iCASE Project / AY 2026 -2027

Understanding cellulose digestion by cryo-EM structure of cellulose microfibril-enzyme complexes

Project Reference: ICS-BIO-PD26

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Industrial Partner: Novonesis

Main BBSRC strategic theme: Bioscience for renewable resources and clean growth

Secondary BBSRC strategic theme: Bioscience for sustainable agriculture and food

Project outline:

Cellulose as the worlds most abundant biopolymer will provide the main source of sustainable renewable carbon to replace fossil carbon used in plastics, packaging, textiles and fuels.

Many of the applications of cellulosic materials rely on enzymatic conversion, such as digestion. Nevertheless, the mechanisms of cellulose digestion has been difficult to understand because the structure of the enzyme: substrate complexes has been impossible to resolve. Cellulose fibrils cannot be crystallised with enzymes for X-Ray Diffraction, for example.

We are developing approaches such as using X-ray diffraction and Cryo-EM to provide unique insights into the structure of cellulose-enzyme complexes, and these are already revealing unexpected aspects of this process. The project has the potential to understand why certain enzymes might be applicable in applications such as wood pulping, textile manufacture and nano-cellulose preparation. Novonesis supports this project fully, and can provide enzymes and industrial relevance to the project.