

Our current reliance on fossil fuels is unsustainable and there is a clear need to find alternative sources of renewable fuels and chemicals to meet the needs of an expanding global population. We already possess the technologies to turn waste plant material (lignocellulose biomass) into sugar that can be fermented to produce bioethanol for our cars, trains and planes, but the process is inefficient and remains expensive.

Prospecting novel enzymes capable of digesting lignocellulosic biomass has focused on the relatively few types of microorganisms and animals that have wood-degrading capability. Of particular interest are the GH9-family enzymes that hydrolyze internal glycosidic bonds, and the GH7 cellobiohydrolase enzymes that processively hydrolyze cellulose polymers to cellobiose. We are exploring the rich resource of endogenous lignocellulose-degrading enzymes from the marine environment.

Unlike animals such as termites that employ a complex community of microbial flora to produce digestive enzymes, the marine crustacean *Limnoria quadripunctata*, locally known as Gribble, has a sterile gut and produces all the necessary enzymatic machinery to efficiently digest these challenging substrates. We have cloned, expressed and solved the X-ray structures of several animal GH7 and GH9 enzymes and this has allowed a detailed comparison and the discovery of new properties such as salt tolerance. From an industrial standpoint, robust marine enzymes that efficiently degrade lignocellulosic substrates represent significant value.