Enzymatic degradation and synthesis of crystalline cellulose

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Advances in enzyme technology let us know detailed mechanisms of cellulose degradation and synthesis in molecular level. We recently published how processive cellulases evolved from non-processive enzymes. This process is similar to "convergent evolution" like relationship between shark and dolphin, which have similar shape of body while they are quite different species each other. Processive cellulases have common feature with asymmetric subsite covered by loops, and these structural features are well conserved in processive cellulases.

In enzymatic synthesis of cellulose, we have launched cellodextrin phosphorylase and its substrate to International Space Station, and synthesized cellulose crystal under microgravity to understand the effect of gravity for cellulose synthesis. Since density of cellulose is about 1.5, cellulose synthesized at ground is always precipitated, while the space cellulose was quite homogeneous gel-like material.