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Dr. Chocolate



Gilbert W. Arias / Seattle PI

“Here, put on this hair net,” says Andy McShea. He walks through the showroom of the Theo Chocolate factory, past heaps of chunky samples on gleaming slate. McShea is the Chief Operating Officer of the 4-year-old company, which he describes as the fastest-growing organic, fair-trade chocolate producer in the country. He’s known as Doc Choc, because he came to Theo Chocolate in 2007, after 7 years at the Seattle

biotechnology company CombiMatrix and 3 years as a postdoctoral fellow at Fred Hutchinson Cancer Research Center. He’s now using his science background to make better—and healthier—chocolate.

McShea goes through a door to the factory, which is full of natural light, industrial noise, and a rich, biting chocolate smell. “That sharpness is the acetic acid,” he says, pushing buttons and flipping switches next to giant tanks of chocolate until it is quiet enough to talk. “Remind me to start all that back up again.” In the tanks, chocolate paste is conched, or gently ground for smoothness, and heated to over 70°C. Conching refines flavors and drives off the acetic acid produced during cocoa bean fermentation.

“Unfermented cocoa beans have a nasty, astringent taste,” explains McShea. To develop the chocolate taste, harvested beans undergo about a week of spontaneous fermentation, with yeast generating ethanol, lactobacilli producing lactic acid, and acetobacilli making acetic acid. McShea’s research and development for Theo

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Chocolate focuses on identifying and quantifying these and other compounds produced during fermentation and processing. “We’re developing high-tech methods to understand chocolate quality, and ultimately, the chemistry of good food in general.” That’s the source of his motto: “better science through chocolate.”



“We want to understand the characteristics of perfect chocolate at the molecular level,” says McShea. He had no prior chocolate experience before joining the company, but he knows how to develop an assay, so he is focusing on the quantitative analysis of cocoa. For on-site experiments, he has a small research space at the chocolate factory, behind a door marked “super secret chocolate laboratory,” but he mainly works with collaborators from Seattle to Cleveland to Manchester, England. Currently, the chocolate team is developing chromatography and mass spectrometry methods that generate profiles of the volatile compounds released by fermented cocoa beans. The goals are to find biomarker compounds and specific chemical profiles that indicate bean quality, and possibly country of origin.

As proof-of-concept, McShea and colleagues recently published two papers showing that chemical profiling can detect cocoa beans that have spoiled. Beans stored under dry conditions had higher amounts of acetic acid than beans stored under moist conditions. Two pyrazines –organic ring molecules associated with unpleasant, earthy odors–were higher in the poorly stored beans (*J Chromatogr A*, 1217:1963-70, 2010). Although a professional might catch spoiled beans by sight, taste, or smell, McShea says that electronic tests “could run 24/7,” and would be more sensitive than current methods, which include using what McShea calls a “bean guillotine” to simultaneously cut an array of beans in half

lengthwise, for visual inspection.

McShea's motto: Better Science Through Chocolate

McShea's research projects are funded by the Washington Technology Center, which supports state business development. He is also pursuing federal funding to study the health benefits of chocolate, which is an anti-inflammatory and lowers blood pressure, and find ways to make it even healthier. "Cocoa contains several substances that may help to prevent cardiovascular diseases like myocardial infarction or stroke," says Dirk Taubert, who studies the effects of chocolate at the Department of Pharmacology at University Hospital of Cologne, Germany. "Even in low amounts, cocoa-rich chocolate can lower blood pressure." (Of course, eating enough to cause weight gain offsets any benefits, Taubert cautions.)

McShea's interest in the physiological effects of cocoa is partly based on the work of Taubert and colleagues, who have shown that chocolate's health benefits stem from polyphenols. These organic molecules are found in all fruits and vegetables, but are especially high in cocoa. Some polyphenols are strong antioxidants that neutralize oxygen radicals.

Chocolate flavor, especially the bitterness and sharpness, is strongly influenced by these polyphenols, but they also add mouth-puckering properties, so McShea says, "You can't just shovel antioxidants into chocolate or it will taste horrible. But if you make a properly balanced mixture, it will taste superb." With that, McShea restarts the machines, removes the hair net, and goes into the super secret chocolate laboratory to find that perfect balance.