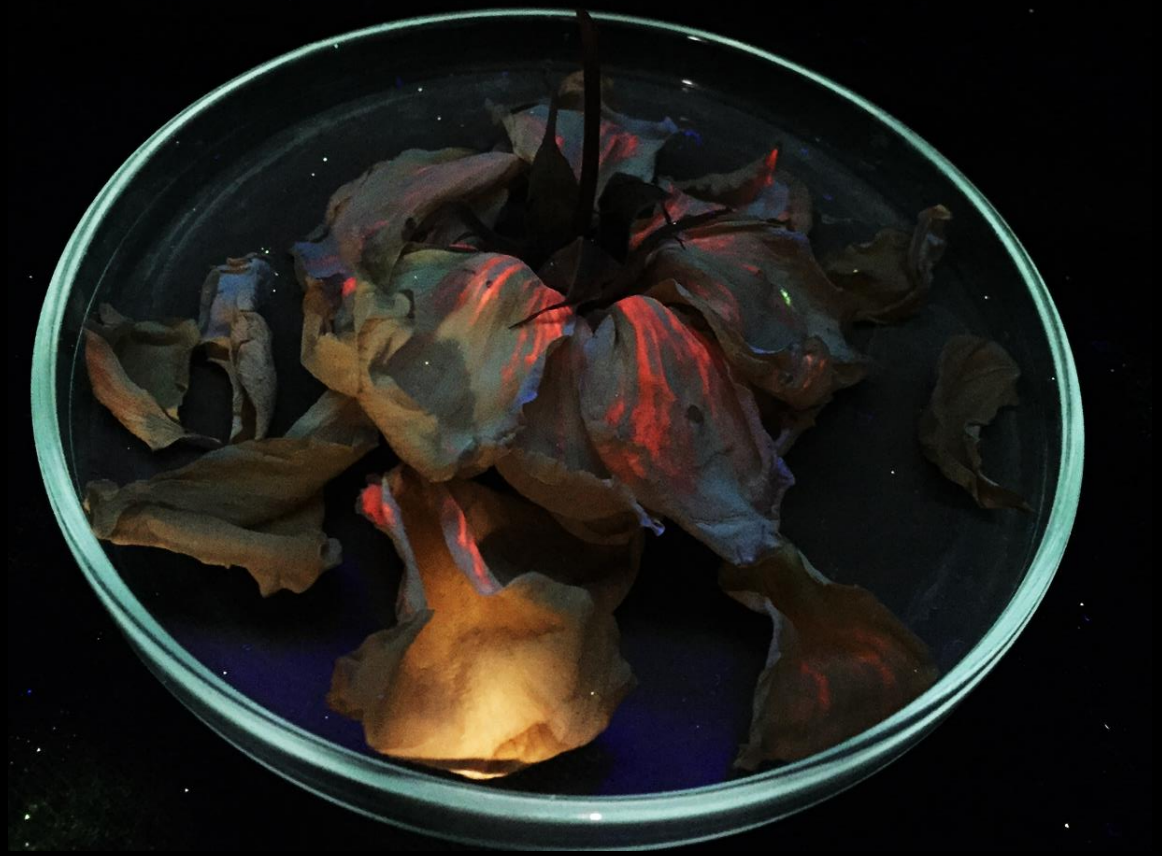
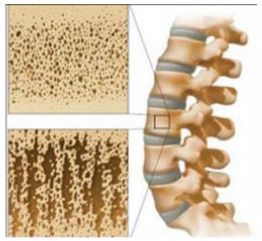
Biomineralization of metal-organic materials on polysaccharides and plants



Joseph J. Richardson (richardson@g.ecc.u-tokyo.ac.jp)
University of Tokyo, Materials Engineering, Ejima Lab

Porous materials are important

Lungs



Bones

Coral

Soil

Sandstone

Porous Materials in Nature

Butterfly wings

Snow

Sea sponge

Egg shells

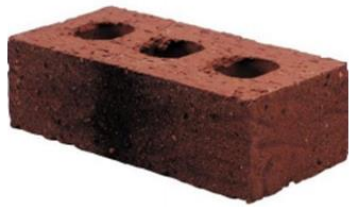
Lemons

Synthetic porous materials are really important

Paper

Textile

Chalk



Brick

Insulation

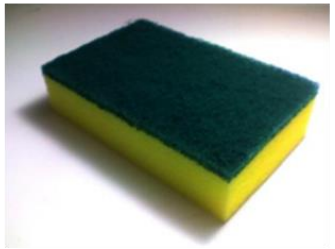
Artificial Porous Materials

Concrete

Ceramics

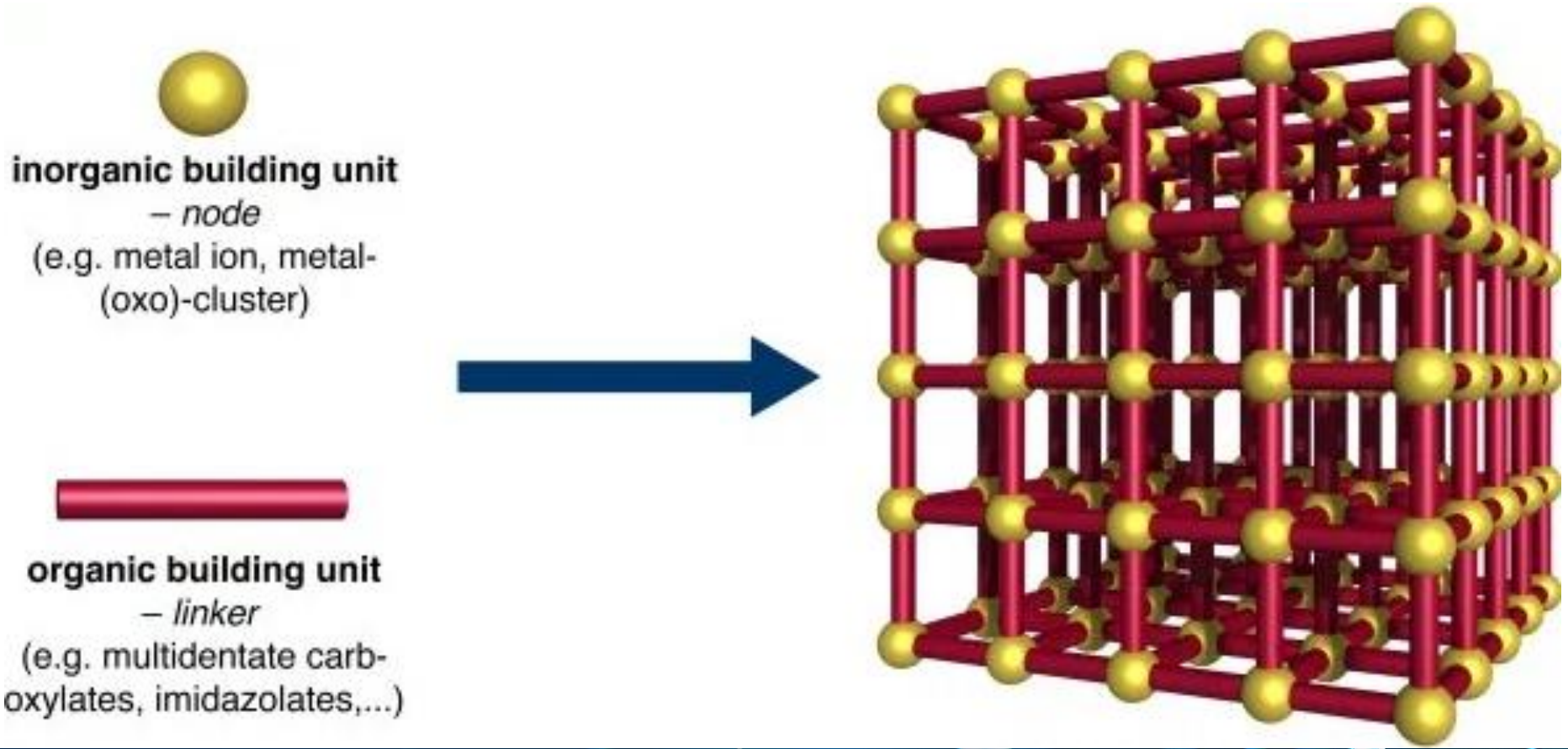
Cakes

Bread

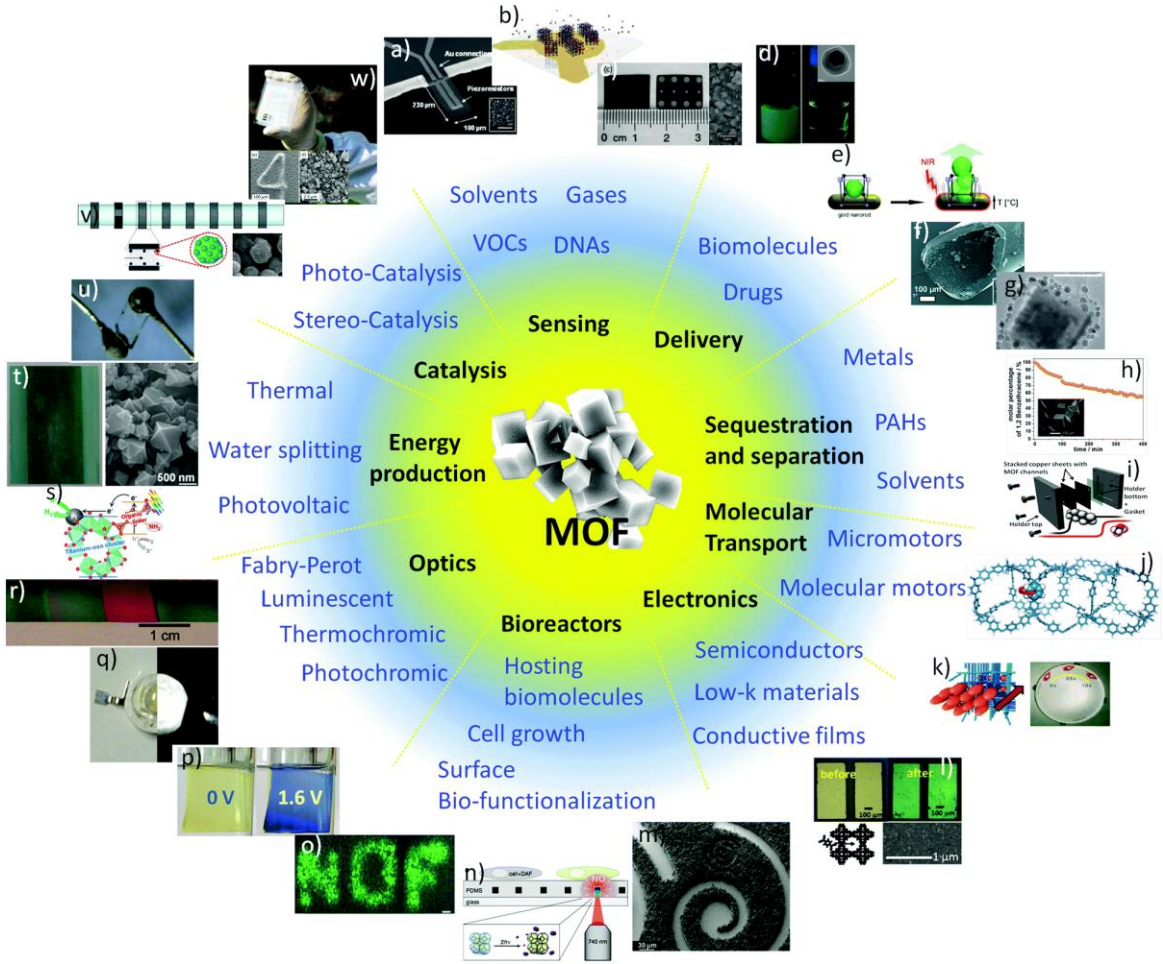


Kitchen sponges

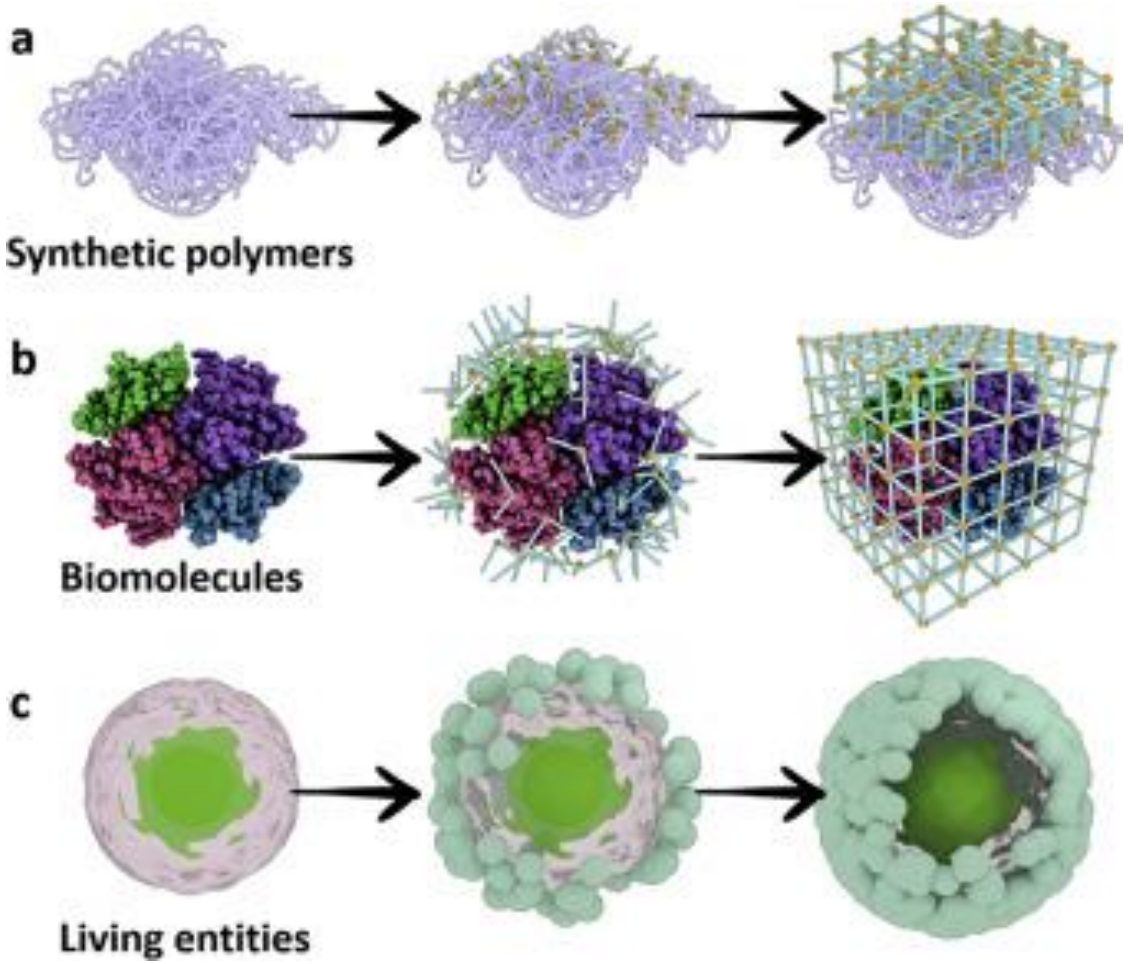
Unique porous materials, Metal-Organic Frameworks (MOFs)



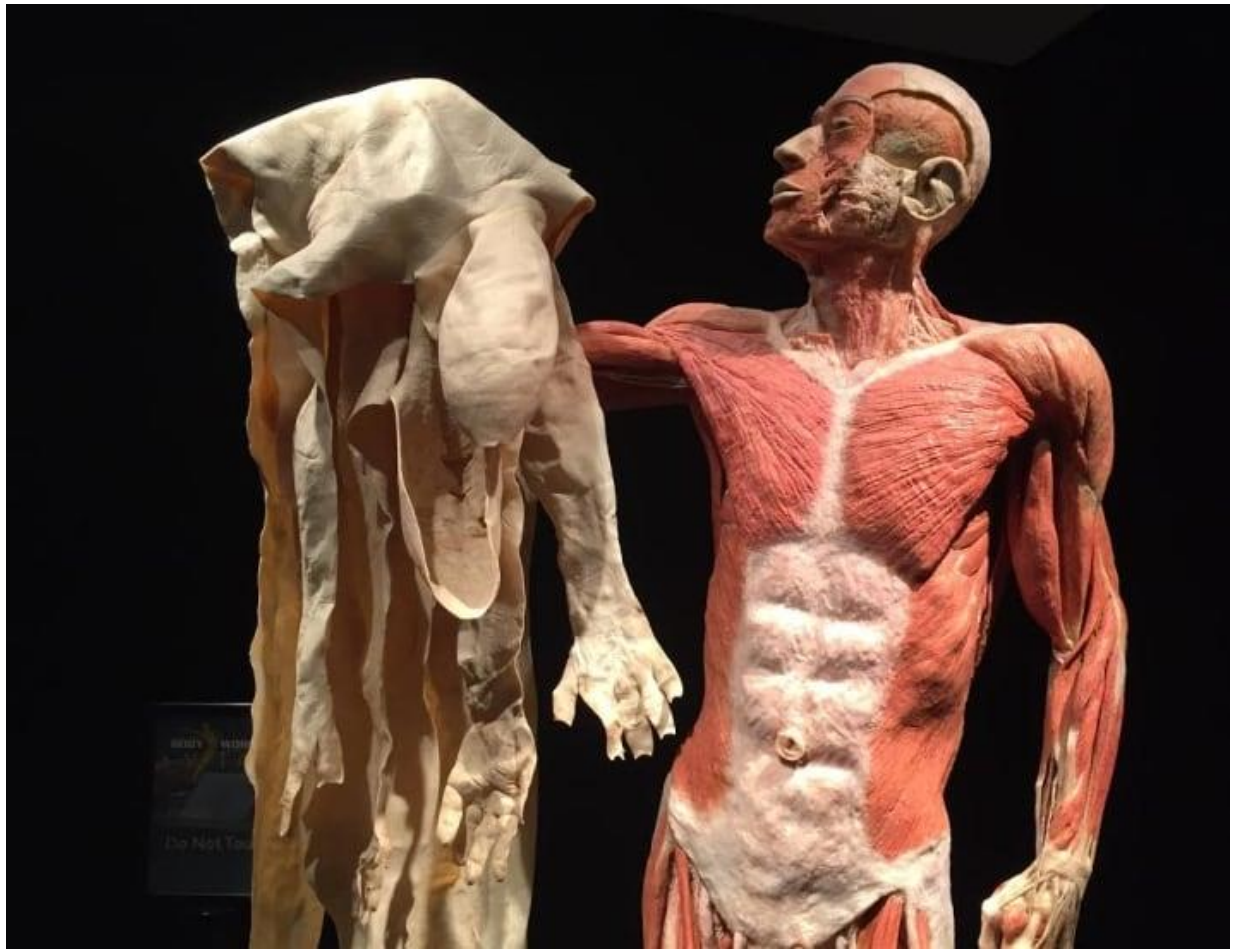
Plenty of “applications” for MOFS



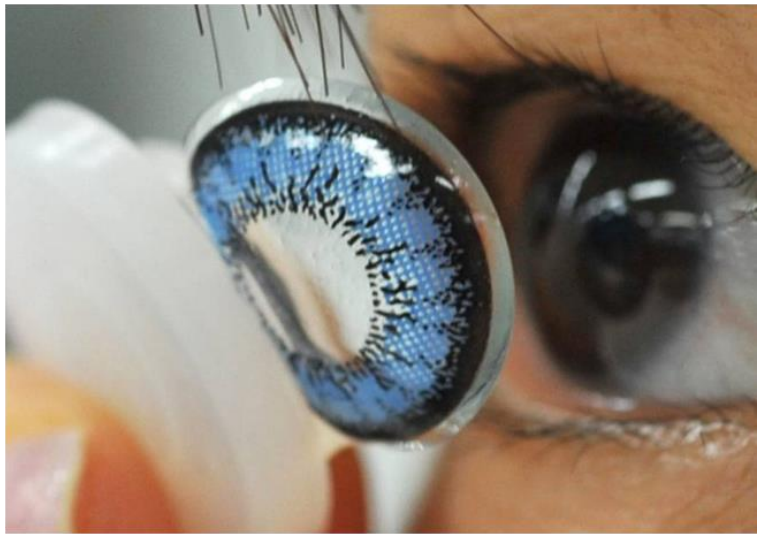
MOFs around polymeric materials



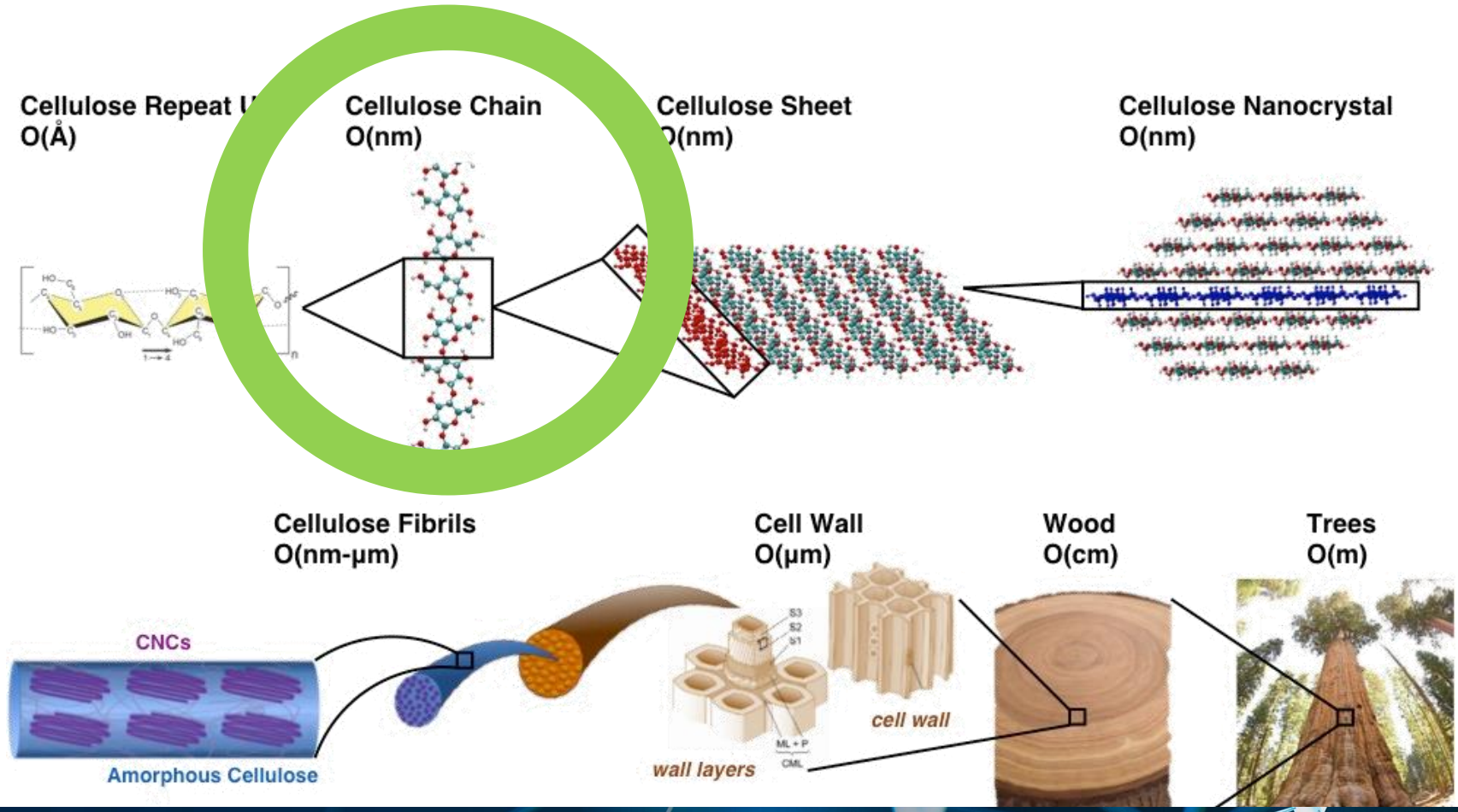
Interfaces are important



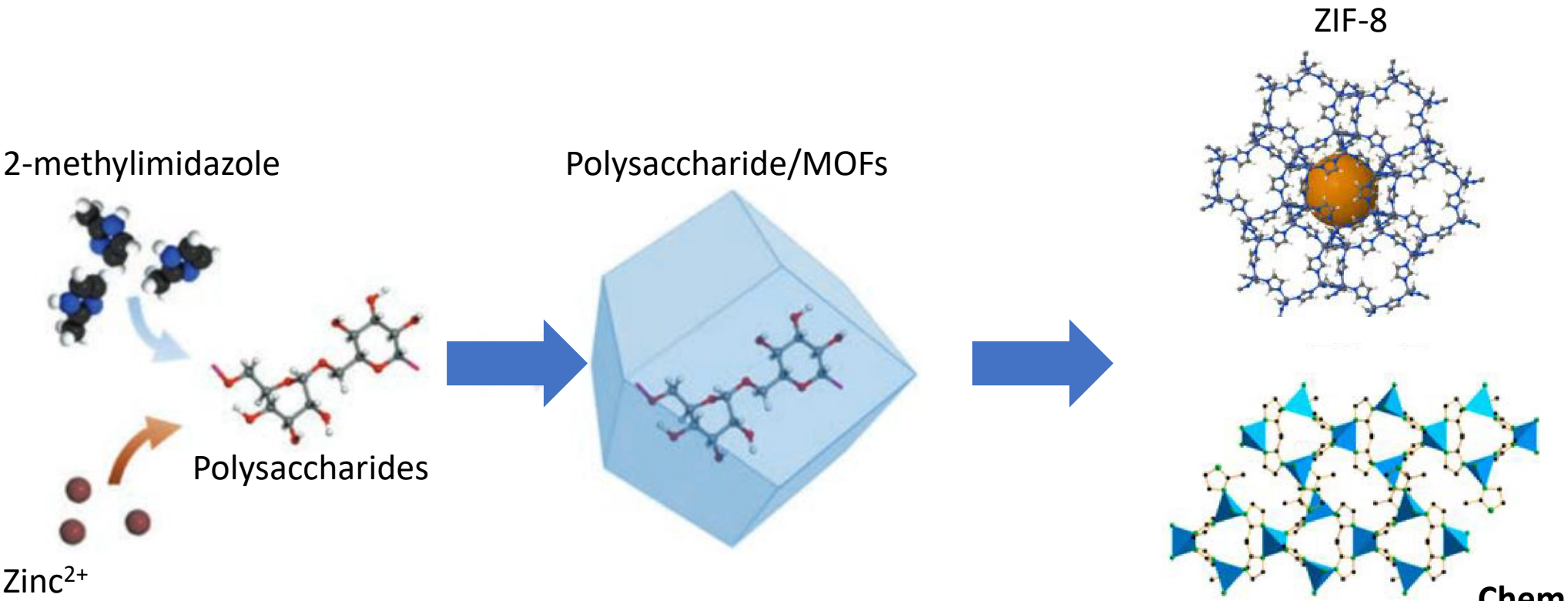
Coatings let us engineer interfaces!



Simple building blocks to complex lifeforms



Facile preparation of polysaccharides/MOFs



Facile self-assembly at room temperature in aqueous conditions

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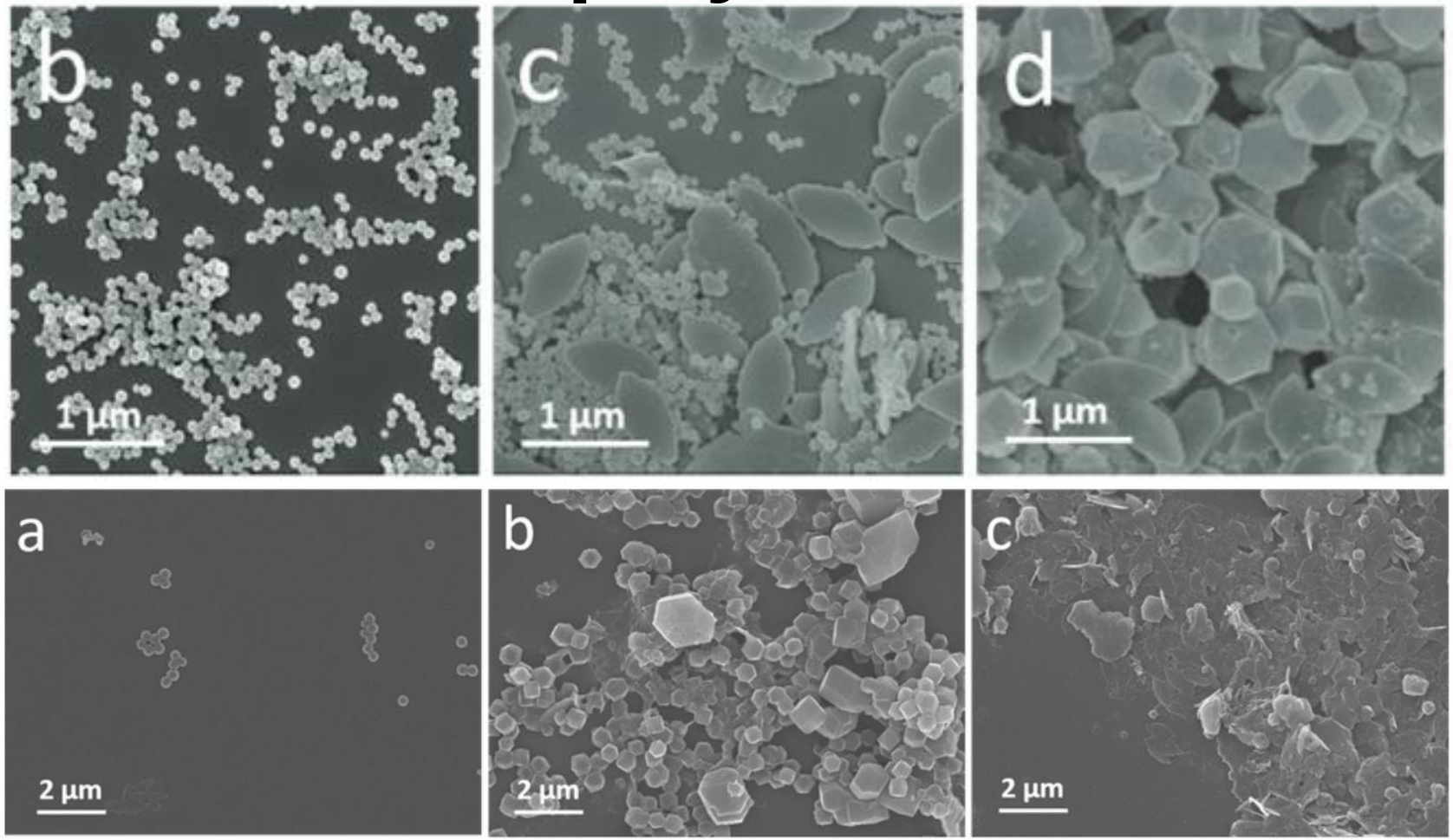
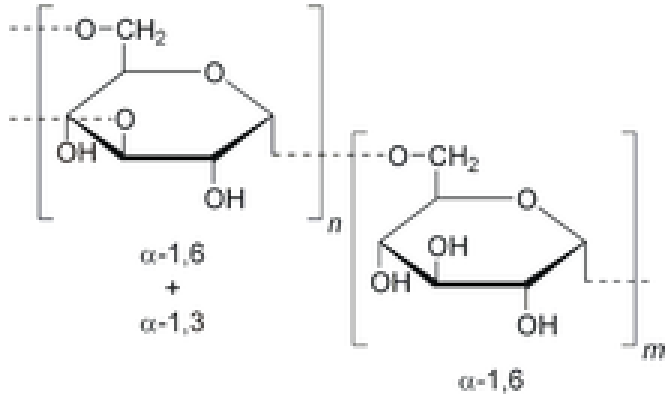
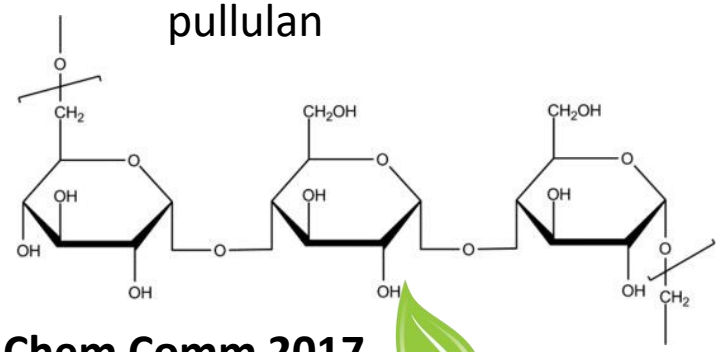
Different polysaccharides can be used



dextran



pullulan



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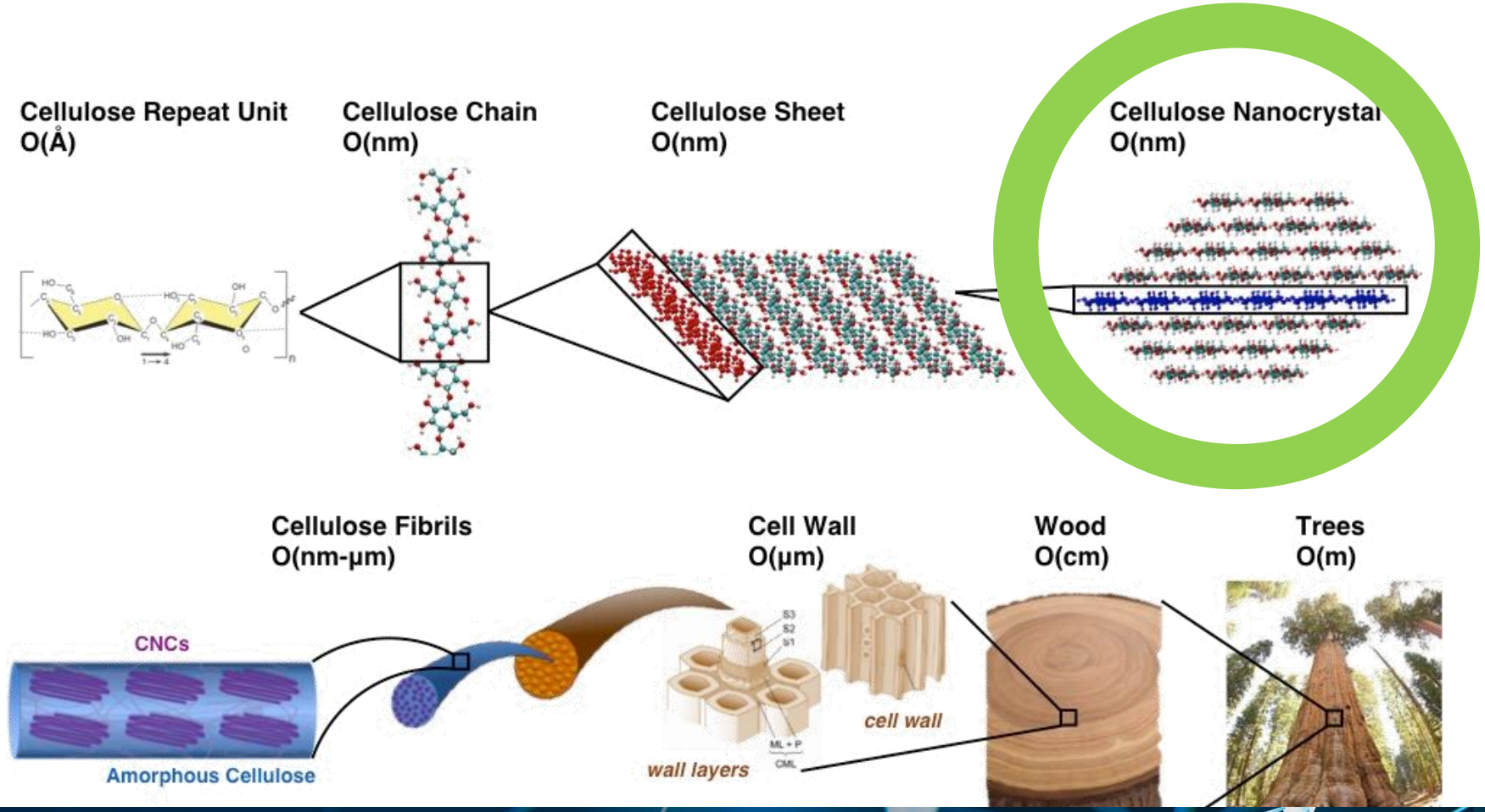
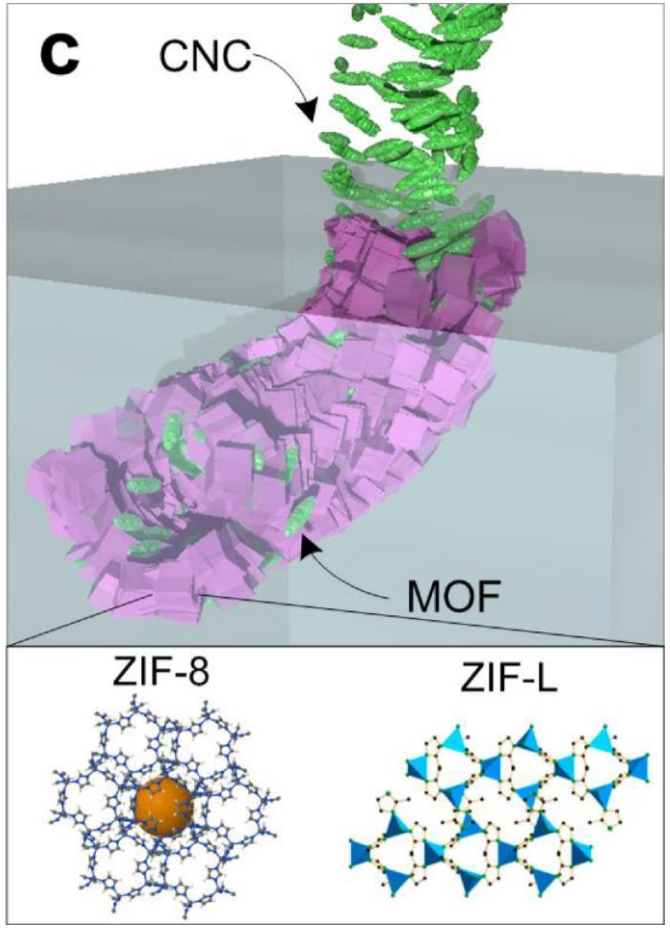
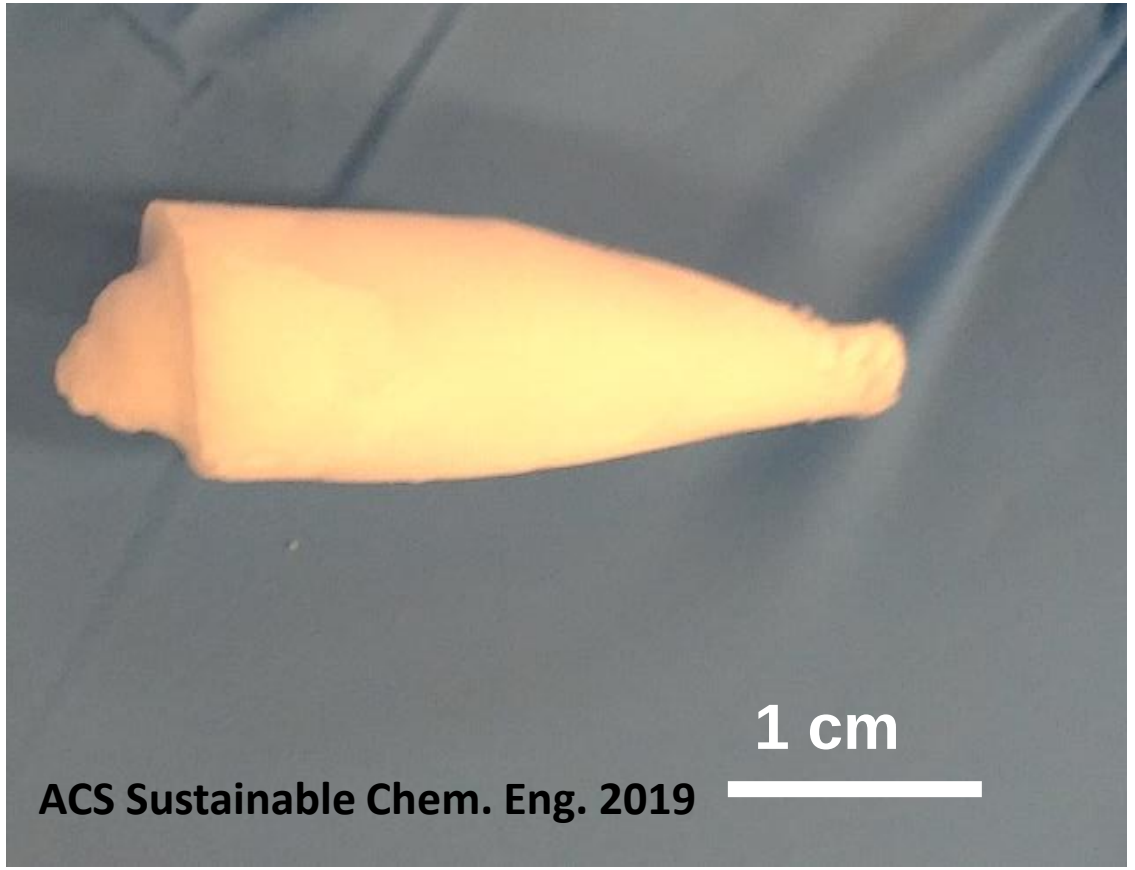
Simple building blocks to complex lifeforms



Extrusion of CNC/MOF Composites

- CNC-MOF extrusion





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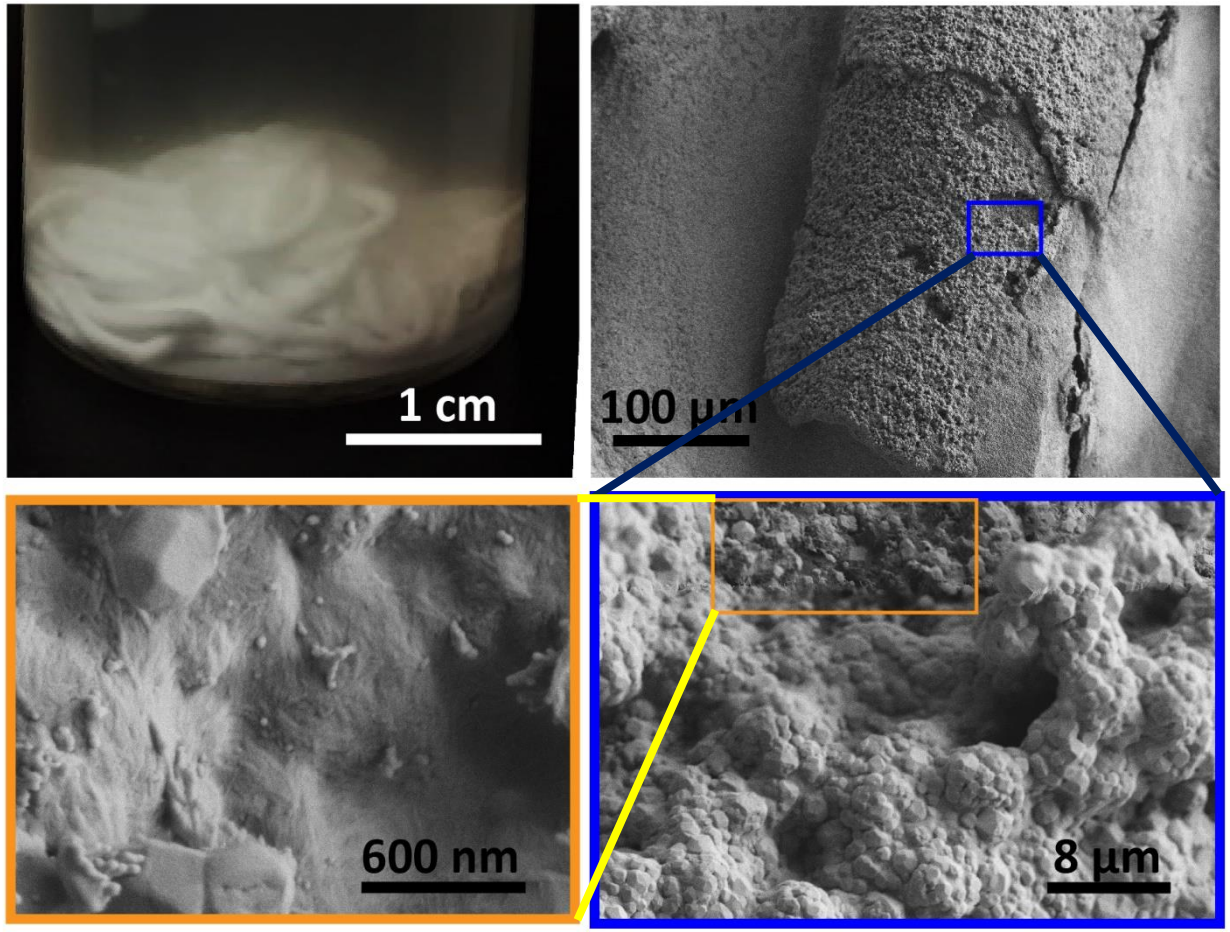
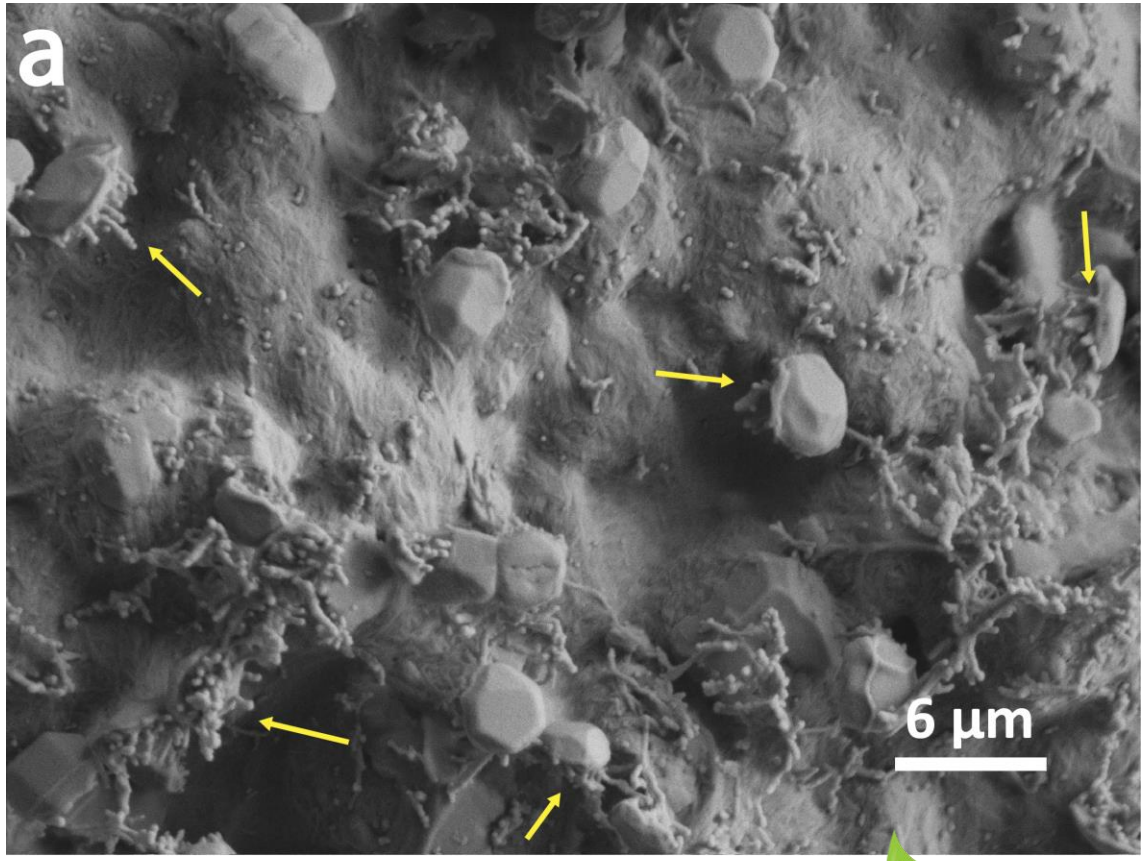
CNCs inside the MOF

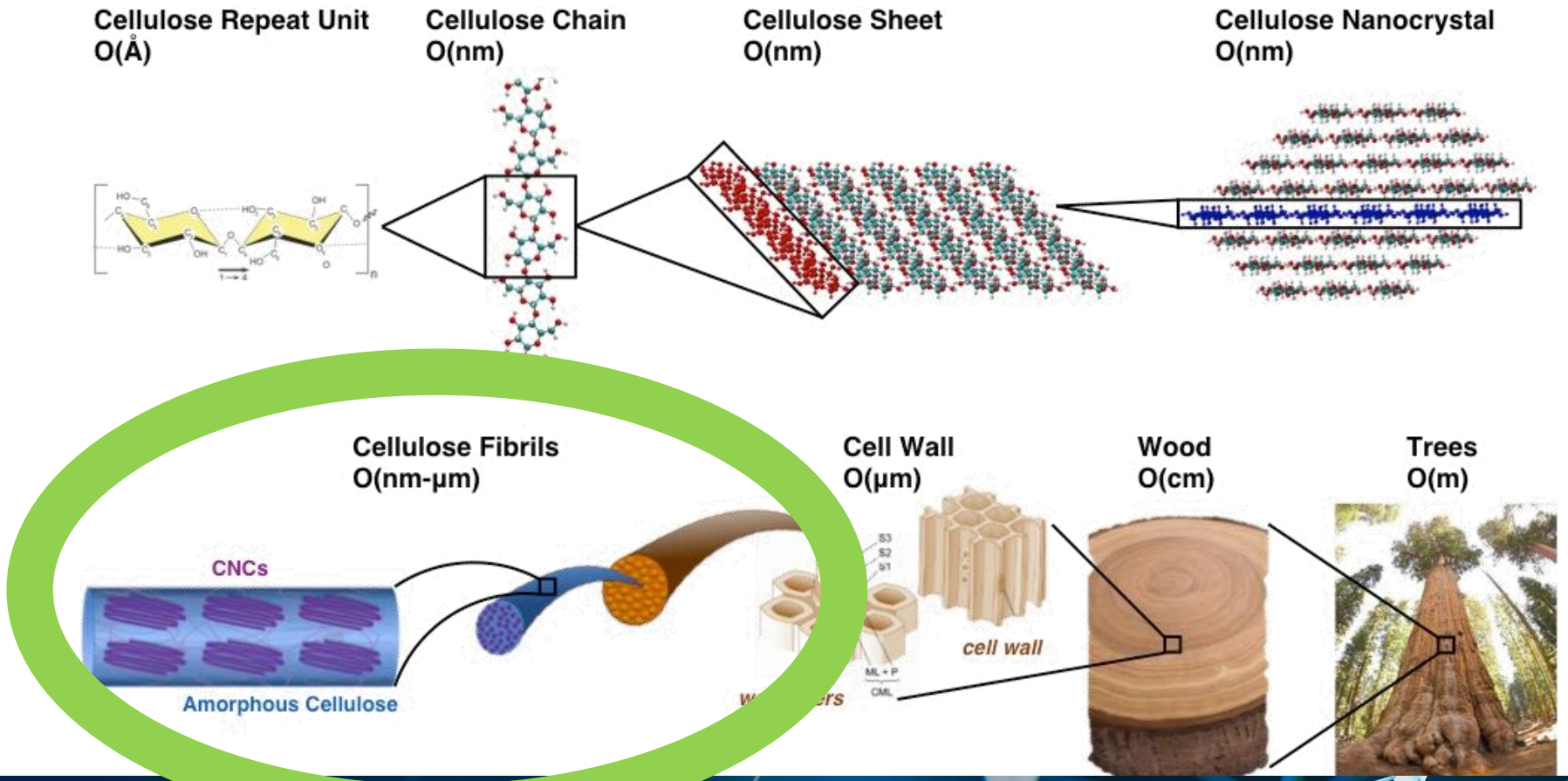


Extruded CNC/MOF fibers

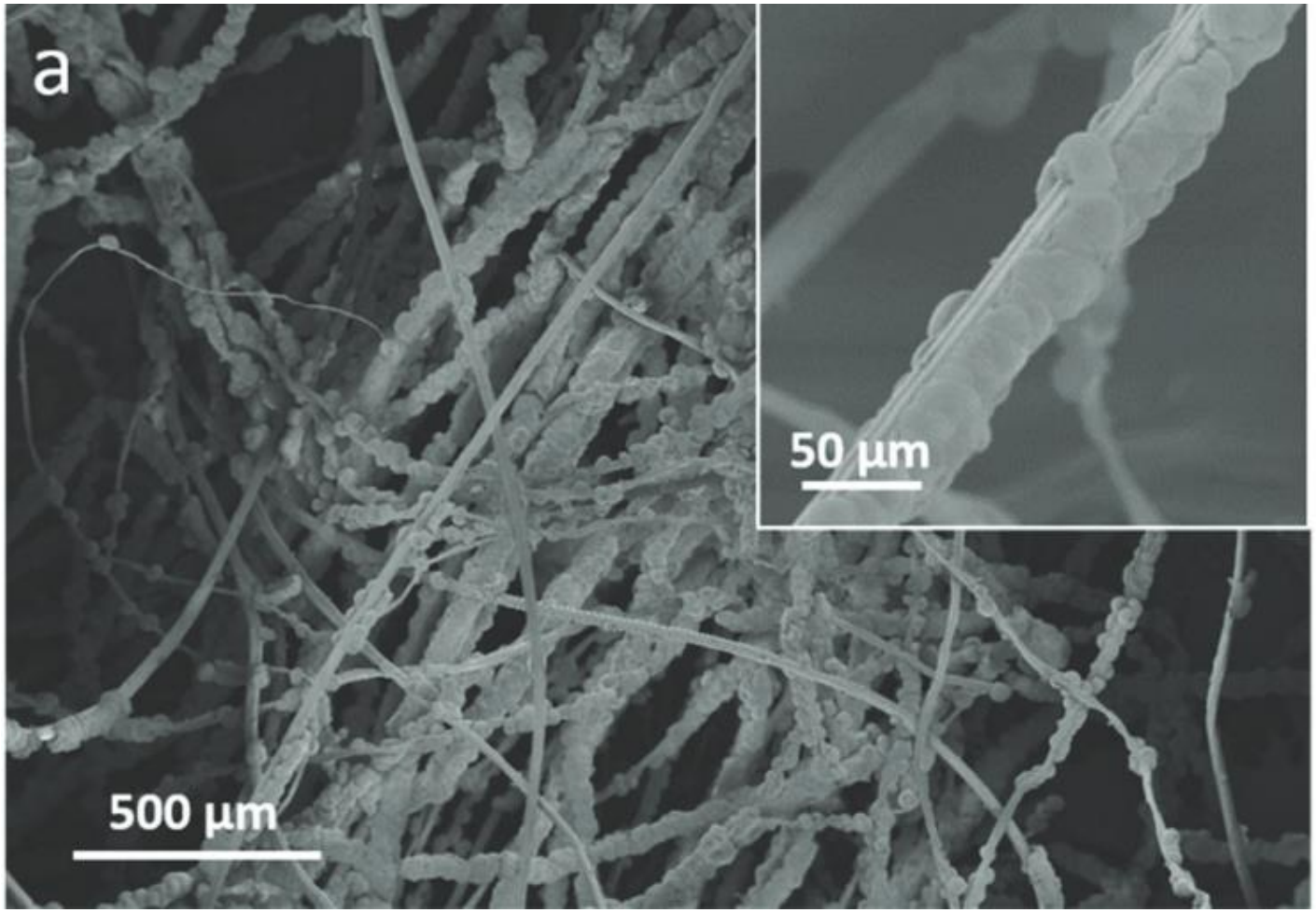


The CNC incorporation process is partially visible

Simple building blocks to complex lifeforms



MOFs can grow on cellulose fibers



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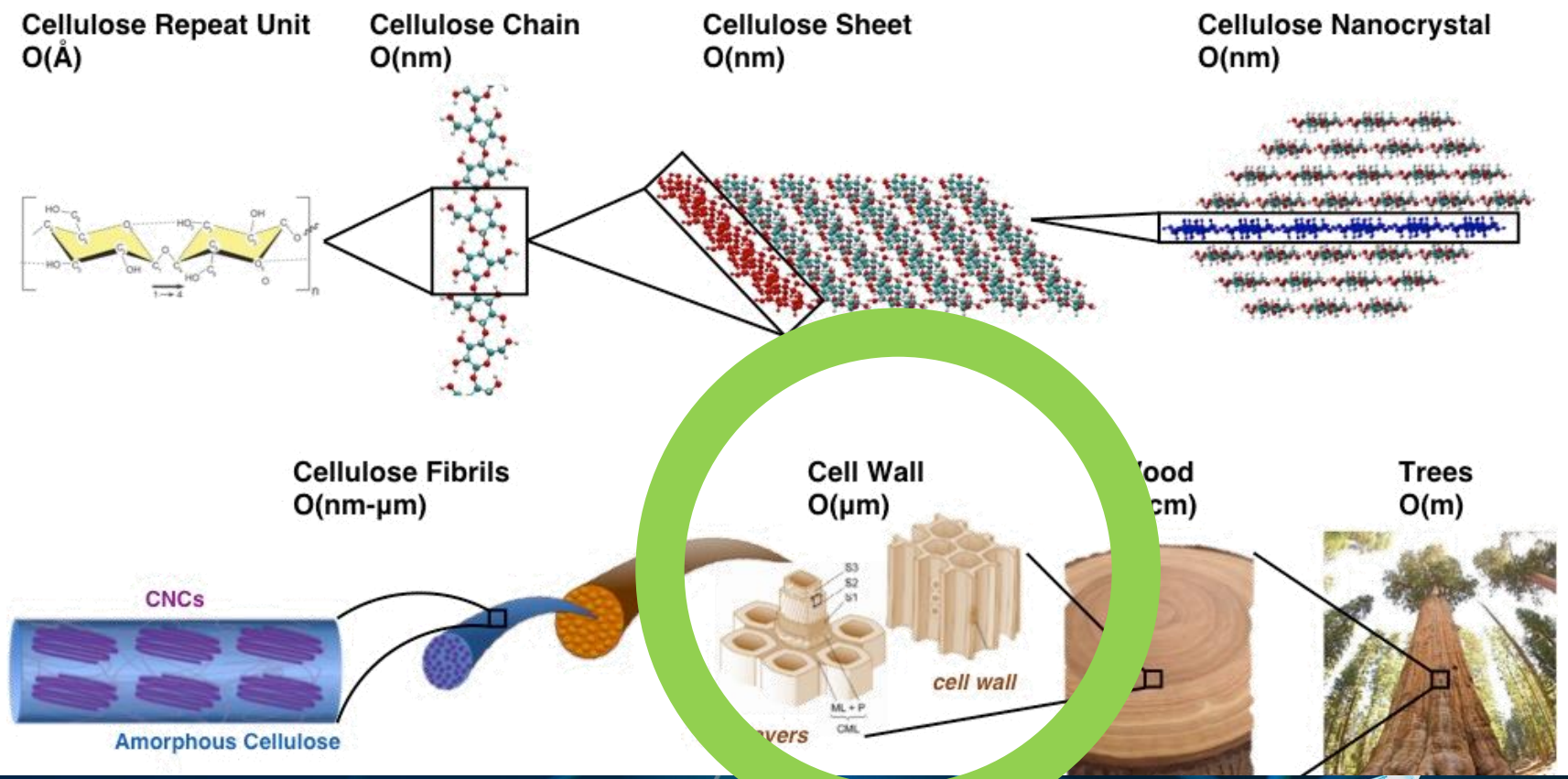
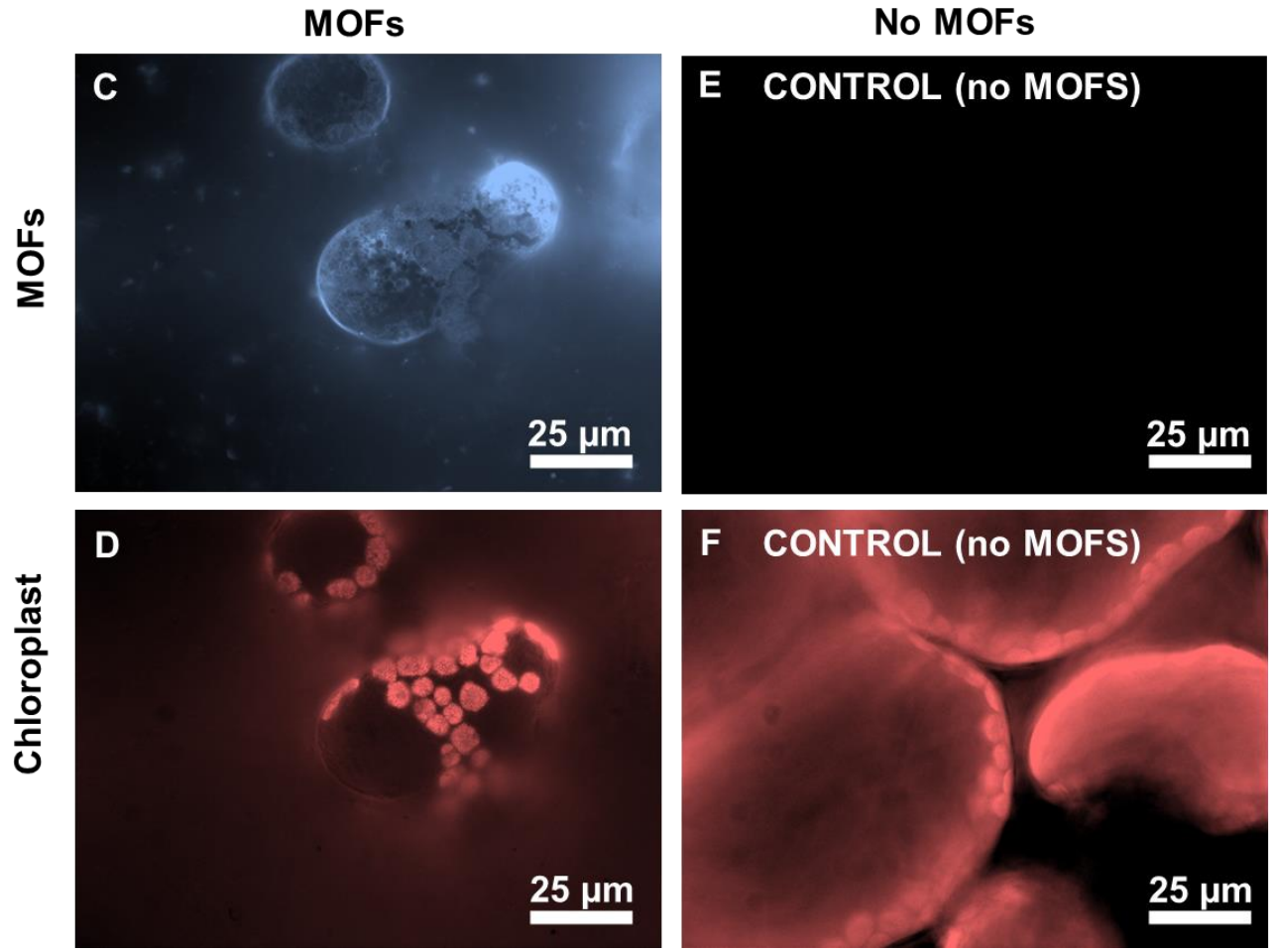
Simple building blocks to complex lifeforms

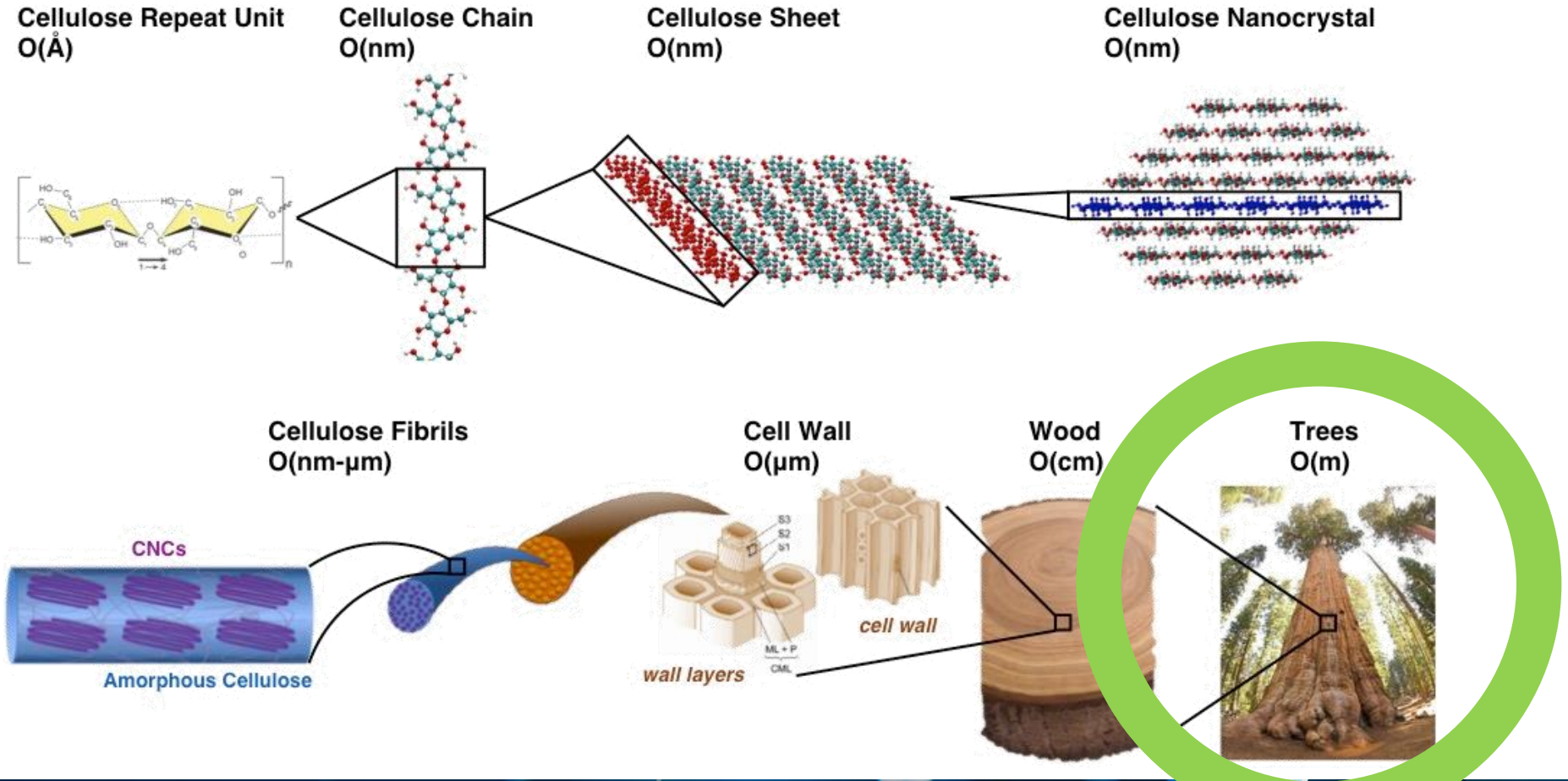


MOFs grown around cell walls in plants



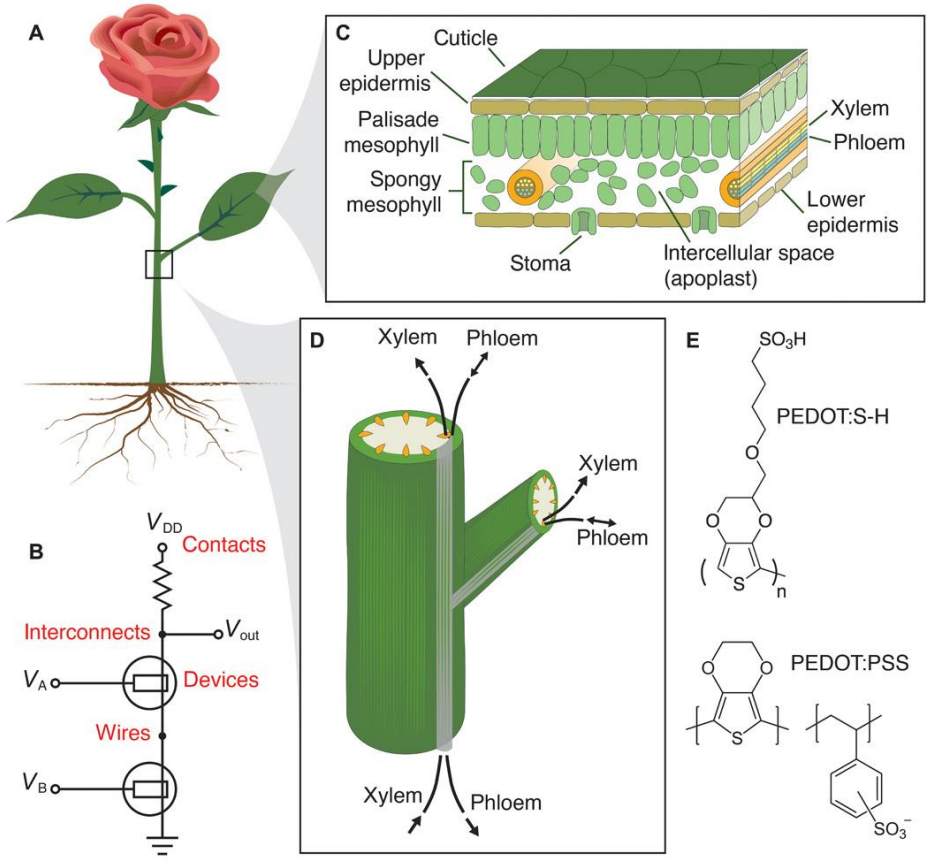
Small 201

Simple building blocks to complex lifeforms

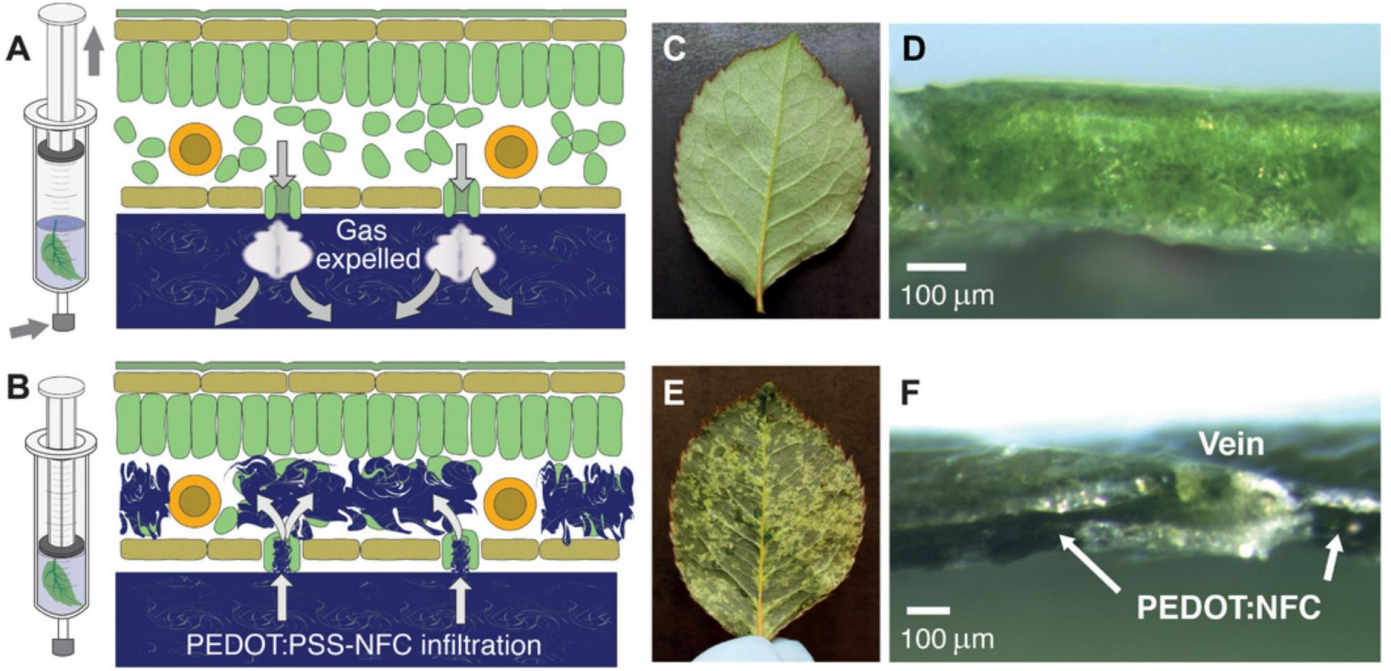


From an ancient protocol

To modern experiments

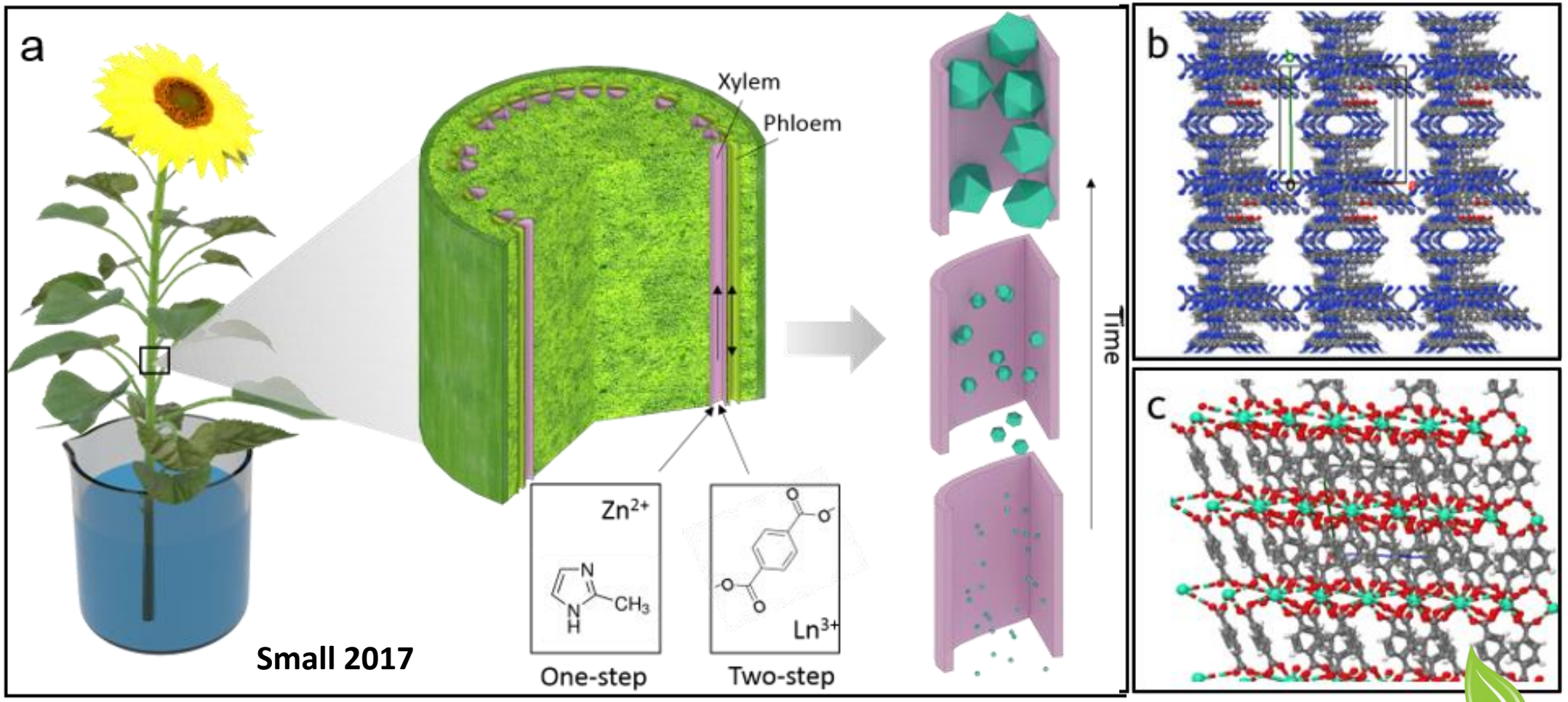


Science Advances 2015: Vol. 1, no. 10, e1501136



- **Trimming the stem**
- **Permeabilizing the leaves**

Growing functional MOFs in vivo



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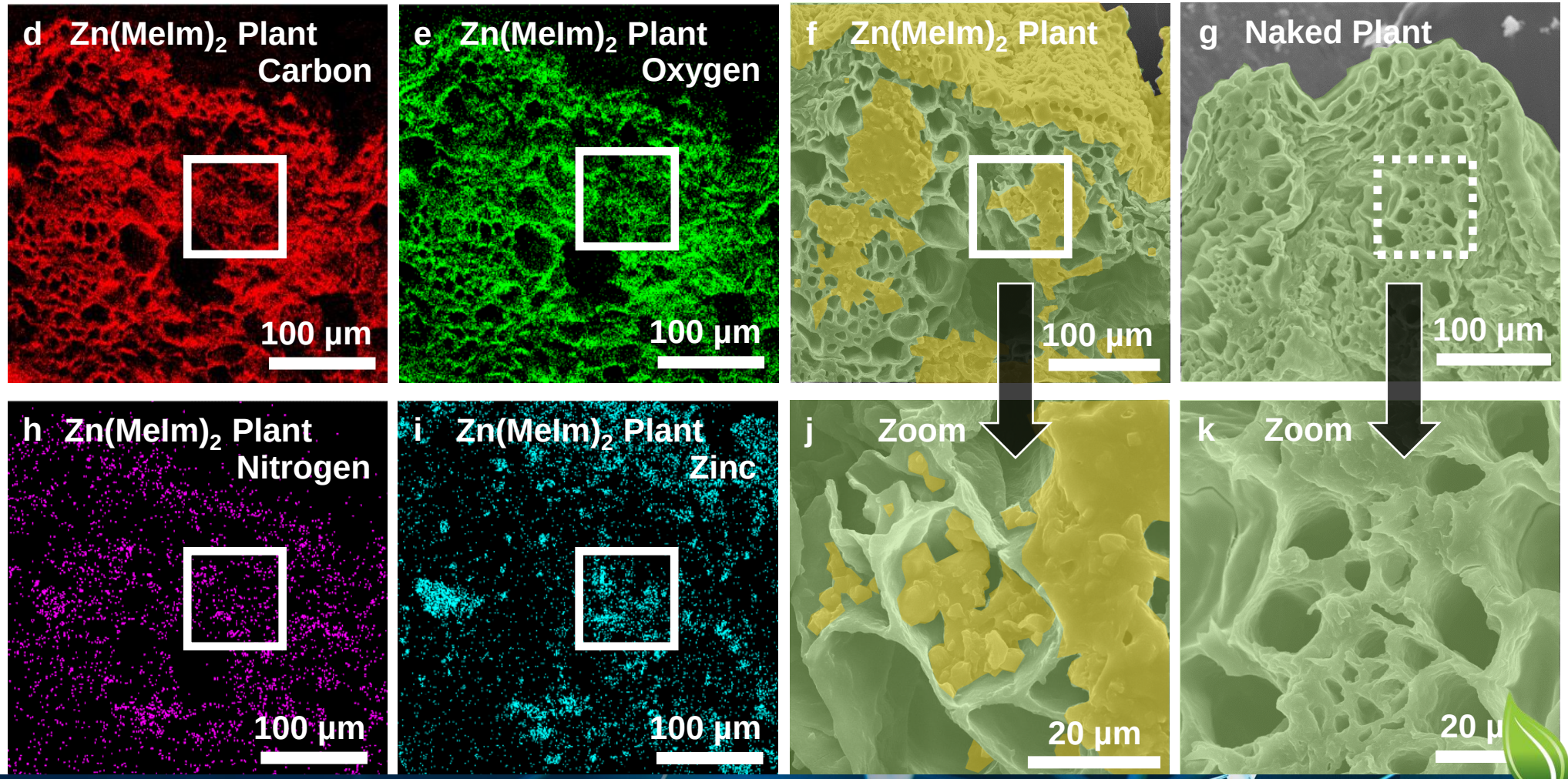
MOFs grow in xylem/phloem and externally



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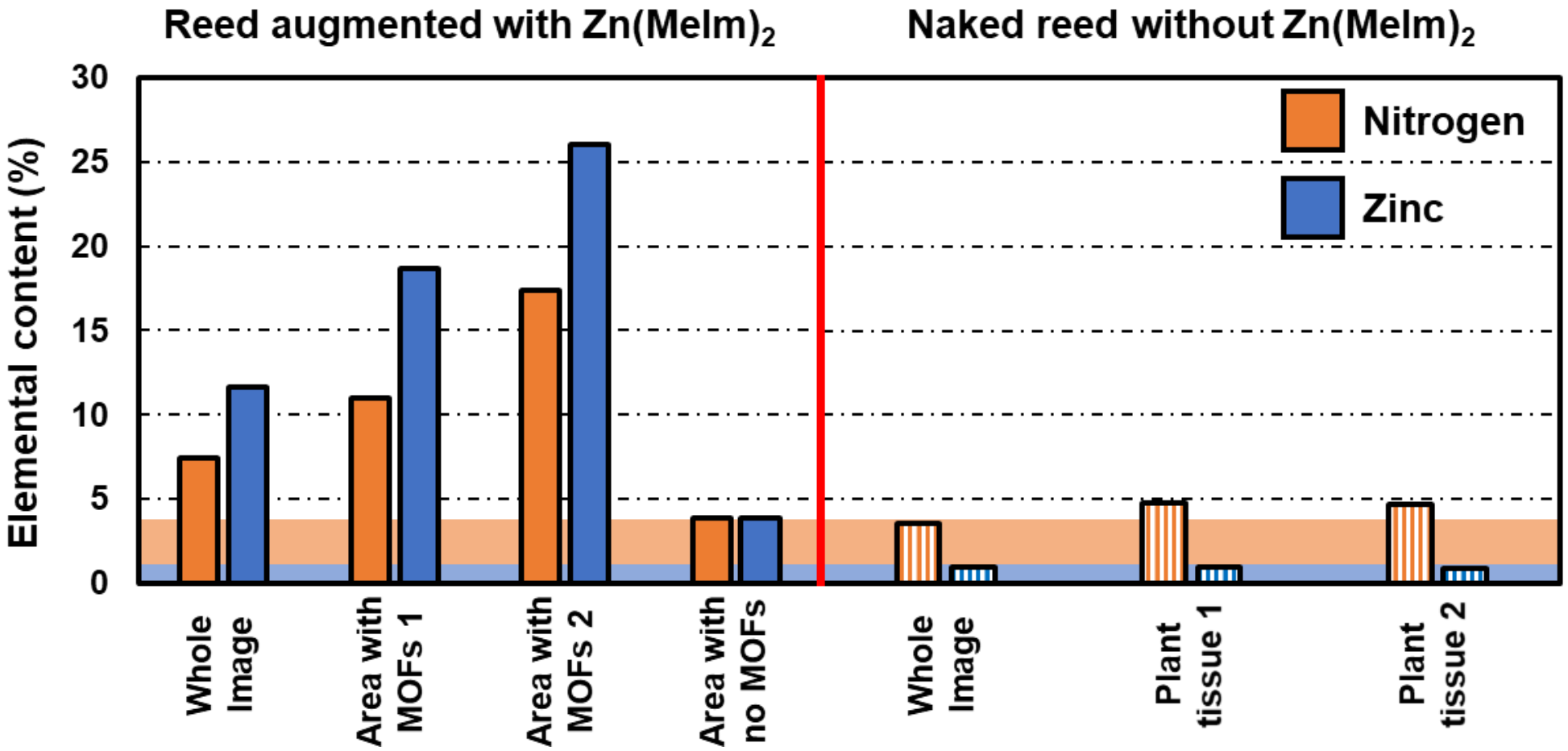
Elemental content shifts after MOF growth



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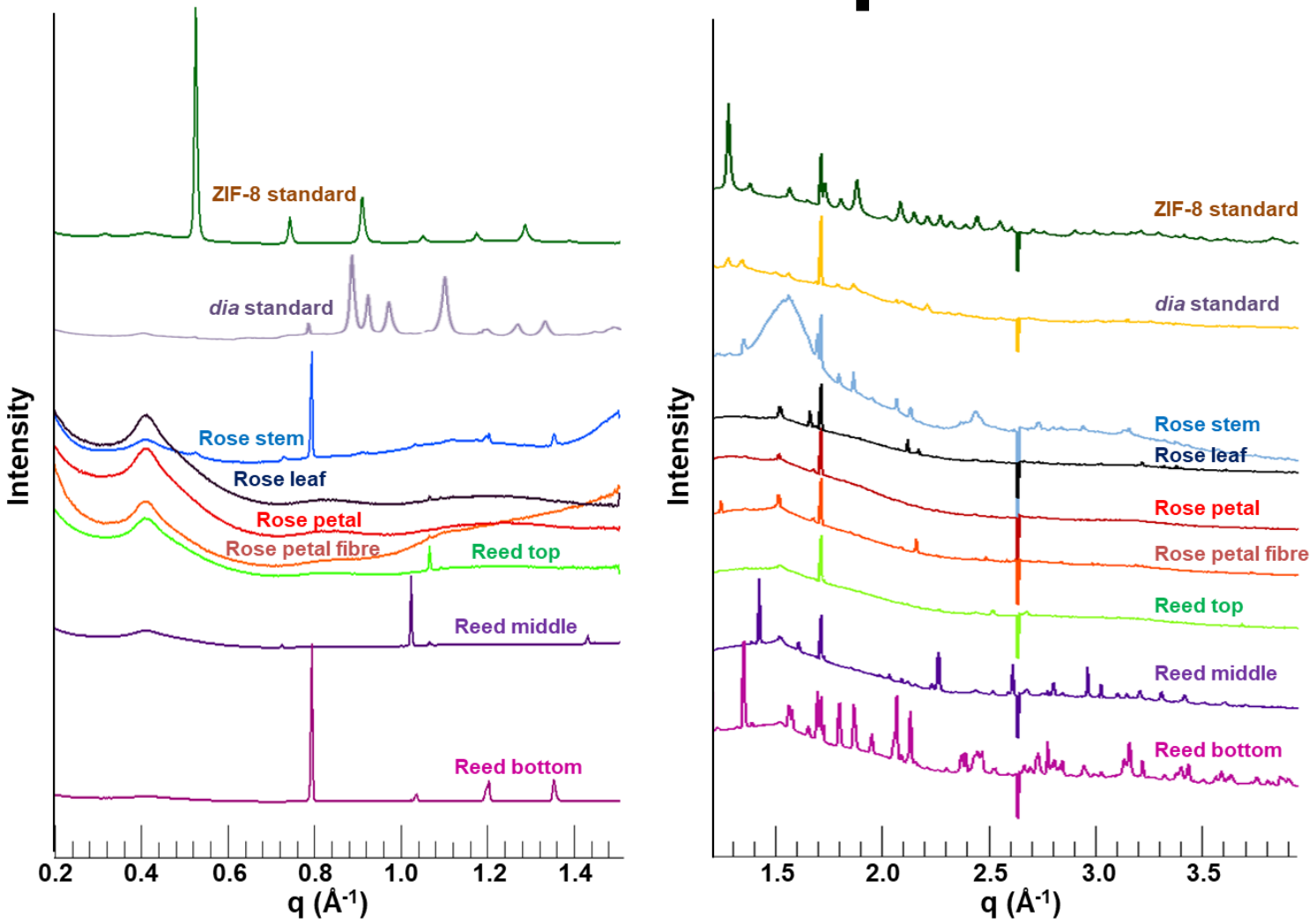
Different crystal phases



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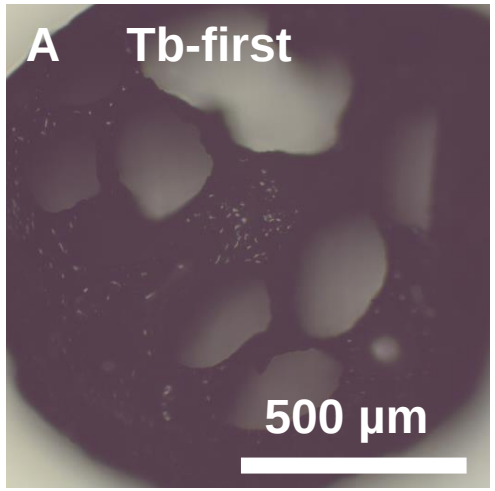
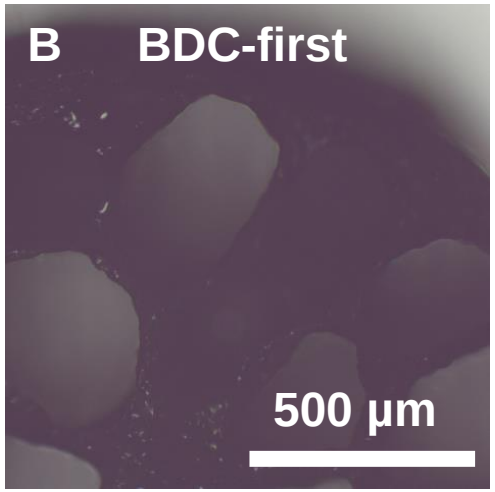
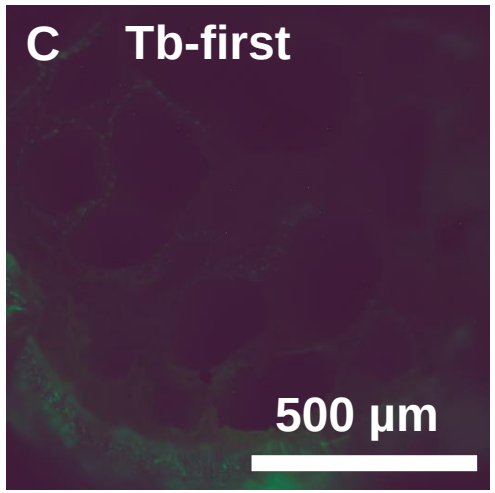
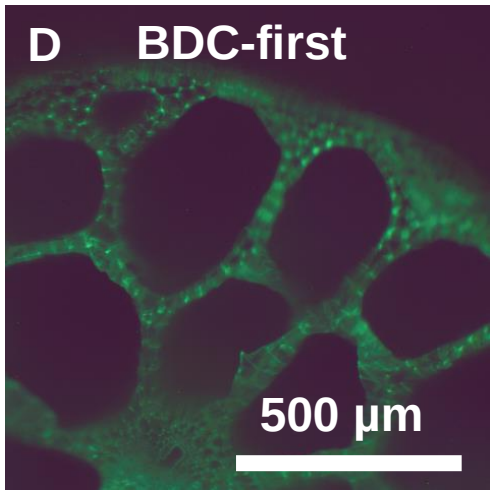
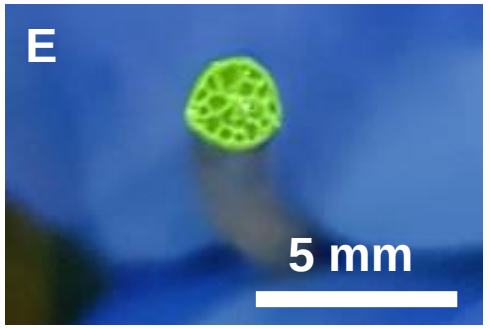
Luminescent MOFs can be grown, too

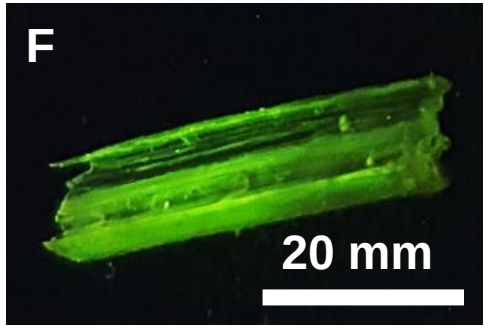


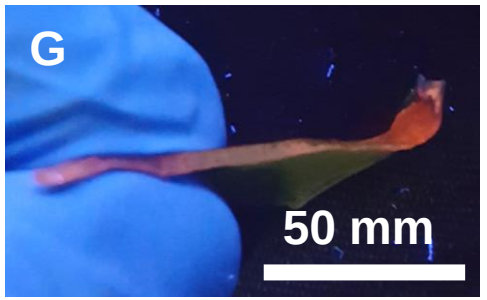


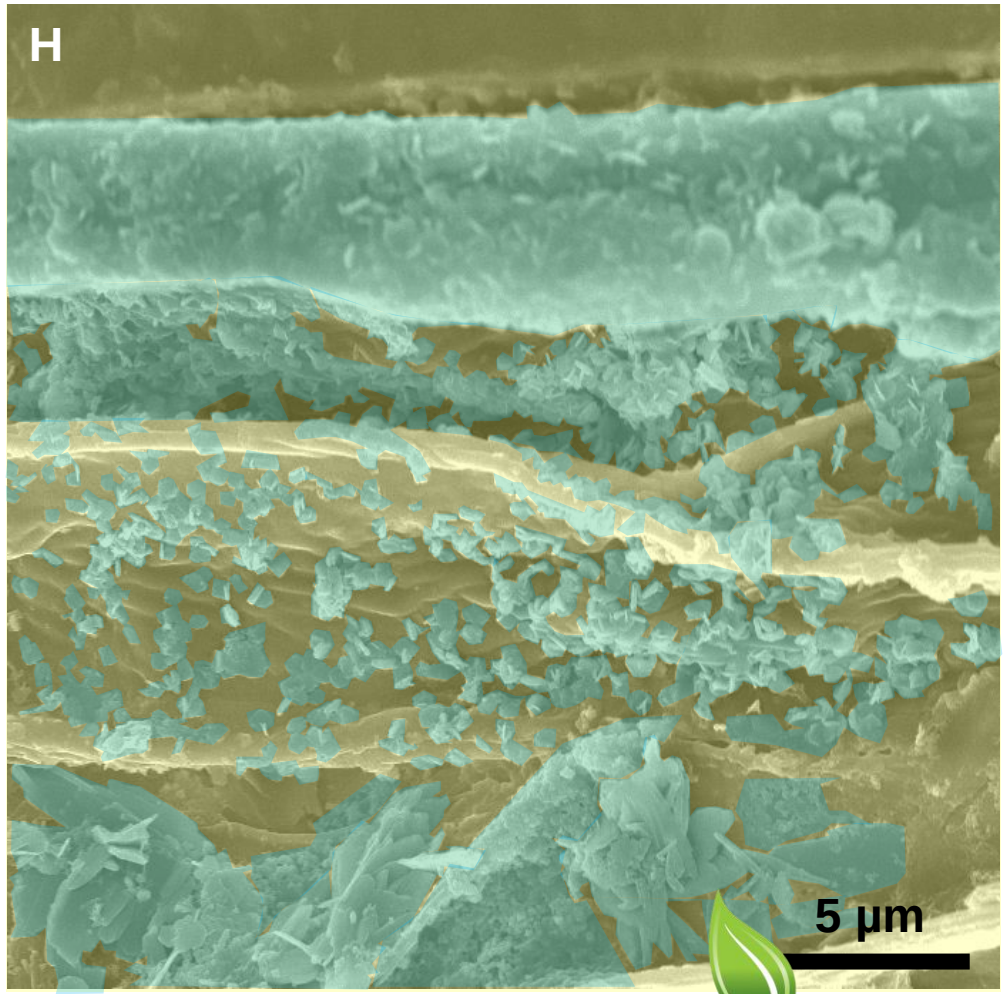




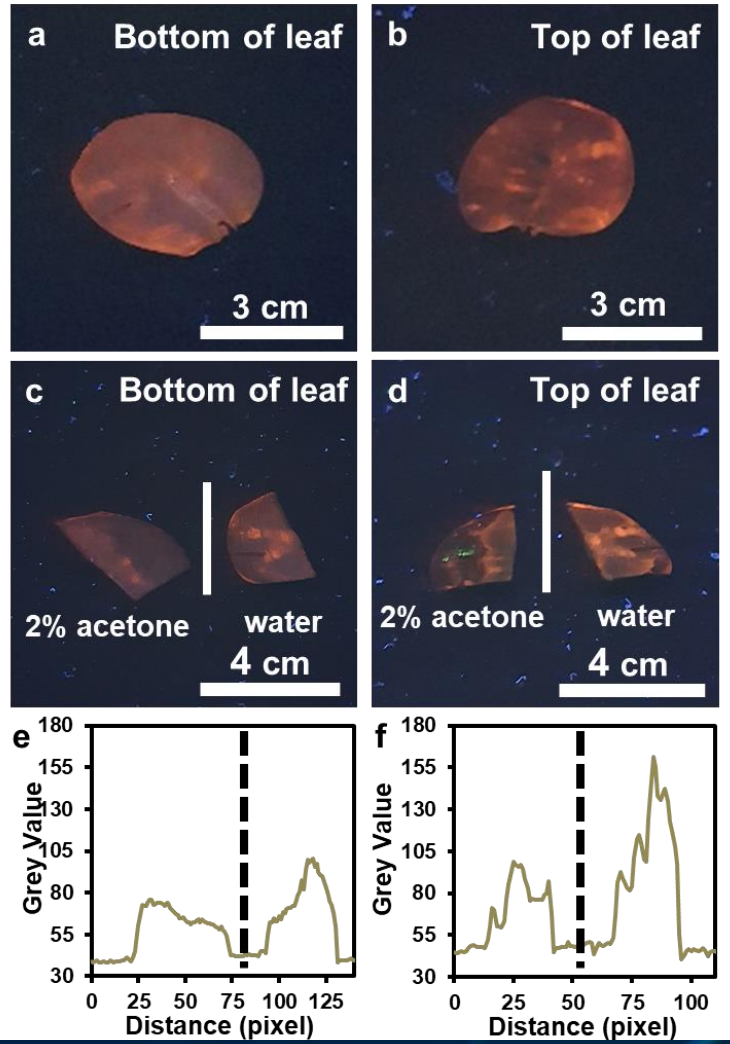


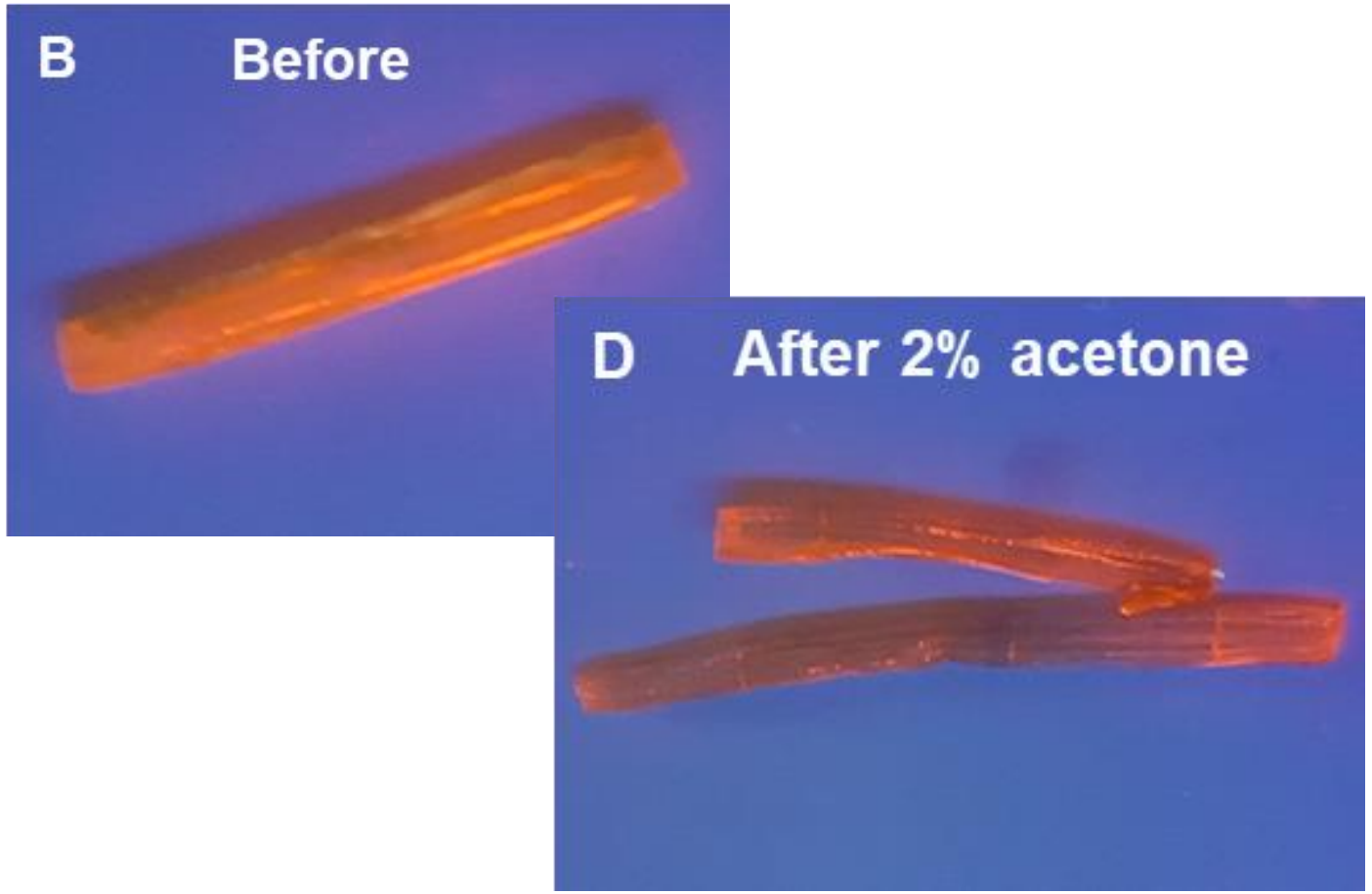






Luminescent MOFs for sensing





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Thanks to

Prof Hirotaka Ejima
Dr Blaise Tardy,
Dr Kang Liang,
Prof Junling Guo,
Prof Frank Caruso,
Prof Orlando Rojas,

lots of others!

A conclusion is simply the place where you got tired of thinking…

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