

PHOTO ESSAY

BIOTECHNOLOGY

Genetically Modified Crops

From St Louis to India

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Anthropology may have been slow to engage the issue of genetically modified (GM) crops, but this new technology intersects many core anthropological questions. The following images juxtapose contested (but linked) terrains in St Louis and Andhra Pradesh (southern India).

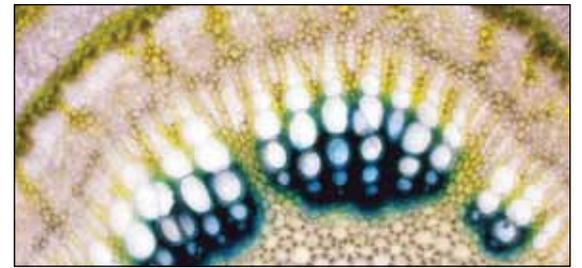
St Louis is a global hub of GM crops chiefly because of Washington University and the Monsanto Company. Among Washington University's contributions were Mary-Dell Chilton's pioneering work on the use of *Agrobacterium* to transform plants, key findings by Wayne Barnes on the now widely-used Bt genes which make crops produce insecticide, and Roger Beachy's use of genetic modification to develop virus-resistant plants. Monsanto has dominated commercial agricultural biotechnology worldwide, and owns a commanding portfolio of gene patents including many based on research at Washington University. St Louis is also home to the non-profit Donald Danforth Plant Science Center, which houses ILTAB (the International Laboratory for Tropical Agricultural Biotechnology)—a lab focused on GM crops for farmers in the global South. Not surpris-

ingly, St Louis has on occasion been a lightning rod for anti-GM activism.

India has played a pivotal role in GM crop development and controversy for years. By 2000, much of the debate on GM crops had turned to their potential role in feeding populations the global south (Stone 2002, "Both Sides Now," *Current Anthropology* 43:611; Stone 2005 "A Science of the Gray" in *Embedding Ethics*). However the main GM crop available to farmers was Bt cotton; this put India, with its enormous but highly troubled cotton sector, directly in the global spotlight. Indian cotton farmers had become classic victims of the pesticide treadmill, suffering heavy predation by some of the pests that Bt cotton was intended to combat. India was also home to one of the world's largest and most energetic NGO sectors; these organizations have aggressively challenged Bt cotton on a variety of grounds, even as it has been widely adopted by Indian farmers.

The following images are from my own participation in biological research at the Donald Danforth Plant Science Center, long-term fieldwork in rural Warangal District in a cotton growing area of Andhra Pradesh, and intermittent fieldwork in St Louis.

A more fully referenced version of this essay appears at <http://tinyurl.com/7dsp56s>.



Trangenic Crops Research at ILTAB ILTAB, 2000. In 2000 I spent a semester at ILTAB participating in a study evaluating a promoter for use in cassava. (Promoters are DNA regulatory sequences that determine where, and under what conditions, genes express.) The blue cells show where the promoter is causing the GUS reporter gene to express in specific areas of this tobacco stem. Tobacco was being used as a model plant because the ultimate target, cassava, is a very difficult plant to manipulate by genetic modification. Unlike most current commercial GM crops, GM cassava may offer unique advantages to smallholders in the global south (Stone 2002, "Both Sides Now," *Current Anthropology* 43:611). Fall 2000. Photo courtesy Glenn Davis Stone

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Pacha Purugu In Warangal. By the late 1990s south Indian cotton farms were overrun with Lepidopteran (caterpillar) pests. The most destructive was the "American Bollworm"—known in Telugu as *pacha purugu* or "green caterpillar." Since Bt cotton was toxic to these pests, it was heralded as a solution to a pressing agricultural problem. But whether bollworm predation was best seen as a problem in need of a technological intervention, or as a symptom of systemic problems created by other technological interventions, is an interesting anthropological question. Pest-prone hybrid cotton had spread quickly in the 1990s along with heavy reliance on pesticides, which quickly lost effectiveness on *pacha purugu*, contributed to agricultural deskilling, and plunged farmers into debt (Stone 2007, "Agricultural Deskilling and the Spread of Genetically Modified Cotton," *Current Anthropology* 48:67). Summer 2002. Photo courtesy Glenn Davis Stone



St Louis to Andhra Pradesh. Bt cotton—genetically modified with Chilton’s *Agrobacterium* method, containing a variant of the Bt gene used by Barnes, patented by Monsanto, and sold by an Indian seed company partly owned by Monsanto—was approved in 2002 for sale in India. This followed four years of intense controversy, including marches to protest the use of the so-called “Terminator Technology” that was actually not being used anywhere in the world. Summer 2002. Photo courtesy Glenn Davis Stone



Penu Banka. In Warangal, Bt cotton’s initial success in reducing bollworm predation was quickly followed by surges in non-target insects like the aphids (penu banka) covering this cotton leaf. A similar pattern has been reported in China, where in some cases non-target pests have eroded the early benefits from Bt cotton (Stone 2010, “The anthropology of genetically modified crops,” *Annual Review of Anthropology* 39:381). Within a few years, the first reports of Bt resistance in bollworms had also appeared in India (Tabashnik and Carrière 2010, “Field-Evolved Resistance to Bt Cotton,” *SW Entomologist* 35:417). Summer 2008. Photo courtesy Glenn Davis Stone



Early by Cotton Adopters. Farmers in rural Warangal display the village’s first box of Bt cotton seed, purchased for 1600 rupees (approximately \$40). This amount was four times the cost of a box of convention cotton seed, and 32 times the cost of a day of farm labor. Summer 2002. Photo courtesy Glenn Davis Stone



Resistance and Counter-Terrorism in St Louis. In 2003 St Louis hosted the agribusiness-friendly World Agricultural Forum, prompting activists and scholars to plan a “Biodevastation” counter-conference across town. Advised by the FBI Counterterrorism office, which had been egged on by Monsanto (FBI 2003, “Memo to Counterterrorism branch St Louis re: World Agricultural Forum,” by FOIA request), city police arrested and detained would-be conference participants on charges later admitted to be baseless. Here Ignacio Chapela (UC Berkeley), John Peck (Family Farm Defenders) and Jesse Reynolds

(Students for Responsible Research) give presentations on effects of biotechnology on industry-academy relations. The empty chair was for speaker Sarah Bantz (Missouri Resistance Against Genetic Engineering) who had been arrested and jailed for allegedly driving with an unfastened seatbelt and for carrying Vitamin C pills. The police had also arrested and detained members of an anti-GM group for bicycling without a license (a non-existent law in a city that does not issue bicycle licenses). Police also forced their way into a house where conferees were staying, claimed a box of roofing nails to be a weapon, slashed bicycle tires, removed artwork, submitted a woman to a strip search, urinated on the inhabitants’ clothing, and made arrests for inhabiting a condemned building (which had just been condemned by an inspector who came with the police). The St Louis Police fought an ACLU lawsuit for six years before issuing an apology and paying monetary damages (Ratcliffe 2009, “City police apologize for raids in 2003,” *St Louis Post-Dispatch*, 25 Aug). Spring 2003. Photo courtesy Glenn Davis Stone



Cultivation Bias. A Warangal woman farmer who was an early adopter of Bt cotton hand-waters her recently-planted seeds. Normally hand watering is unheard of, and this was the first time I had ever seen it. But like most early adopters, she lavished extraordinary attention on the field with the expensive Bt cotton seed. Such fields were then reported by economists as evidence that Bt cotton had an inherent “yield advantage” (Stone 2011, “Field vs. Farm in Warangal,” *World Development* 39:387). Summer 2002. Photo courtesy Glenn Davis Stone



Transgenic Crops at ILTAB, 2011. ILTAB director Claude Fauquet talks with a group of Washington University students. Work on genetic modification of cassava has progressed significantly in the last 10 years, both in nutritional enhancement and in virus resistance. Yet GM cassava still remains many years from release. Despite extraordinary funding from the Gates Foundation and other philanthropies, ILTAB struggles to fund its research. Cassava will never be a big money maker. Spring 2011. Photo courtesy Glenn Davis Stone