

Why Biomaterials Are So Interesting?

Will Lockett

- Potatoes are made of coal
- Wood is made of plastic
- You don't need a Purpose to make a Plan

- Potatoes are made of coal [Restructured Organic Inputs]
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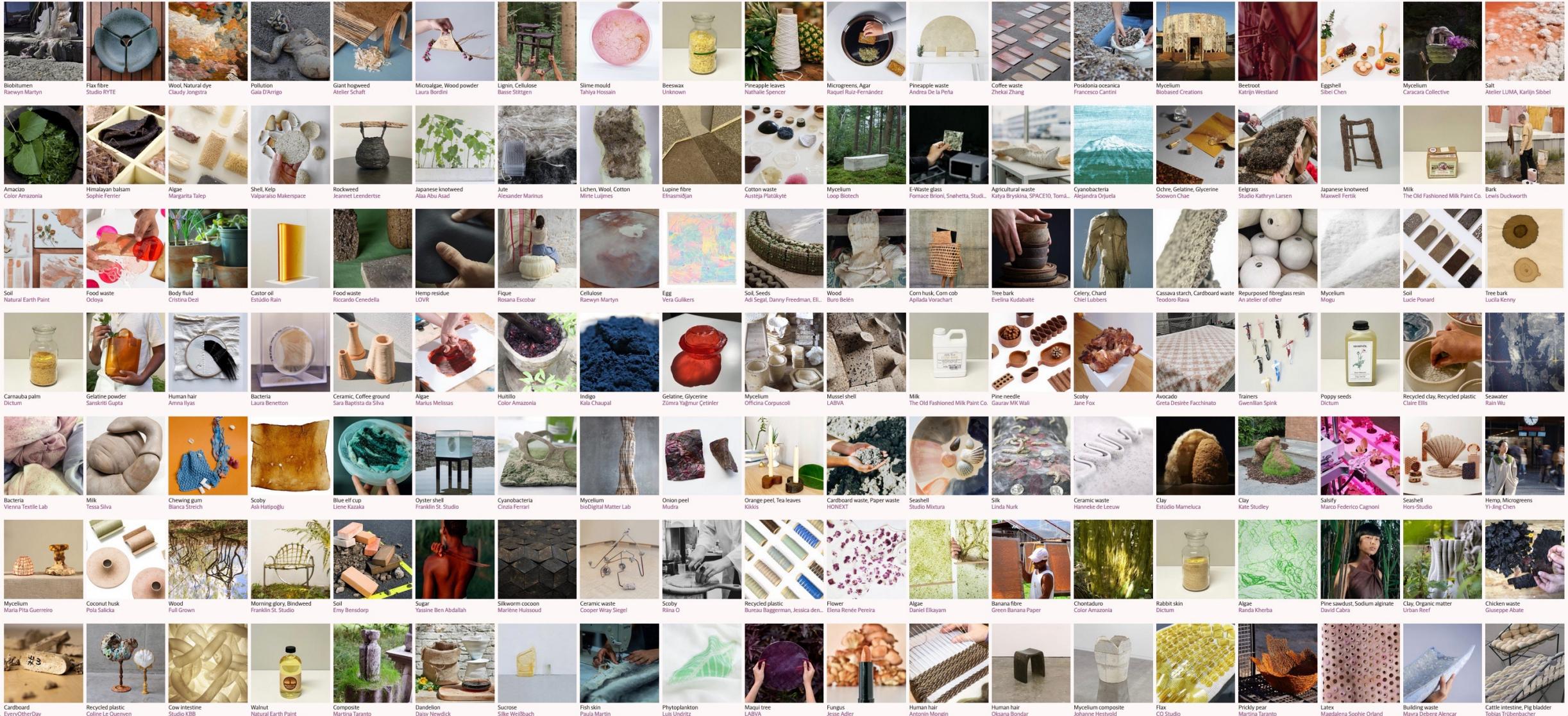
https://archive.org/details/environmentpower0000odum_u7w5

- Potatoes are made of coal [Restructured Organic Inputs]
- Wood is made of plastic { The Ethico-Aesthetics of Plastic }
- You don't need a Purpose to make a Plan



Materials

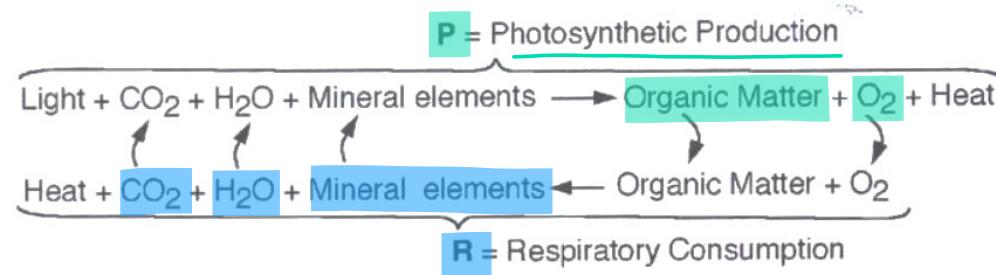
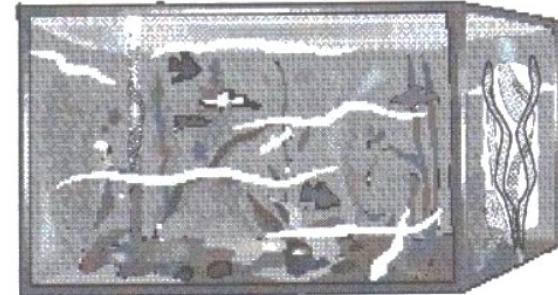
Filter by qualities



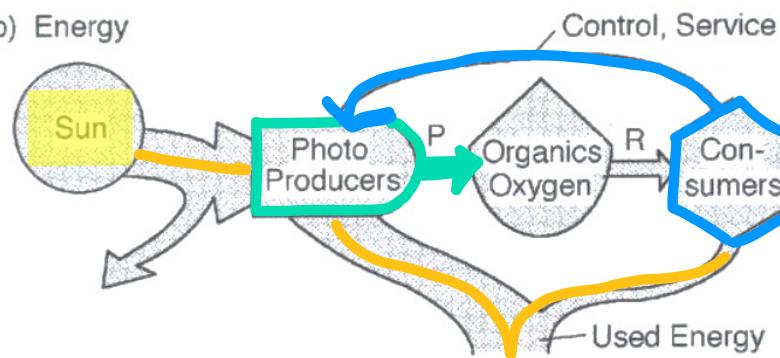
- Potatoes are made of coal [**Restructured Organic Inputs**]
- Wood is made of plastic { **The Ethico-Aesthetics of Plastic** }
- You don't need a Purpose to make a Plan // **Niche Formation** //

[Restructured Organic Inputs]

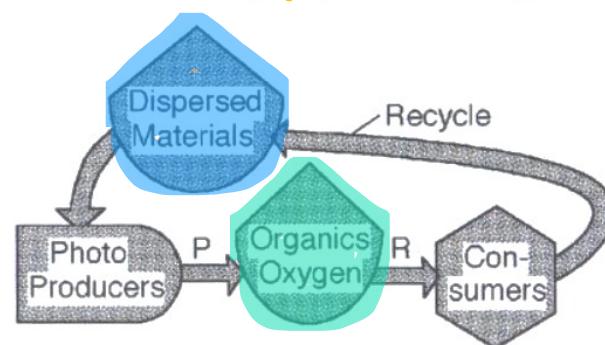
(a) Balanced Aquarium



(b) Energy

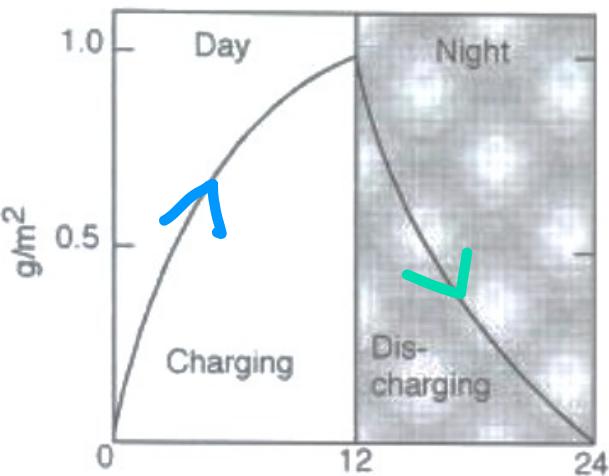


(c) Materials

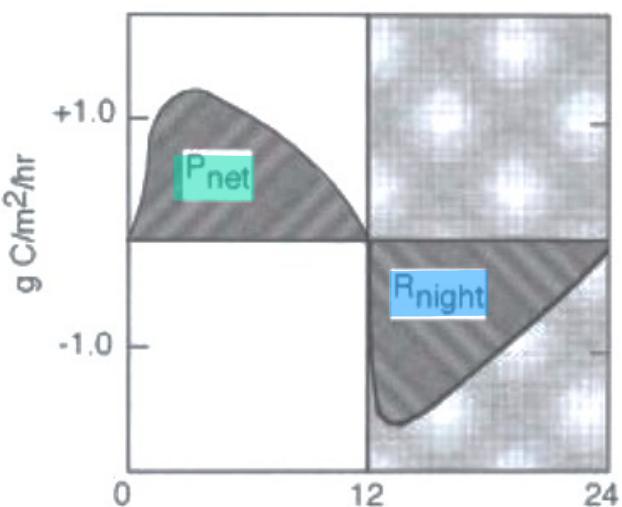


[Restructured Organic Inputs]

(a) Labile Biomass Stored



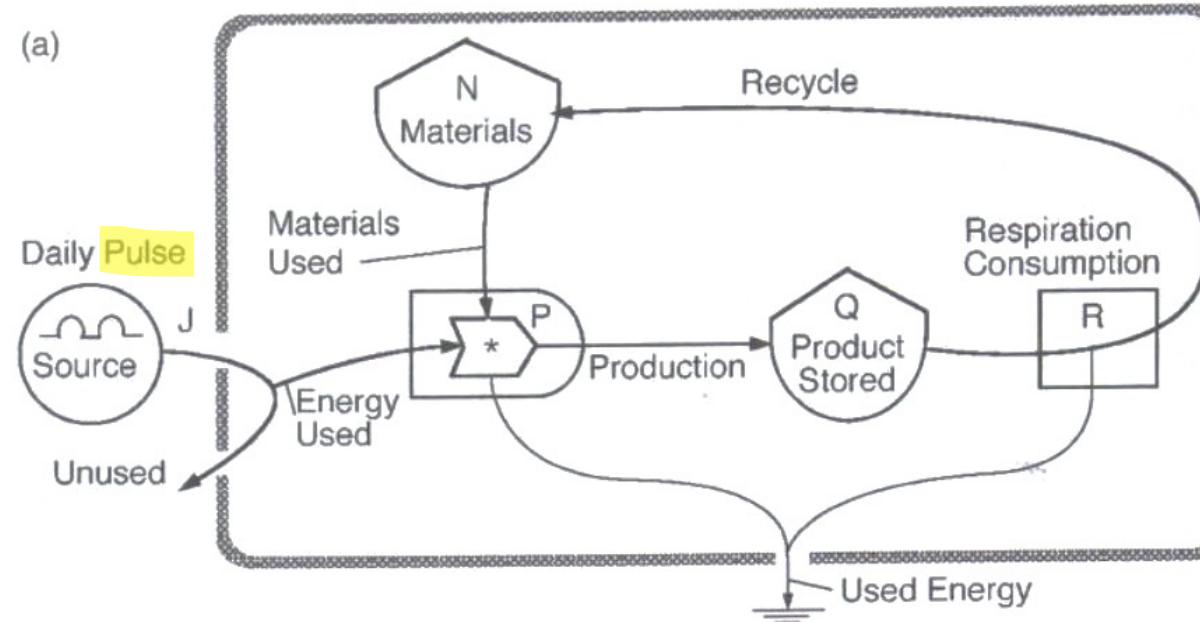
(b) Metabolic Rate



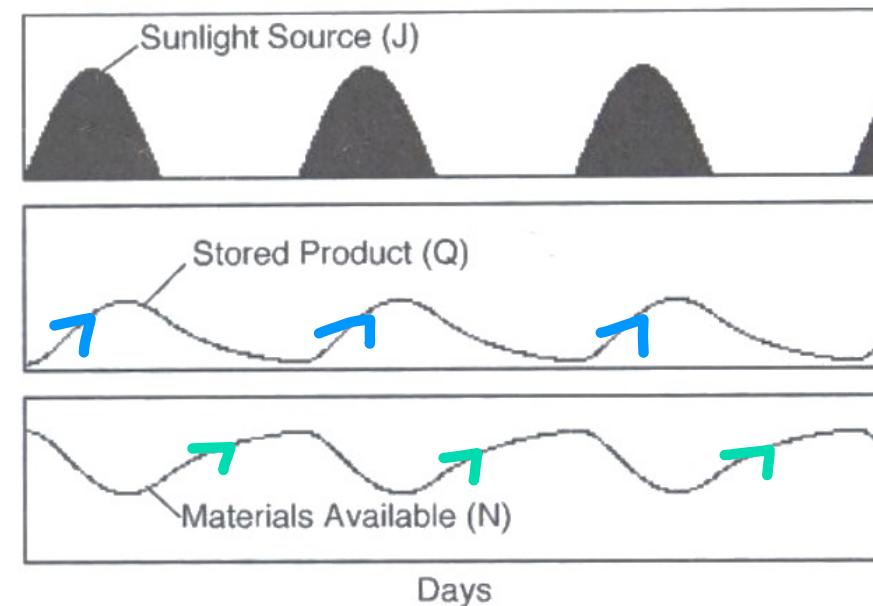
(c) Input



[Restructured Organic Inputs]

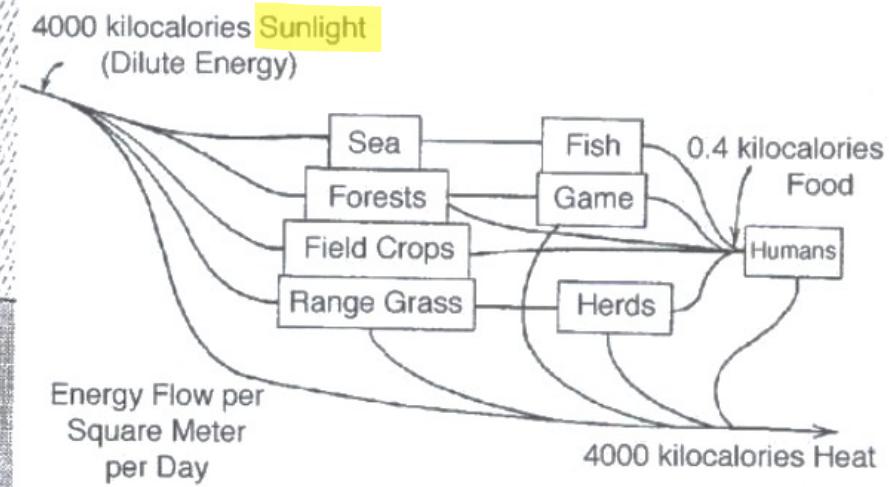
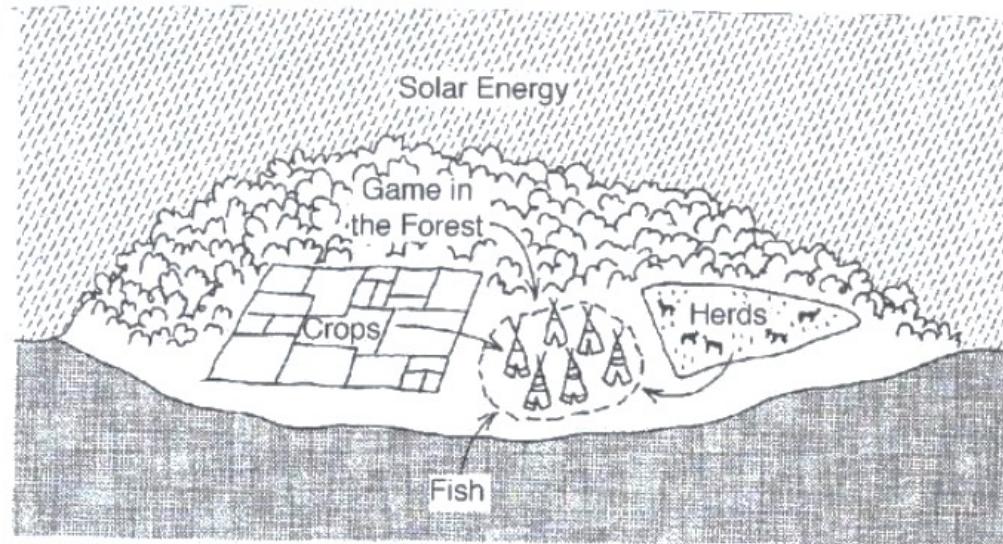


(b) Computer Simulation

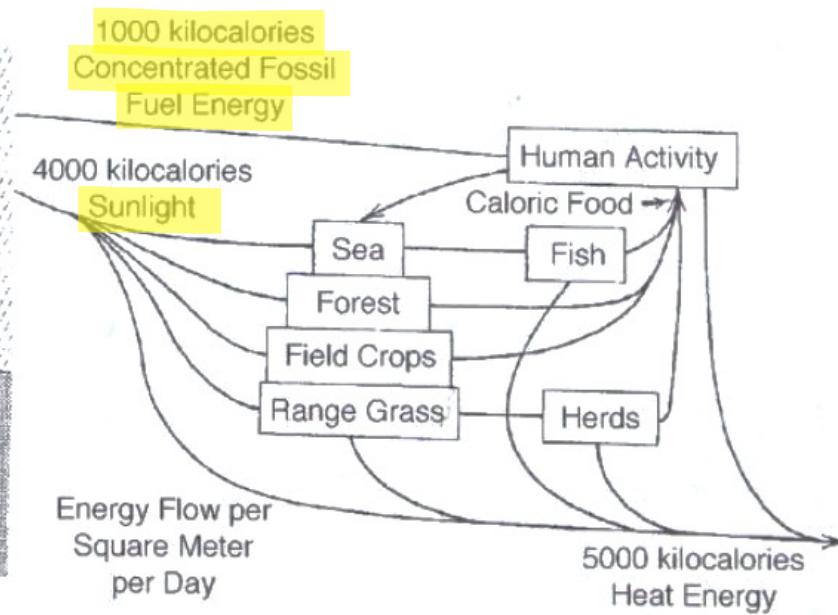
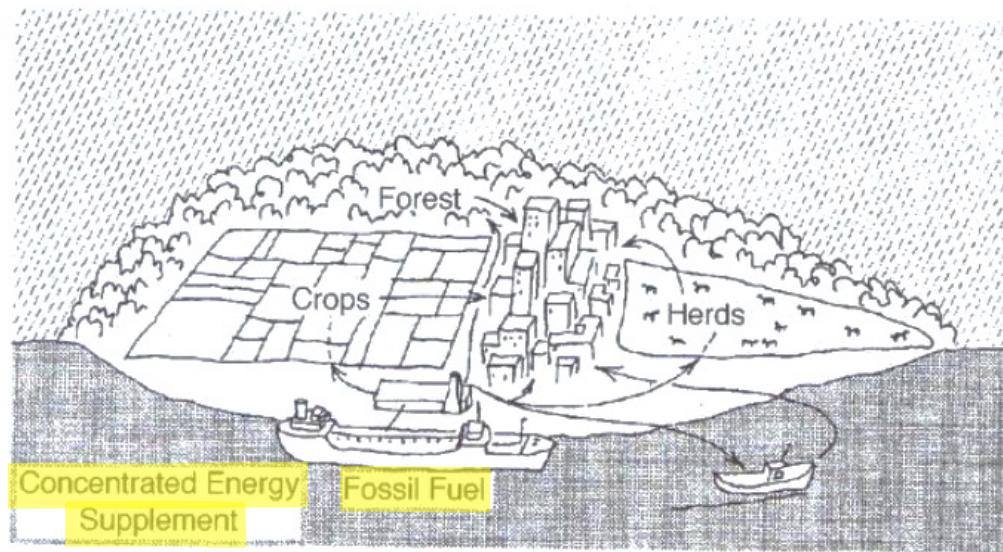


[Restructured Organic Inputs]

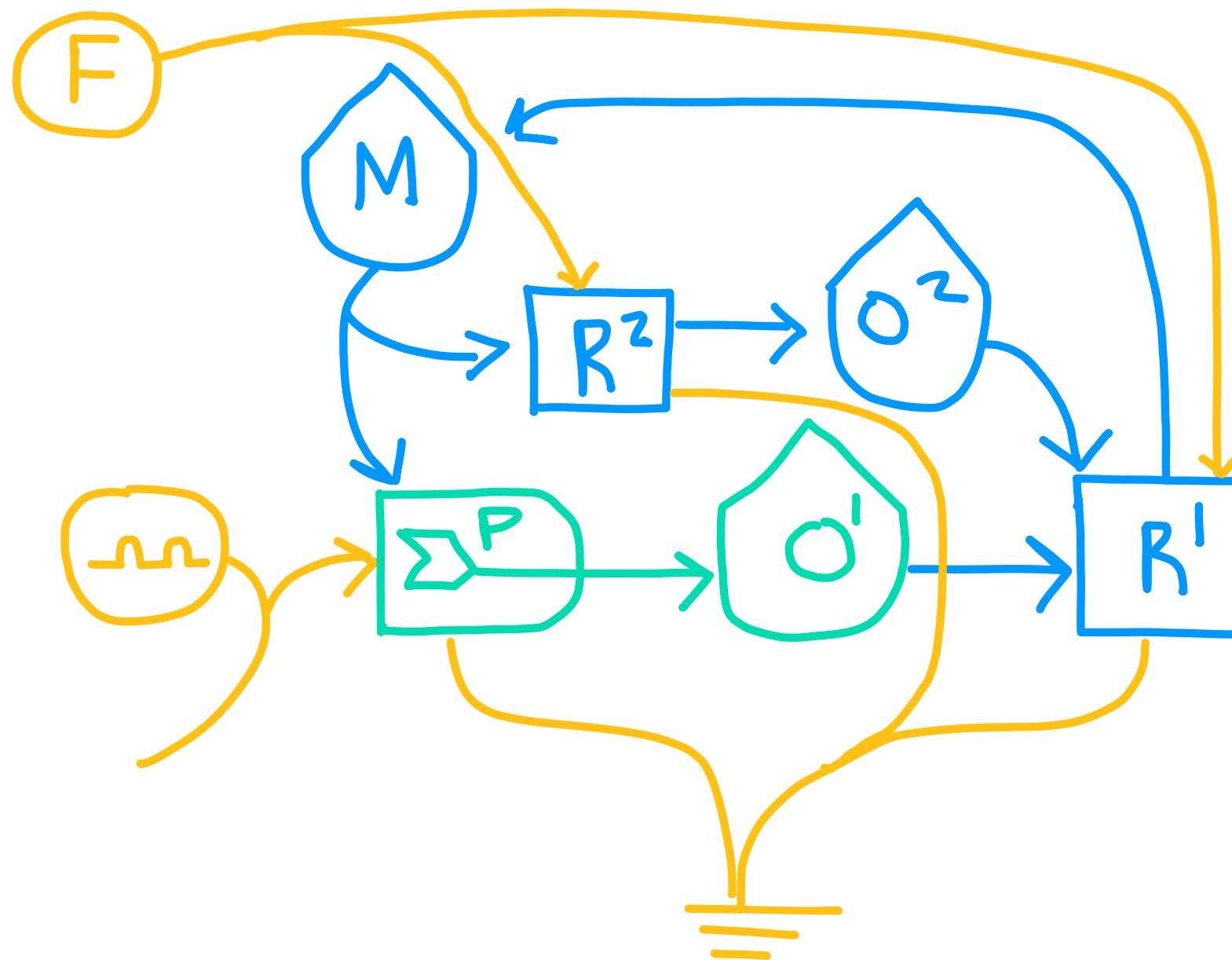
(a)



(b)

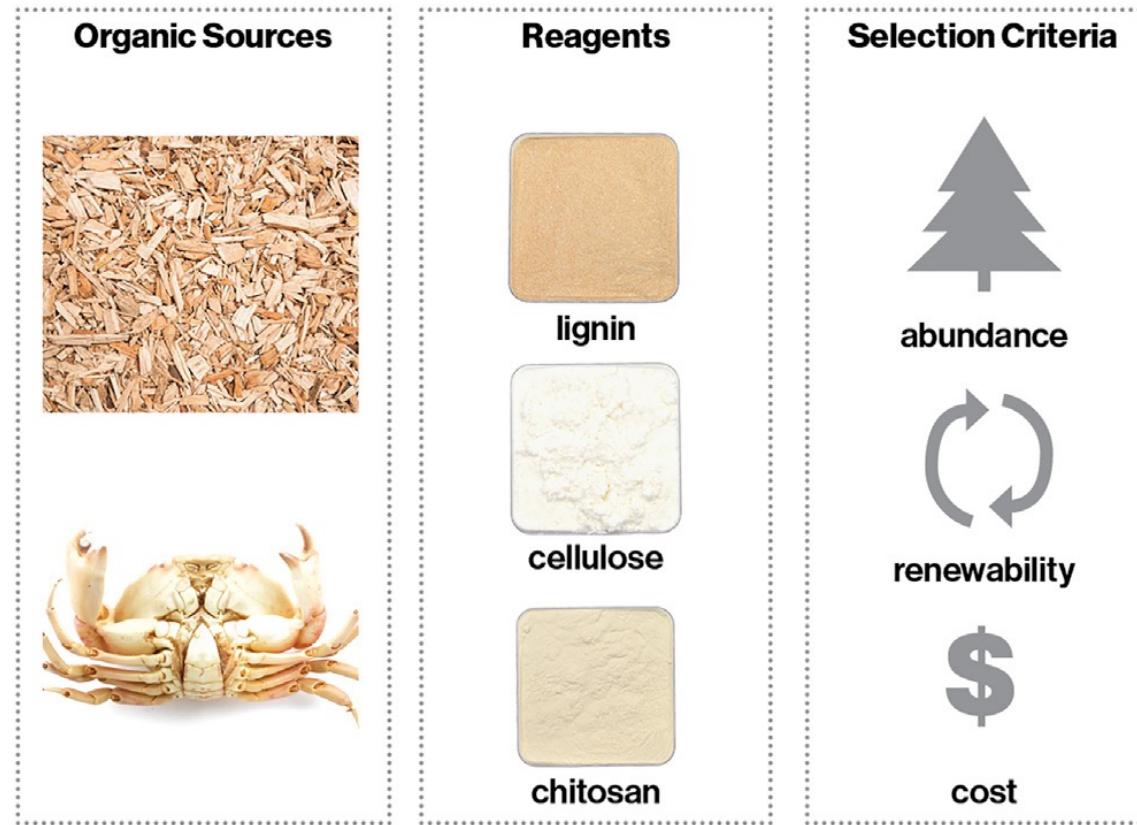


[Restructured Organic Inputs]



Material and Goal Selection

A

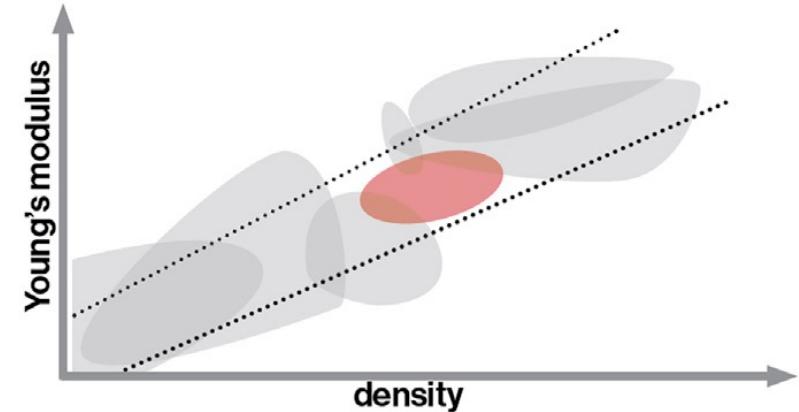
**source material selection**

[https://www.cell.com/matter/fulltext/S2590-2385\(22\)00590-2](https://www.cell.com/matter/fulltext/S2590-2385(22)00590-2)

B

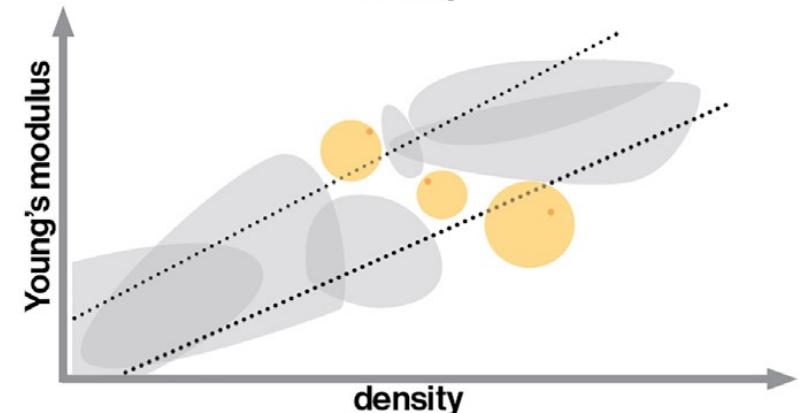
Material Optimization

-  target properties
-  known materials



Material Discovery

-  unexplored regions
-  novel materials
-  known materials

**experiment goals**

Lee, Shen, Buehler, "An automated biomateromics platform for sustainable programmable materials discovery," *Matter* (2022)

Hydrogel Mixing

A

Reagents

a. lignin



b. cellulose



c. chitosan

Input Ratio

A [X%]

B [Y%]

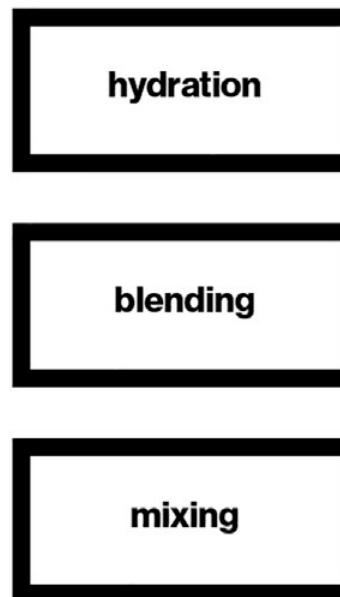
C [Z%]

experiment
goals

formulation

A
B
C

B

Homogenization

C

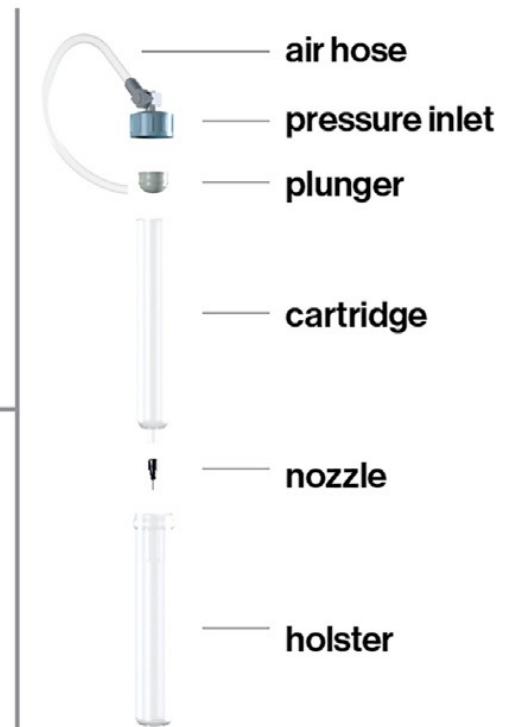
**component selection****homogenization****loading and preparation**

Fabrication

A



B



tensile



compressive



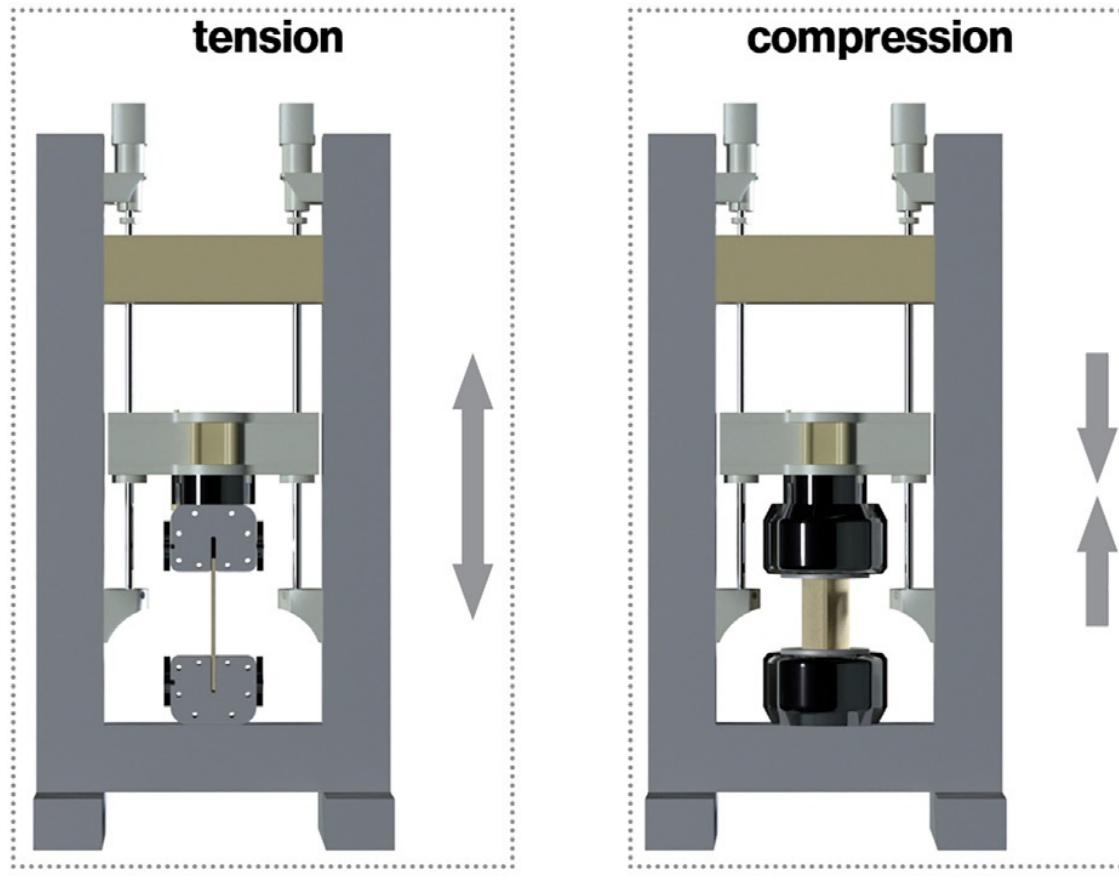
additive manufacturing system

test geometries

[https://www.cell.com/matter/fulltext/S2590-2385\(22\)00590-2](https://www.cell.com/matter/fulltext/S2590-2385(22)00590-2)

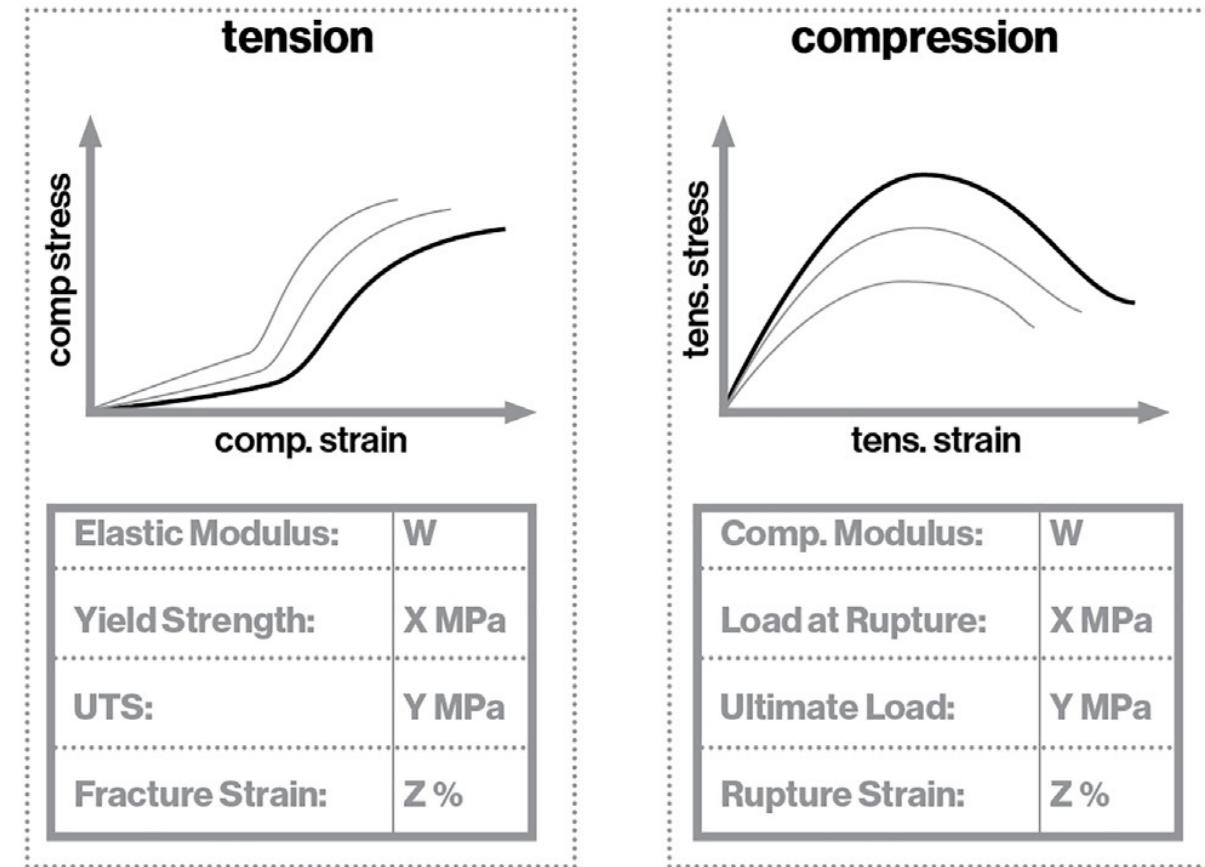
Mechanical Testing

A



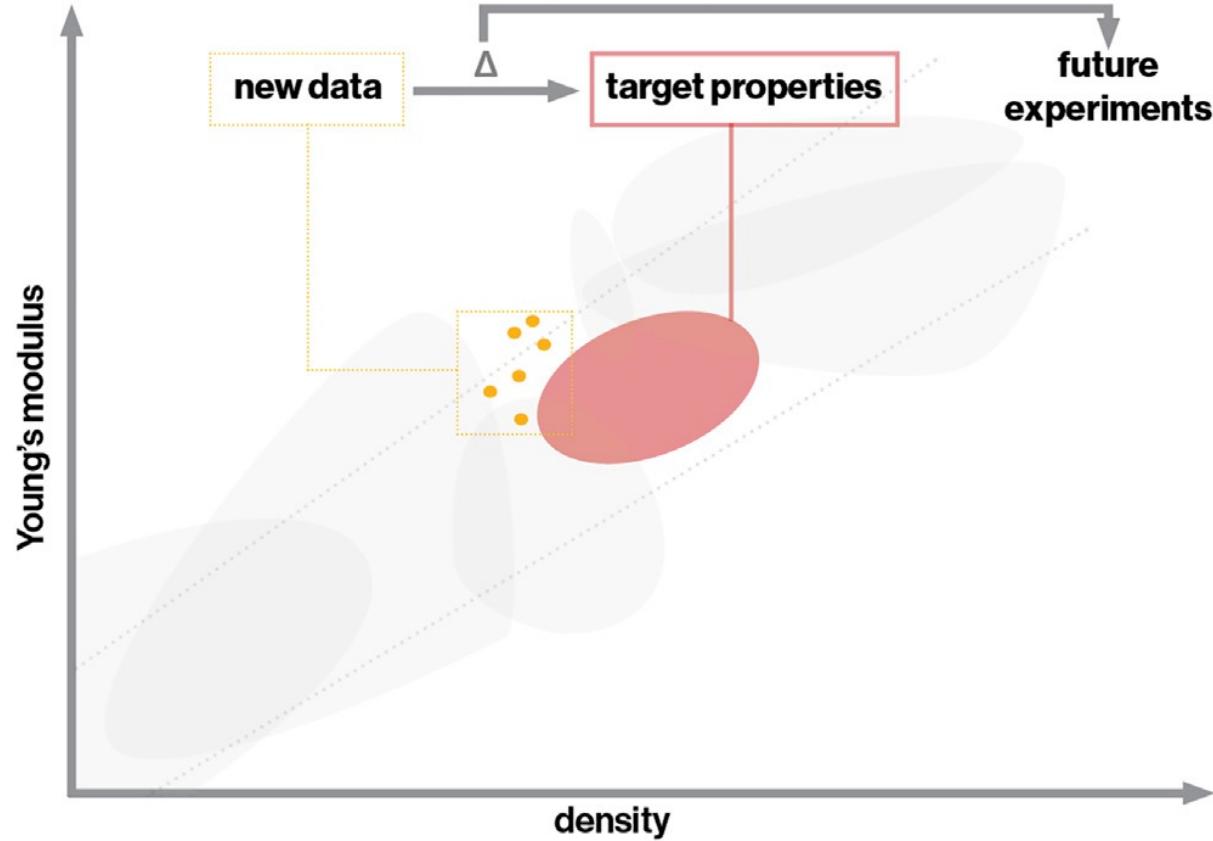
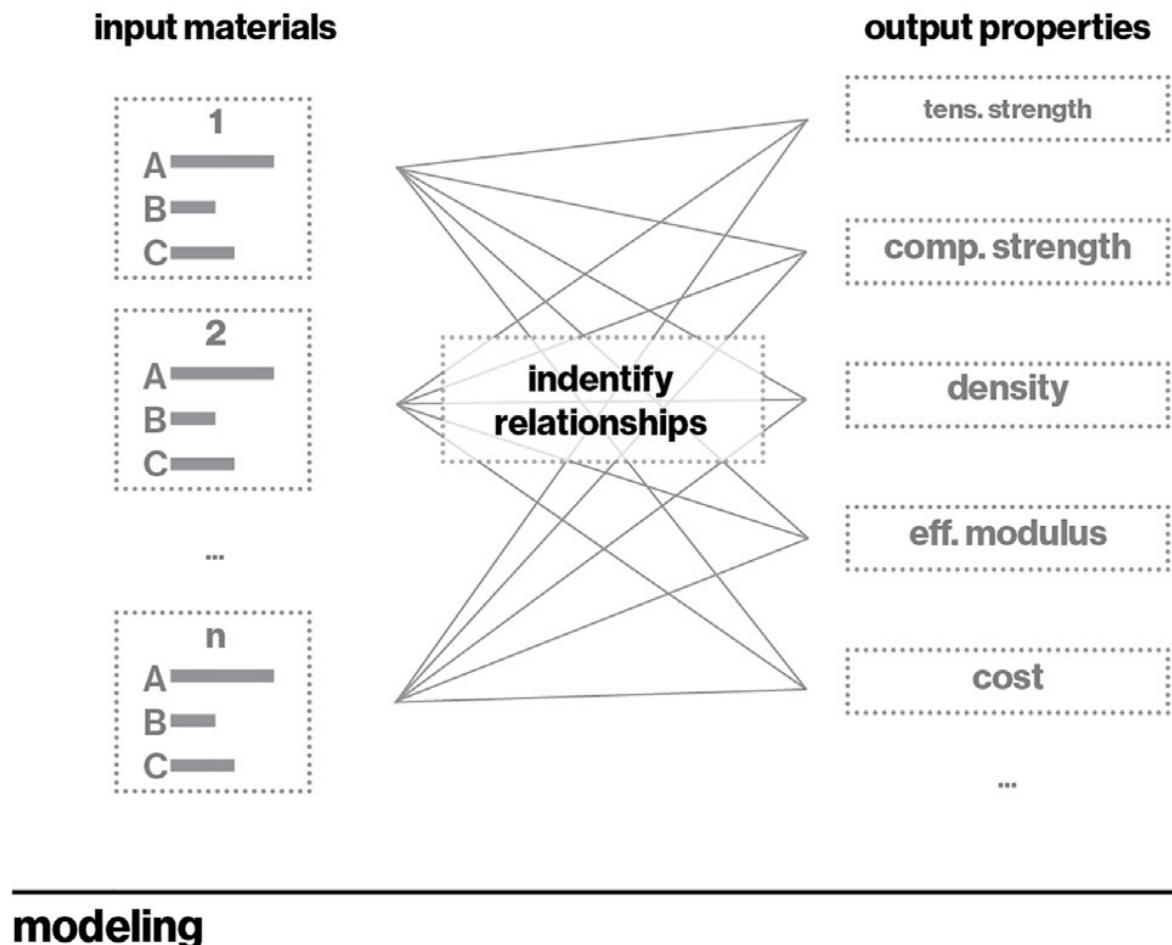
testing equipment

B

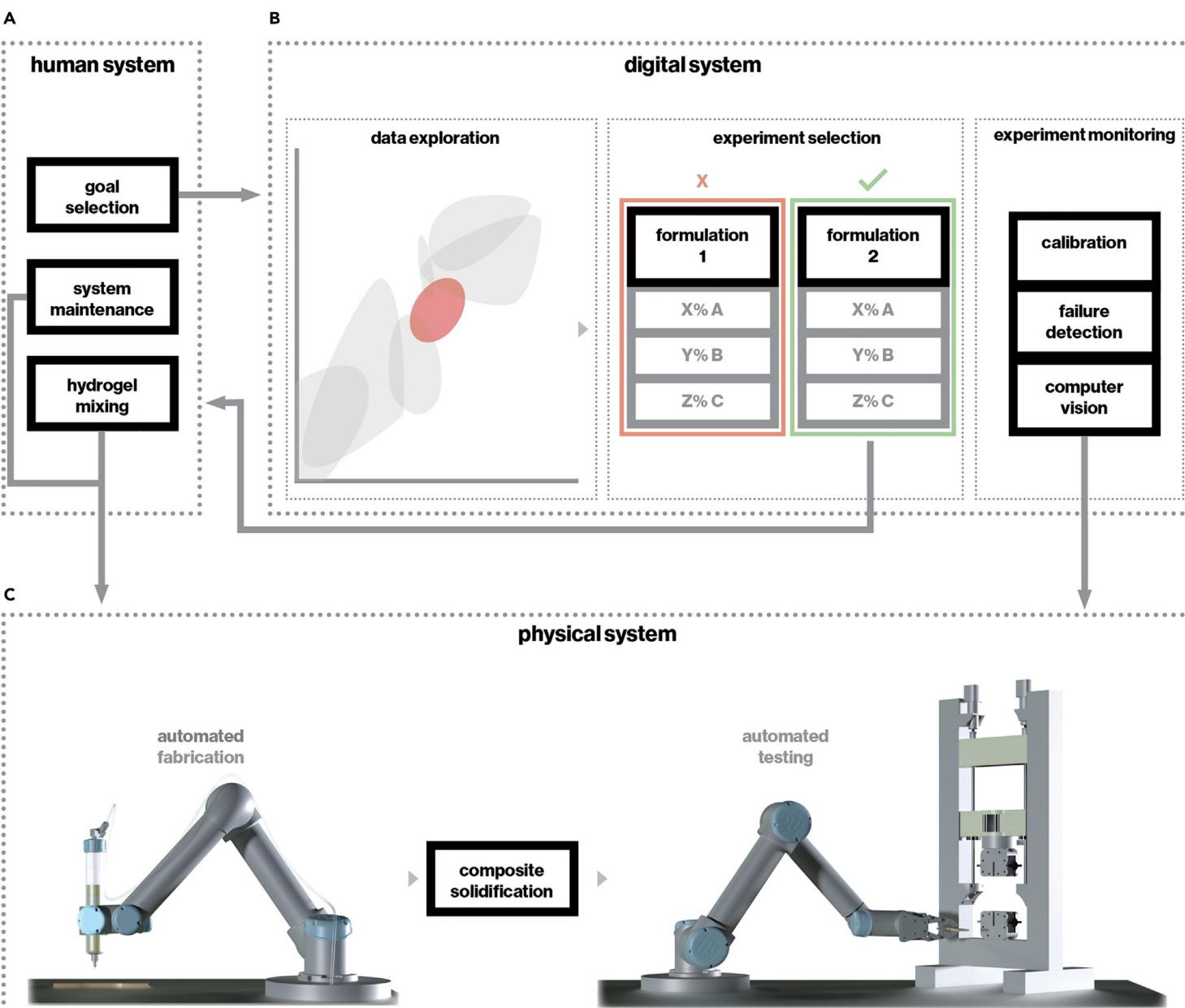


output data

Modeling and Experiment Selection

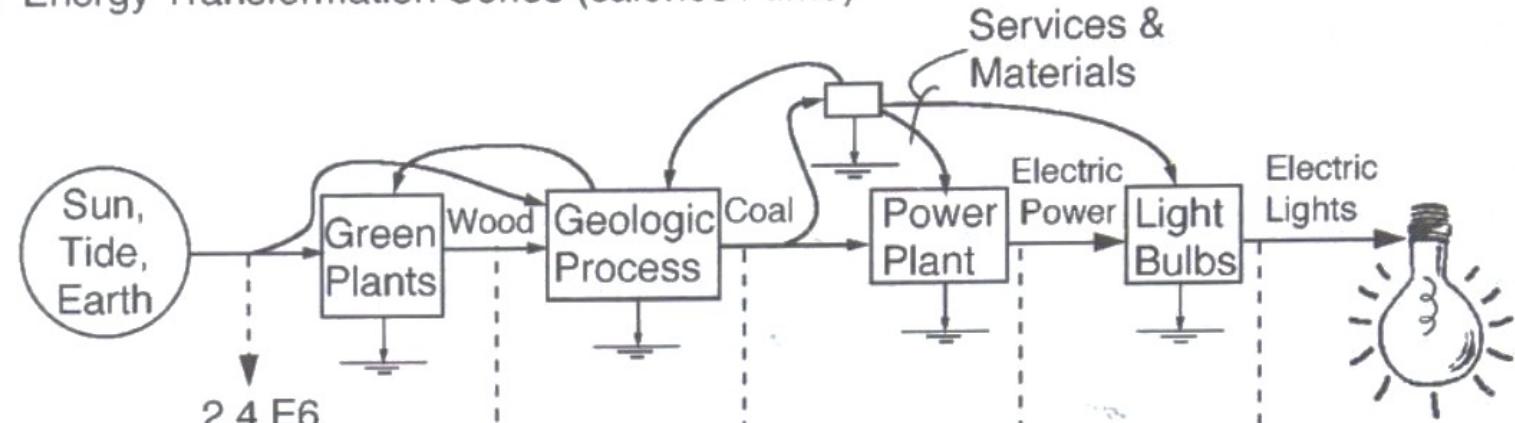
A**data exploration****B****modeling**

Automated Fabrication and Characterization

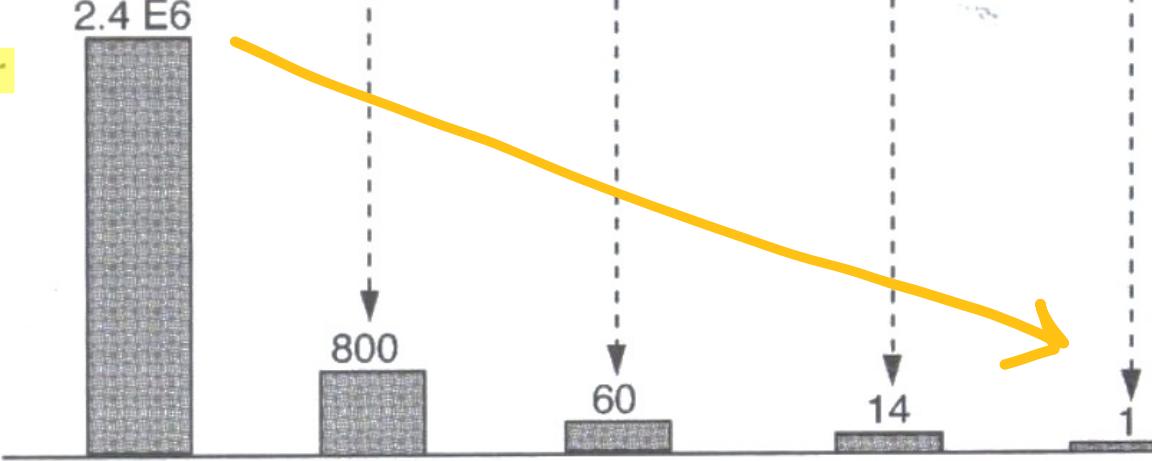


[Restructured Organic Inputs]

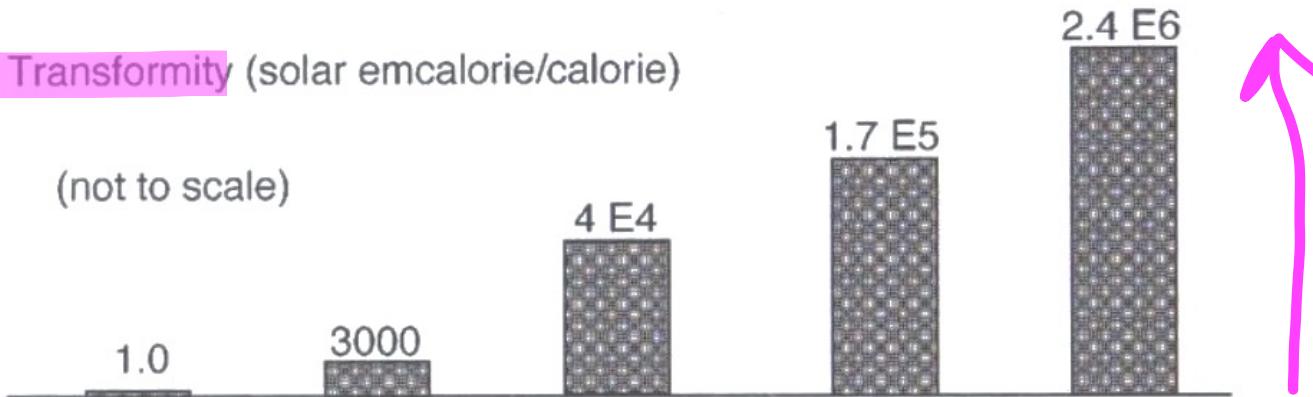
(a) Energy Transformation Series (calories / time)



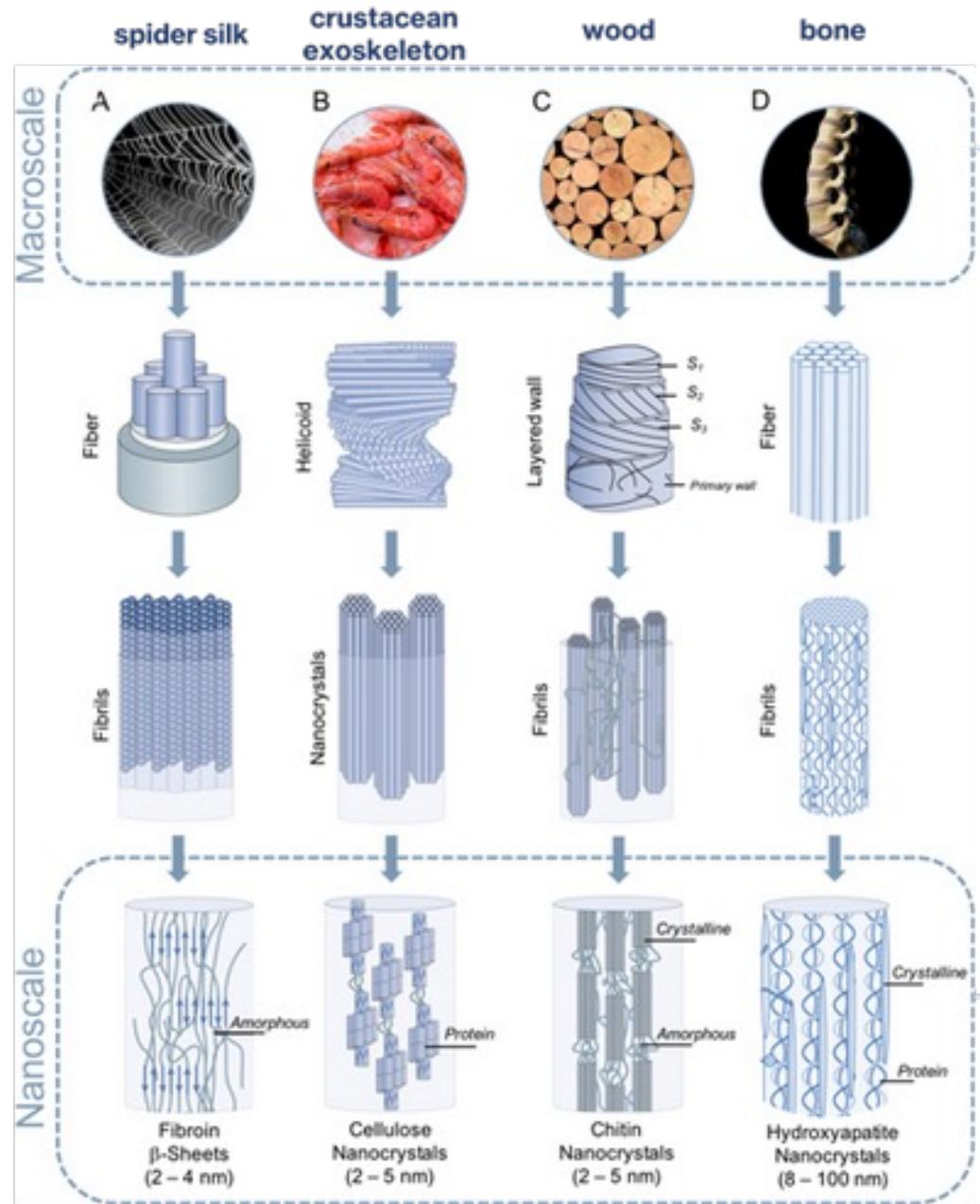
(b) Power



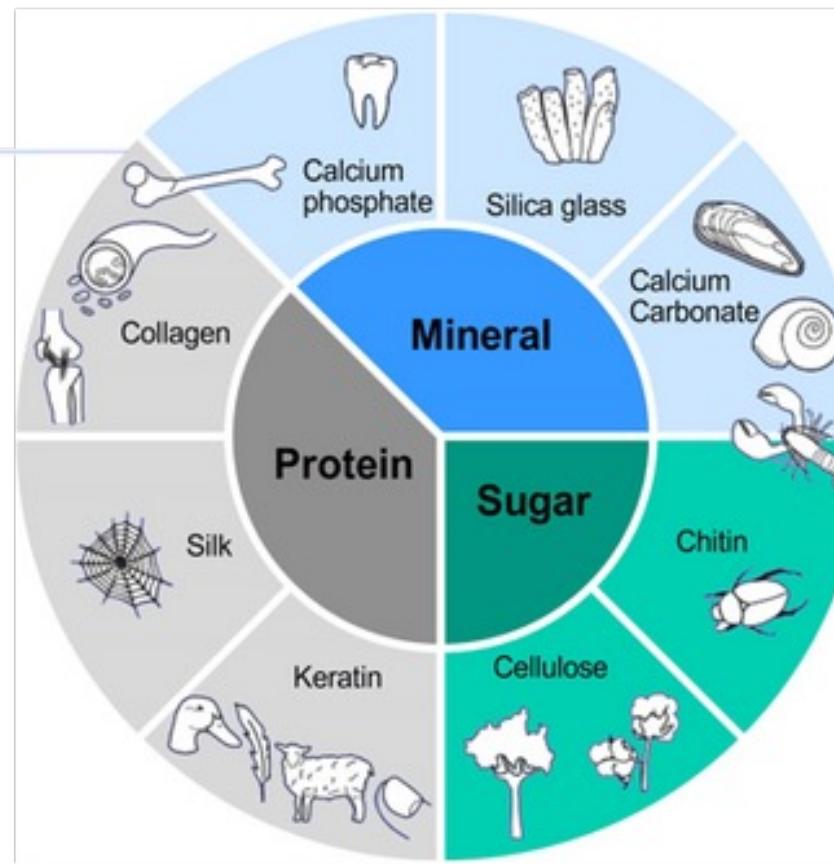
(c) Solar Transformity (solar emcalorie/calorie)



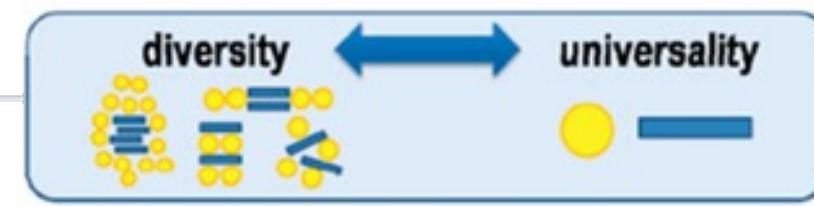
a Examples of Hierarchical Biological Materials

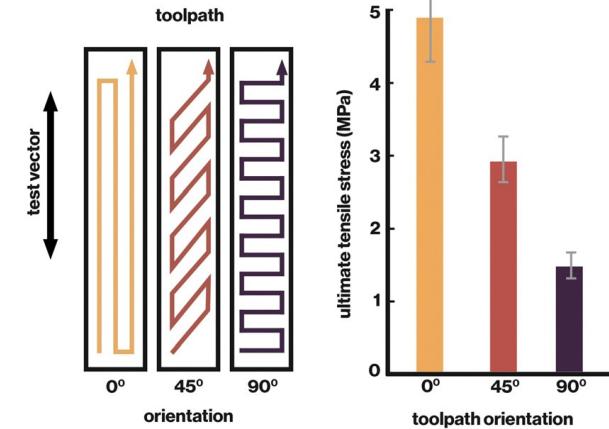
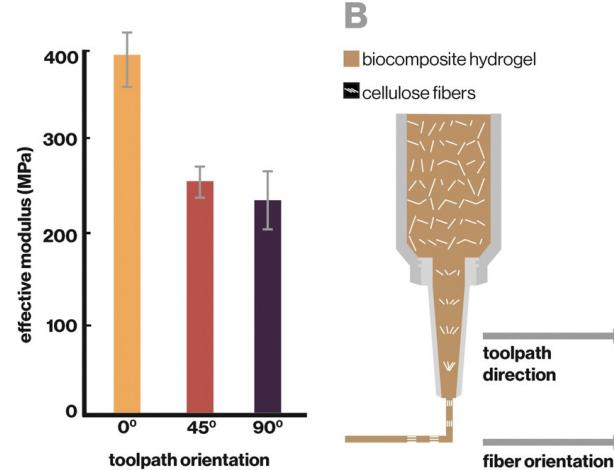


b Compositions of Biological Materials



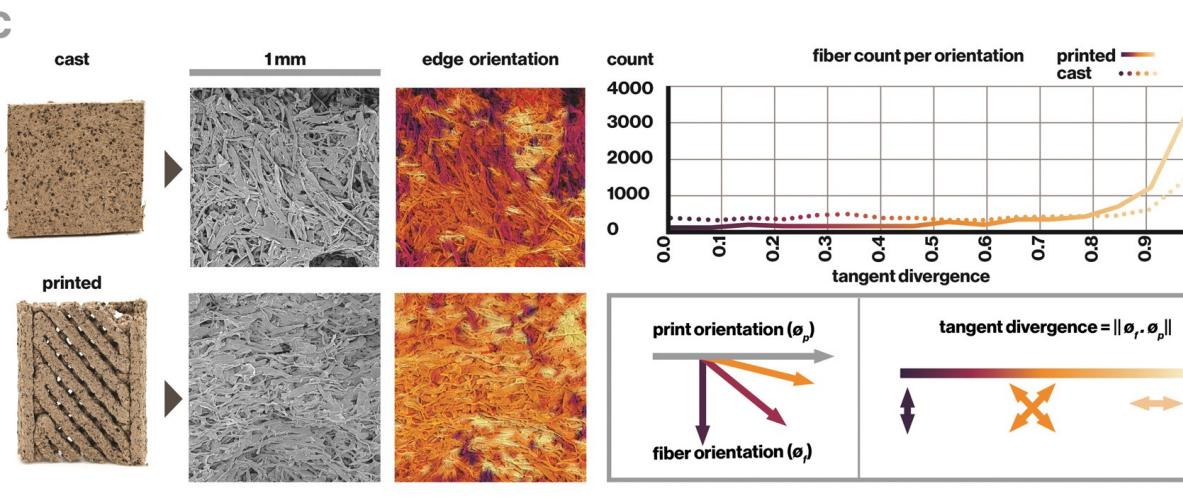
c Universality-Diversity Paradigm



A**B**

[Restructured Organic Inputs]

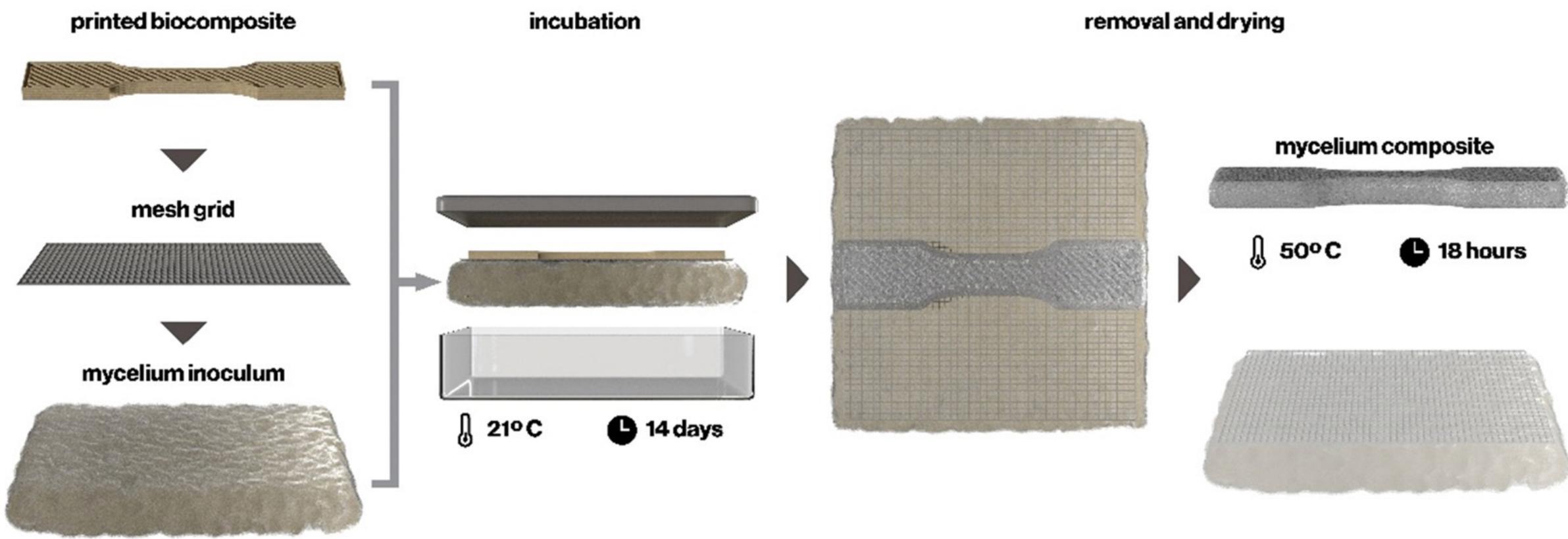
Composite anisotropy

C

Fiber orientation quantification

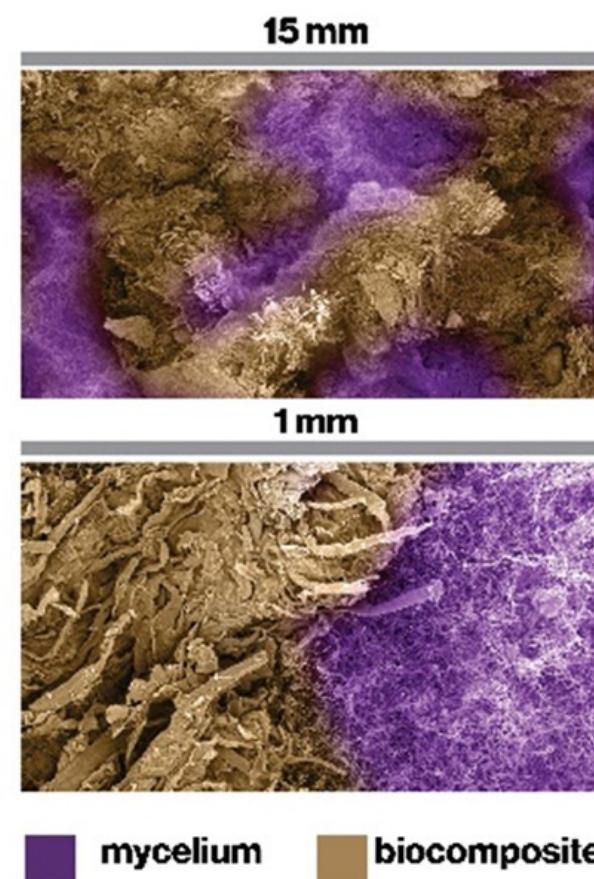
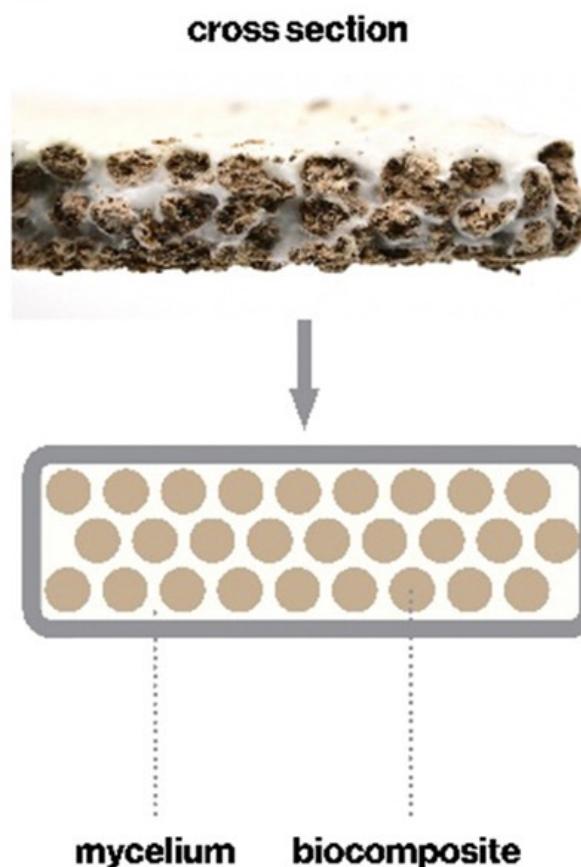
Sabrina C. Shen,[‡] Nicolas A. Lee,[‡] William J. Lockett, Aliai D. Acuil, Hannah B. Gazdus, Branden N. Spitzer and Markus J. Buehler, "Robust myco-composites: a biocomposite platform for versatile hybrid-living materials," *Materials Horizons*, (2024)

A

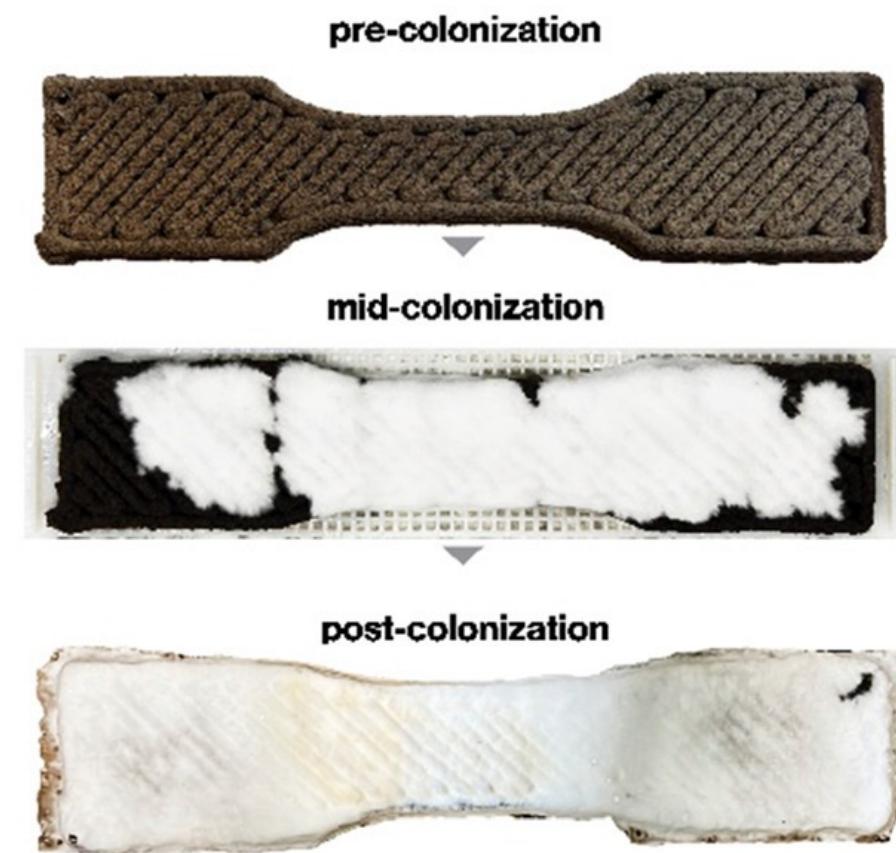


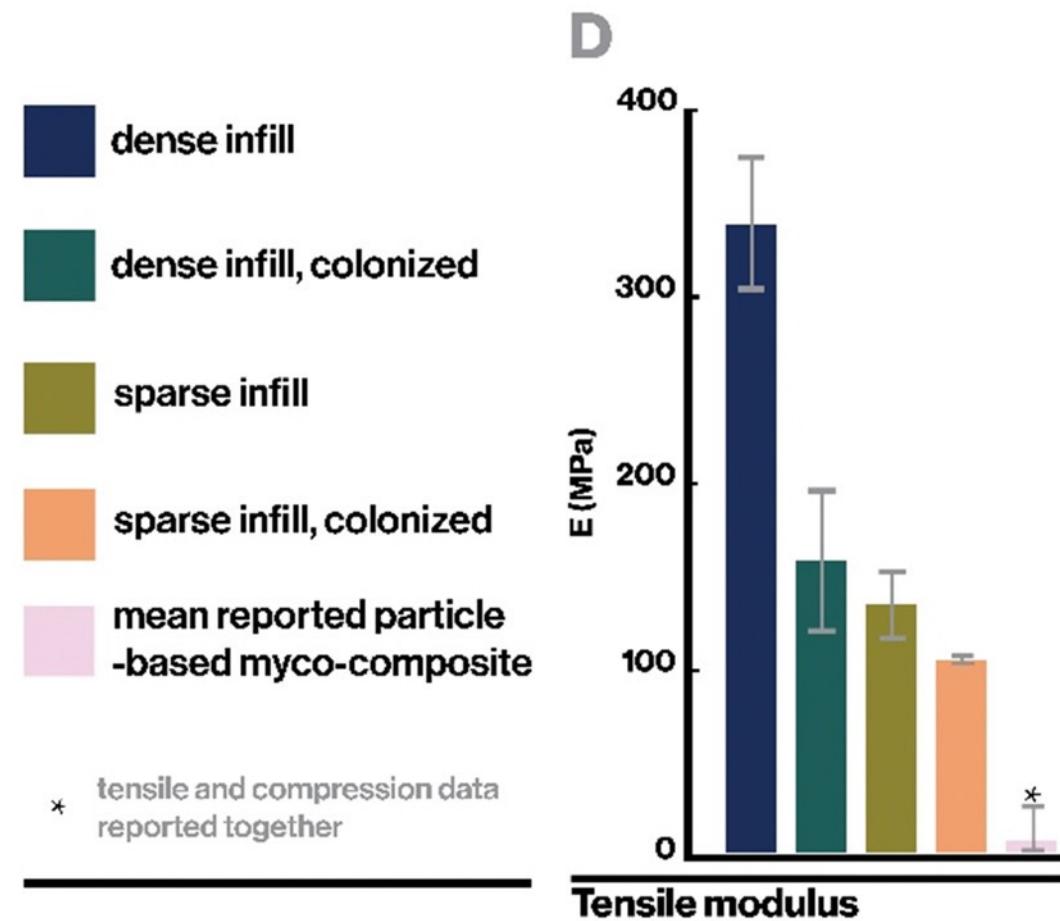
Indirect inoculation process

B



C



Distribution of mycelium and biocomposite**Indirect inoculation of a printed composite**