Using resistant starch to tailor diets to the human gut microbiome

Abstract: The gut microbiome has important connections to human health and one of the most important protective factors is the production of the short chain fatty acid butyrate, which is known to have anti-inflammatory, anti-diabetic and anti-tumorigenic properties. Butyrate in the gut is mostly produced through the fermentation of dietary fiber, particularly resistant starch. However, there a number of different resistant starches and variability in how a given person’s microbiome will respond to each. Thus, we would like to be able to predict whether a given person will respond favorably to a given resistant starch (in terms of butyrate levels) and features of the microbiome are the mostly likely predictors. However, past clinical trials have been limited in how many different resistant starches can be tested for a given microbiome (usually just one). Thus, we have employed both in vivo and in vitro fermentation approaches to test the response of the same microbiomes to multiple different resistant starches. In our ongoing clinical trial participants undergo four periods, a control and three resistant starches in a cross-over design. We then measure changes in short chain fatty acid production and microbiome composition. In our in vitro approach, we start from fecal samples and perform parallel fermentations with a number of different resistant starches. What we have found so far is that indeed, a given microbiome differ in terms of which resistant starches generate butyrate increases. This seems to be driven by both which resistant starch degrading organisms are present and which butyrate producing organisms are present, with certain combinations favoring greater butyrate production. With this information we are building towards models which will allow us to predict the most butyrogenic resistant starch for a given person’s microbiome.

Biography: Dr. Cockburn is originally from Canada, performing both his undergraduate and PhD studies at the University of Guelph with Dr. Anthony Clarke. From there he moved to a postdoctoral position at the Technical University of Denmark with Dr. Birte Svensson, before moving to the University of Michigan for a second postdoctoral position with Dr. Nicole Koropatkin and finally starting his own lab as an Assistant Professor in the Department of Food Science at Penn State in the summer of 2017. Throughout his career Dr. Cockburn’s research has centered on microbial carbohydrate digestion in various systems, but now focusing on resistant starch digestion in the human gut.