Tim Whitehead, an assistant professor in the Michigan State University departments of Chemical Engineering and Materials Science, and Biosystems and Agricultural Engineering, has received a National Science Foundation CAREER award.

Funding from this five-year, $416,970 grant, which began May 15, will support Whitehead’s work in programming the activity of proteins using computer-aided design and integration of next generation DNA sequencing data.

Proteins power most of the individual workings of cells and find wide use in therapeutic and industrial settings: from monoclonal antibodies that target and kill cancer cells to enzymes that convert cellulosic biomass to fermentable simple carbohydrates. Unfortunately, natural proteins are not always optimal for such applications, and current methods of improving proteins can be expensive and time consuming.

What is needed are new ways to search through the vast combinations of possible mutations to find those few that improve function. With this grant Whitehead is designing and testing a method for sequencing DNA that quantifies sequence-function relationships for hundreds of thousands of protein variants and enables the rapid discovery of those few beneficial mutations. He will use this method to develop mutations that modify the function of proteins in specific ways. These optimized proteins will enable microbes to convert cellulosic biomass to next-generation fuels and value-added chemicals.

The project's education plan aims to increase the retention of women in science by increasing research and engagement opportunities in synthetic biology at the high school and undergraduate levels. To achieve this goal, Whitehead plans to: provide research opportunities within his lab for undergraduate and high school students; teach a series of workshops on biochemical engineering fundamentals for high school students; and develop a new synthetic biology lab/lecture course at MSU for undergraduate students. He also plans to form the first MSU team for the international genetically engineered machines (iGEM) competition, in which undergraduates perform self-guided research projects and present results at a national meeting. Women will be aggressively recruited to participate in each of these programs.

Whitehead received his PhD in chemical engineering in 2008 from the University of California, Berkeley, and conducted postdoctoral research within the Biochemistry Department of the University of Washington before coming to MSU in 2011. He is a co-author on more than a dozen peer-reviewed journal articles and two patent applications.

The Faculty Early Career Development (CAREER) Award is among the NSF's most prestigious honors, recognizing
young faculty members who are effectively integrating research and teaching.

Within the past four years, twelve MSU College of Engineering faculty members have been named NSF CAREER Award winners.

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The abstract of the award

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