Energy can be changed from one form to another, but cannot be created or destroyed, and fuel, food, and all biological products are simply different forms of chemical energy. All of these products are ultimately derived from photosynthesis, the process by which sunlight energy is converted to chemical energy. Eukaryotic algae offer tremendous potential for the large scale production of biofuels and bio-products as algae require only sunlight as an energy source and sequester CO2 during the production of biomass, and algae can be much more efficient then terrestrial plants in fixing CO2 and producing biomass. Lost in much of the energy debate is the fact that the fertilizers required for productive modern agriculture are derived from fossil fuels as well, and as fossil fuels become more expensive and limited, the costs of agriculture will rise while productivity declines. These factors have provided the impetus behind the development of new renewable energy sources that can supplant fossil fuels while greatly reducing carbon emissions into the atmosphere. We have successfully introduce biosynthetic enzymes to modify hydrocarbon biosynthesis, as well as a variety of valuable protein co-products. The challenges and potential of algae as a source of biofuels and bioproducts will be discussed.

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