moulding/scaffolding + biocomposite growth
b
Moulding
Flat-pack
Compressive stress at 15% strain (KPa)
Plastic
Cardboard
Mold type
c
Fusion and repair
kg
Elastic modulus (MPa)
Untorn
Healed (amb.)
Healed (hum.)
Undamaged
Hole
Healed hole
d
Hinge and flat-pack assembly
Slot-together mould
Demoulded biocomposite object
Living hinge assembly
Fused final object
Flexible matting
Flexible matting
kg

Fig. 1: Development of a versatile fungal–bacterial living material. Credit: DOI: 10.1038/s41563-021-01123-y

A team of researchers from Columbia University, Ecovative Design and MIT has developed a living type of building block made from fungus feeding on woody waste products. They have published their results in the journal *Nature Materials*.

As researchers look for more sustainable options for building materials, many have turned to fungus-based materials. These are made by adding a type of fungus to a plant-based material that they can feed on. Over time, the two fuse together, creating a dense material that can be used as a brick or building block. With such bio-composites, the fungus is typically killed before the material is used to prevent continuing breakdown. More recently, others have looked at the possibility of creating similar bricks with living fungi, allowing for a living brick structure. In this new effort, the researchers have expanded on such efforts by feeding a type of Ganoderma fungus a woody waste product left over during processing of hemp. The two are mixed and then poured into a mold shaped like a brick. Within a few weeks, the fungus combines with the waste mix to form a dense mesh, filling the brick mold. After extraction from the mold, the brick is ready for use. Because the bricks contain living material, they can be bonded without using mortar. Instead, they grow together forming a dense connection.

To test their idea, the researchers built an arch several feet high using their living blocks. They found that in addition to connecting themselves together, the blocks were also self-repairing. They next engineered two types of bacteria—one to fluoresce when exposed to a certain signal

material, and the other to grow the signal material, and added them to brick mixes. When two of the blocks were placed together, not only did they grow a connection, they glowed. Such living blocks must be reenergized periodically, as the original material is continually broken down—or, as the researchers note, the structure itself can be torn down and used as fodder for the construction of another structure.

More information: Ross M. McBee et al, Engineering living and regenerative fungal–bacterial biocomposite structures, *Nature Materials* (2021). DOI: 10.1038/s41563-021-01123-y