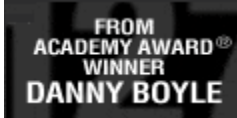


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Rival Candy Projects Both Parse Cocoa's DNA

By **ANDREW POLLACK**

Scientists say they have determined the complete DNA sequence of the tree that produces cocoa beans, an accomplishment that is expected to vastly accelerate efforts to assure a stable supply of chocolate and to make it better-tasting and healthier.

But there are two separate groups vying for credit in what some might consider the research arm of a chocolate factory war.

The candy maker **Mars** is expected to announce on Wednesday that a project it financed has essentially completed the raw sequence of the genome of the cacao tree, and that it would make the data freely available to researchers.

The announcement upstages a consortium involving French government laboratories and **Pennsylvania State University** that is backed in part by a competitor of Mars, Hershey. This group says it has also completed the sequence, but cannot discuss it until its paper analyzing the genome is published in a scientific journal.

The rivalry between the two big chocolate companies' projects in some ways mirrors what occurred in the race to sequence the human genome, between Celera Genomics and the publicly financed Human Genome Project. That battle was officially declared a tie.

Still, scientists in both groups say that cocoa farmers, candy companies and chocolate lovers will benefit from having two sequences, of different varieties of cacao, that can be compared.

"This will help guarantee a sustainable future for cocoa for the farmers, the consumers and Mars Inc.," Howard-Yana Shapiro, the head of plant research at Mars, said in an interview.

Having the DNA information, he said, could help in breeding trees that have higher yields and are more resistant to diseases. The cocoa crop in Brazil, for instance, was decimated some years ago by a fungal disease called witches' broom.

Today, about 70 percent of the world crop is grown in West Africa, and several million small farmers depend on it for their livelihoods. Scientists say it might be possible to as much as quintuple the output of beans per acre in Africa through breeding that relies on genetic information.

Mars, the maker of Snickers, M&M'S, Milky Way and other confections, announced two years ago that it would spend \$10 million over five years to sequence and analyze the cocoa genome, in a project involving the Department of Agriculture, **I.B.M.** and some academic collaborators. The analysis is only now getting under way in earnest.

Dr. Shapiro said a goal of the project was to make sure the genetic data was available for all to use without intellectual property restrictions. Those gaining access to the data on the group's Web site www.cacaogenomedb.org have to agree not to patent anything, like specific genes, from their findings.

He said that while Mars would gain from larger supplies and potentially lower prices for cocoa, the company would have no special advantage over other companies.

"We have a sustainable supply of cocoa, but so does everybody else," he said.

Mark J. Gultinan, a professor of plant molecular biology at Penn State, a leader of the other effort, said his group also intended to make its data freely available, though it would not explicitly prohibit others from patenting inventions made by using the research.

Dr. Gultinan said the new genetic information could lead to chocolate that tastes better and contains more flavonoids, ingredients that scientists think may be healthful. He said one of his graduate students spent five years isolating and studying just four genes involved in making flavonoids.

"After we sequenced the genome," he said, "we got all the genes in a couple of days."

Dr. Gultinan said there had initially been efforts to do one genome project, but that Mars and the Agriculture Department "decided to go it alone, so we decided to keep doing what we had planned to do."

Raymond J. Schnell, a geneticist at the Department of Agriculture's Subtropical Horticulture Research Station in Miami, said the Mars project started before the other one. He said his group wasn't trying to upstage the other consortium's paper, but that the genome data was being released now because it was ready.

The tree, known officially as *Theobroma cacao* (meaning “food of the gods”), contains about 420 million DNA units, represented by the letters A, C, G and T. That is fairly small for a plant. The human genome has about three billion units.

The Mars group used so-called second generation sequencers made by **Illumina** and 454, a division of Roche. But that left some gaps that had to be resolved by resorting to the older sequencing technique known as Sanger sequencing.