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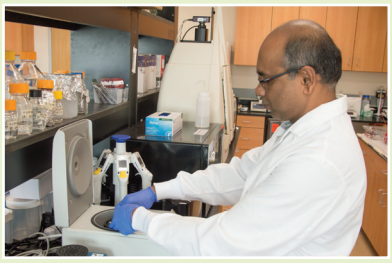
FROM GENES TO JET FUEL:
The Promise Of Oilcane

The paths to fossil fuel free energy are as nuanced and complex as engineering sugarcane (*Saccharum* spp.) to produce oil. Dr. Moni Qiande lives and knows these truths, which help drive her science. Originally from Inner Mongolia, Dr. Qiande did her PhD with Professor Fredy Altpeter at the University of Florida, working to turn sugarcane into oilcane for bioenergy. Dr. Qiande was initially interested in grass breeding to improve the productivity of Inner Mongolian grasslands for animal grazing, part of her family's background. All renewable energy sources have limits, and overuse of any one can cause undesirable local environmental effects. In concert with climate change, wind farms in Inner Mongolia could be altering precipitation patterns, potentially reducing plant growth, straining the animal herds and their herder's way of life.[1,2] Dr. Qiande was drawn to the Altpeter lab's work on oilcane in order to help diversify our renewable energy sources. The research, in conjunction with scientists at Brookhaven National Laboratory, is an important project within the Center for Advanced Bioenergy and Bioproducts Innovation (CABBI), one of four U.S. Department of Energy funded bioenergy research centers in the US.

Sugarcane is a bioenergy success story in Brazil, where simple sugars found largely in stems are converted into bioethanol for vehicles. Gene editing technologies have opened new opportunities for plant improvement, and the Altpeter lab is taking on the challenge of turning sugarcane into oilcane, improving it as a bioenergy crop. The goal of oilcane is to produce triacylglycerols (TAGs) to make biodiesel and possibly jet fuels.[3] Biodiesel is more energy rich than bioethanol, and its production has a far greater energy return over energy invested.[4] More recently, the Altpeter lab has had success producing TAGs in energycane, more productive and perennial *Saccharum* hybrids that grow at higher latitudes and do better on marginal land compared to traditional sugarcane.[5] Looking to the future, whereas road vehicles are going electric, heavy equipment and aviation stand to use liquid fuels for some time.



Rewiring *Saccharum* to efficiently produce and accumulate oils across the entire plant body is no simple feat. *Saccharum* hybrids have large polyploid genomes, complex matrices of gene copies, promoters, and other regulatory elements. Accumulating TAGs in the stem will be critical for success, as stems make up >70% of *Saccharum*'s biomass. Achieving a TAG concentration of 5% or more in the harvestable biomass will solidify oilcane's economic and environmental viability. Only 5% TAG content in biomass is required because of the immense productivity of *Saccharum*, driven in part by its C_4 photosynthesis. To unravel the gene networks of stem specific TAG expression in *Saccharum* hybrids, Dr. Qiande used temperature inducible gene expression.[6] BioChambers high light TPRB growth rooms are well suited for growing *Saccharum*; their precise temperature control allowed Dr. Qiande to confidently decipher the gene regulatory networks of TAG metabolism. Dr. Qiande is planning to stay at the University of Florida and pursue a post-doc in synthetic biology with Professor Cătălin Voiniciuc.

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*Former or current Altpeter lab members.

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