

Ventria Bioscience and the Controversy over Plant-Made Medicines

“Ventria is dedicated to leading the development of plant-made pharmaceuticals that promise affordable human health products for the global community.”

Scott Deeter, president and CEO, Ventria Bioscience

It was a warm, sunny day in mid-July 2004—perfect conditions for growing rice in California’s lushly irrigated Sacramento Valley. But *their* rice was not in the ground, thought Scott Deeter with mounting frustration. Deeter was the president and CEO of Ventria Bioscience, a Sacramento, California–based biotechnology firm. The 20-person start-up had developed an innovative process to produce pharmaceutical proteins in the seeds of genetically modified rice. Ventria believed that its first product—a medicine designed to lessen the severity of childhood diarrhea—held great promise for public health, particularly in the developing world. The company had tested its bioengineered rice in small test plots near its headquarters. That spring, it had sought to plant at least 120 acres to begin commercial-scale production. But in its effort to obtain the necessary permits, Ventria had been stymied at nearly every turn. Facing vigorous opposition from environmentalists, food safety activists, consumer advocates, and rice farmers, the California Secretary of Agriculture had denied the company’s request to plant rice on a commercial scale. Now Deeter had to figure out the best way forward for the fledgling, venture capital–backed firm.



Ventria Bioscience

Ventria Bioscience (originally called Applied Phytologics) was founded in 1993 by Dr. Raymond Rodriguez, a molecular biologist on the faculty of the University of California–Davis. In the early 1980s, Rodriguez and his graduate students had embarked on an ambitious research program aimed at improving the productivity of rice, a crop he recognized as being of great importance to human nutrition worldwide. With the support of a state government grant to encourage the commercialization of basic scientific research, Rodriguez

By Anne T. Lawrence. Copyright © 2008 by the author. All rights reserved. An earlier version of this case was presented at the 2008 annual meeting of the North American Case Research Association. The author is grateful to Dr. Raymond Rodriguez for his assistance in the preparation of this case. The author also gratefully acknowledges research funding provided by the Don and Sally Lucas Foundation.

began to develop techniques to “express” medically useful proteins in rice plants, from which they could be extracted and purified. He explained,

We were working on expression technology—taking a gene that encodes for a medical protein and using recombinant DNA technology to produce that protein in the plant. The key technology for Ventria was the ability to express a protein abundantly in a harvestable organ or tissue. That was the breakthrough. Roots or tubers like a potato, fruits like a tomato, ears of corn, or grains of rice—those are harvestable. Expressing the protein of interest in stems and leaves is a waste of effort and resources. If you can focus your overexpression technology on a harvestable organ, you are way ahead in terms of efficiency. Very few research labs or ag biotech companies could do this at that time.

In 1993, Rodriguez incorporated Applied Phytologics to commercialize his techniques for producing medical proteins in rice. In his search for funding, he approached Dr. William Rutter, the founder and board chairman of the Emeryville biotechnology firm Chiron, with whom he had earlier worked as a postdoctoral fellow at the University of California–San Francisco. Rutter was immediately attracted to the potential of the new venture. Rodriguez recalled,

[Rutter and I] both like disruptive technologies. Neither of us was interested in incremental improvements in yield and cost efficiencies. We *were* excited, however, by the prospects of order-of-magnitude improvements—thousand-fold increases in yield with similar fold decreases in costs. For a technology-based industry, that’s really critical. We wanted to revolutionize the biopharmaceutical industry by putting production on a metric ton scale instead of a gram or kilogram scale.

With the help of an early “angel” investment from Rutter, Rodriguez opened a lab in Sacramento in 1994 and recruited a small staff of scientists and technicians, including some of his former graduate students. Within a few years, the new company launched research on around 15 different medical and industrial proteins, filed dozens of patent applications, and continued to improve its core technology, which eventually became known as the “ExpressTec System.” In the venture’s early years, Rodriguez chaired the board, as well as overseeing the company’s R&D activities.

As the venture continued its research and development, Dr. Rodriguez gradually built a board of directors of biotech leaders and seasoned entrepreneurs. Early board members included Dr. William J. Rutter and Dr. Pablo Valenzuela, cofounders of Chiron Corporation and early pioneers in biotechnology; William H. Rutter, an attorney and venture capitalist; Ron Vogel, president of Great Western Malting; and bioentrepreneur Dr. Roberto Crea. In 2000, Thomas N. Urban, the former chairman and CEO of Pioneer Hi-Bred International, Inc., a leading agricultural seed company, was recruited to chair the board. Melvin Booth, the former CEO of MedImmune, later became a director. So did William W. Crouse, a general partner of HealthCare Ventures, and David Dwyer, a general partner in Vista Ventures; both venture capital funds specialized in biotechnology. Members of the board and their organizations collectively provided more than 85 percent of the company’s financing.

Overseeing the company’s day-to-day operations was a management team consisting of Frank E. Hagie, Jr., president and CEO; Dr. Delia R. Bethell, a biologist and Ventria’s vice president of clinical development; and Dr. Ning Huang, a molecular biologist and vice president of research and development. (Dr. Huang had received his Ph.D. from Dr. Rodriguez in 1990.) In 2000, Dr. Rodriguez resigned from the board to devote more time to his university research and teaching. As chairman emeritus, Dr. Rodriguez continued to support the company but did not participate directly in its day-to-day operations or governance.



Plant-Made Medicines

Designing plants to produce pharmaceuticals—the work that Rodriguez and his colleagues were pursuing—represented the second wave of agricultural biotechnology. The first wave concentrated on adding traits, such as insect resistance and herbicide tolerance, to edible crops—such as corn, canola, and soybeans—and to fiber crops such as cotton. For example, “RoundUp-Ready” soybeans, developed by Monsanto, were genetically engineered to be impervious to the herbicide RoundUp, allowing farmers to spray the field with weedkiller without hurting the soybean crop. “YieldGuard” corn plants were genetically engineered to resist the corn borer, a common insect pest. The second wave, of which Ventria was part, involved the use of genetic engineering to “phytomanufacture” protein pharmaceuticals and other commercially valuable compounds in plants.

Plant-made medicines, particularly those made in rice, held many real and potential benefits. First, it was too expensive to chemically synthesize anything but the smallest proteins. Most therapeutic proteins, therefore, were produced in mammalian or microbial cell cultures. This was costly and sometimes dangerous, as animal tissues could transmit viruses or prions (such as the infectious agents that caused “mad cow” disease). Second, plant-grown medicines could also be produced much less expensively than they could be using conventional, mammalian cell-culture technology. Third, rice and other agricultural crops could be stored at room temperature from months to years, allowing processing facilities to operate year-round and respond quickly to customer demand. Fourth, the well-established existing infrastructure for harvesting, storing, and milling rice could support the production of rice-based medical proteins. A final advantage of using rice was that medical proteins produced in food crops could be delivered orally without extensive purification. The hypoallergenic and hyperdigestible rice starch served as an ideal natural medium for the recombinant protein.¹

On the other hand, the technology also carried potential risks. Most plant-made medicines were grown in crops also used for food, posing the danger that pharmacologically active plants might become mistakenly commingled with and contaminate the human or animal food supply. Pharmaceutical plants might crossbreed with wild plants or food crops, creating unwanted hybrids, or pose a threat to insects. Also, since the modified genes being transferred into plants often originated as human or animal genes, the potential ethical issues were profound. The public’s reactions to plant-made pharmaceuticals were likely to be extreme, given the high benefits, potential risks, and deep moral quandaries posed by these new technologies.

One earlier incident, in particular, had highlighted the potential risk. In 2001, ProdiGene, a Texas biotech company, had planted a test plot of corn that had been genetically engineered to produce a pig vaccine. The following year, the same field was planted with conventional soybeans, which became contaminated by volunteer corn that had sprouted from the previous season’s seeds. By the time this was discovered, the soybeans had been harvested and stored in a silo containing 500,000 bushels. The genetically modified corn tainted the entire lot of soybeans, which had to be destroyed. ProdiGene was fined \$250,000 and had to pay for the cleanup. Although the contaminated soybeans never reached the food supply, some saw the incident as a warning of the possible risks of commingling.²

¹ Scott Deeter, “Prepared Remarks,” House of Representatives, Small Business Committee, Hearing on Different Applications for Genetically Modified Crops, June 29, 2005.

² “Pharming Reaps Regulatory Changes,” <http://pewagbiotech.org/buzz>.

In 2004, seven companies and research organizations in the United States held permits for field tests of genetically engineered pharmaceutical plants.³ Most, like Ventria, were small, private firms that relied mainly on venture capital as they worked toward the goal of an initial public offering or acquisition by a larger firm. Many were thinly capitalized. In 2004, according to the Biotechnology Industry Organization (BIO), an industry trade association, 60 percent of all biotechnology firms had less than a two-year supply of cash on hand and 30 percent had less than a one-year supply. Reflecting a high concentration of professionals, wages in the biotechnology industry were relatively high, averaging \$65,775 in 2004; top companies invested \$130,000 per employee in research and development. With high wages and research costs, many of these firms had high burn rates. A successful product launch, according to BIO, could take 10 to 15 years and cost as much as \$1 billion in private investment.⁴

Lactiva and Lysomin

In April 2002, Ventria's board appointed Deeter to succeed Hagie as president and CEO. Born in Kansas, Deeter had completed his undergraduate work in economics at the University of Kansas and had then gone on to earn an MBA at the University of Chicago and a Masters of Science at the London School of Economics. He had begun his career in the technology and life sciences group of the Wall Street investment bank Salomon Brothers. He then took a position with the agribusiness firm Cargill, where he worked on a joint venture with Hoffman LaRoche to make human health products from soybeans. From Cargill, Deeter moved to Koch Industries as vice president for agriculture, where he was involved in negotiations to buy Purina Mills in 1998. In 1999, Deeter left Koch to launch CyberCrops, a venture capital-backed website that hosted an online grain exchange service and provided news, weather, and other information to farmers. Deeter sold the business in April 2001, after the dot-com firm was unable to attract additional capital.⁵

Deeter's first task as the new CEO of Ventria was to help Rodriguez and the board winnow down the professor's long list of projects to one or two that had the greatest likelihood of successful commercialization. Deeter and his team analyzed some two dozen possible medically active proteins. They asked three key questions of each one. Did it meet a demonstrated need? Was another company already working on it? Could it be delivered orally or topically, as opposed to injected? Rodriguez later recalled,

What we were looking for was a protein that was extremely valuable to human health and in extremely short supply, with no competition, that could be administered orally in a partially purified form.

³ "Regulation of Plant-Based Pharmaceuticals," Congressional Research Service Report for Congress, March 8, 2005, p. 1. Other sources give a higher figure for the number of organizations involved in biopharming. See, for example, "Biopharming: The Emerging World Market of Plant-Based Therapeutics," *Theta Reports*, November 2002; "The Transgenic Plant Market—Profits from New Products and Novel Drugs," Drug and Market Development Corp., August 2002; and "World Agricultural Biotechnology: Transgenic Crops," Freedomia Industry Study, March 2002, cited in the *Federal Register* 68, no. 151 (April 6, 2003), p. 46435.

⁴ "Biotechnology Industry Facts" and "Importation of Prescription Drugs," Biotechnology Industry Organization, <http://www.bio.org>. These figures provided by BIO are for the biotechnology industry as a whole, of which plant-made pharmaceuticals represent only a small fraction.

⁵ Biographical information on Deeter appears at <http://www.ventria.com>.

The proteins Deeter and his team selected were *lactoferrin* and *lysozyme*, two compounds naturally found in human breast milk. Medical researchers had long recognized that breast-fed babies suffered less from diarrhea than did bottle-fed babies. They had hypothesized that lactoferrin and lysozyme—both considered “natural antibiotics”—conferred some protection against bacterial gastrointestinal illness. Rodriguez had developed a process for producing these compounds abundantly in the grains of genetically modified rice plants. Since the 1960s, the standard treatment for severe diarrhea had been oral rehydration solution (ORS), a mixture of salts and sugars that had been credited with saving the lives of millions. Ventria’s scientists believed that adding lactoferrin and lysozyme to ORS would improve the effectiveness of this commonly used therapy for gastrointestinal illness. The company branded its lactoferrin and lysozyme products *Lactiva* and *Lysomin*, respectively.

The potential market for such a product was huge, the company reasoned. The World Health Organization estimated that the world’s children suffered 4 billion episodes of diarrhea each year. Nearly 2 million of these children died annually from complications of the disease, chiefly dehydration and malnutrition. Just 65 acres of pharmaceutical rice could generate 1,400 pounds of lactoferrin, enough to treat 650,000 children with dehydration, the company estimated.⁶ It also believed that these compounds might be of value in the treatment of diarrhea suffered by tourists and military personnel and in the treatment of inflammatory bowel disease.⁷ The company believed early adopters might include infant formula companies, drug companies that produced ORS, and public health organizations like the Red Cross.

Regulation of Farmed Pharmaceuticals

In order to move forward with its plans to commercialize *Lactiva* and *Lysomin*, Ventria needed both federal and state regulatory approval. In 2004, the regulatory rules covering plant-made pharmaceuticals were complex and evolving. At the federal level, three agencies held partial jurisdiction over plant-made medicines.

FDA: The Food and Drug Administration (FDA) was responsible for the safety and effectiveness of food and medicines. Normally, a medicine produced in a genetically modified plant was subject to the same mandatory premarket approval procedures as any other medicine. However, Ventria had sought classification of *Lactiva* and *Lysomin* as “generally recognized as safe” (GRAS) food additives, which required a lower threshold for approval. A panel of scientific experts commissioned by the company had concluded that *Lactiva* and *Lysomin* met the GRAS standard, and the company had submitted these results to the FDA. In 2004, however, the FDA had not yet cleared Ventria’s products for commercial sale. The FDA also maintained a “zero-tolerance” standard for pharmaceutical crop products in any food intended for animals or humans; any commingling of pharmaceutical crops and food crops was strictly forbidden. The FDA considered fields in which pharmaceutical crops were grown to be manufacturing facilities, and the agency had a right to inspect them. If necessary, it could condemn contaminated food and enjoin the manufacturer.

⁶ “Tending the Fields: State and Federal Roles in the Oversight of Genetically Modified Crops,” Pew Initiative on Food and Biotechnology, www.pewtrusts.org/en/research-and-analysis/reports/0001/01/01/tending-the-fields, p. 97.

⁷ Scott Deeter, “Prepared Remarks,” House of Representatives, Small Business Committee, Hearing on Different Applications for Genetically Modified Crops, June 29, 2005.

EPA: The Environmental Protection Agency (EPA) was responsible for the environmental safety of food crops genetically engineered to contain pesticides or other substances potentially harmful to the environment. The agency's rules required pesticides—including those engineered into a plant—to have "no unreasonable adverse impact on the environment." Pesticide-containing plants required experimental use permits for most field tests. Because Ventria's rice did not contain pesticides, these rules did not apply to it.

USDA: For its part, the U.S. Department of Agriculture's Animal and Plant Health Inspection Service (known as APHIS) had oversight of genetically modified crops being tested in fields. Plants that were genetically modified to produce pharmaceuticals always required an APHIS permit, which generally specified acceptable field testing, storage, transportation, chain of custody, and auditing requirements. APHIS forwarded its permits to the relevant state agency, which could add its own requirements. The service also conducted its own field inspections; it inspected all pharmaceutical field trials at least annually.⁸ Since 1997, Ventria had applied for and received dozens of permits from APHIS to field-test its pharmaceutical crops.

In 1986, the federal government adopted a Coordinated Framework for the Regulation of Biotechnology, which proposed to use existing agencies and laws to regulate the products of biotechnology. Michael Rodemeyer, former executive director of the Pew Initiative on Food and Biotechnology, explained the complexities of this regulatory approach for both regulators and those they regulated:

On one level . . . the Coordinated Framework is very easy to describe. The FDA is responsible for food safety, the EPA is responsible for microbes and pesticides, and APHIS is responsible for all plants. In practice, however, it is much more complex than that. Why? In part, because some products fall into multiple categories. For example, a corn plant that has been engineered to produce its own pesticide is a plant, a pesticide, and a food, so it falls under the purview of all three agencies. In addition, each of the three agencies uses different laws to govern the products of biotechnology, and most of these laws were passed well before the advent of biotechnology.⁹

The consequence of this system, for biotechnology firms, was a complex regulatory landscape with multiple, overlapping requirements.

California Rice Industry

In California, genetically engineered rice required the approval not only of federal and state regulators, but also indirectly of the rice industry itself.

California was home to a major rice industry. The state was the leading producer of short- and medium-grain rice in the United States and second only to Arkansas in total volume of rice produced. (Other major rice-producing states were Missouri, Texas, Louisiana, and Mississippi.) In 2003, California produced 1.75 million tons of rice on 507,000 acres. Almost all of the state's rice fields lay in a swath of land abutting the Sacramento River, a broad valley that relied on the river and its tributaries for irrigation. The crop generated annual sales of more than \$500 million.

⁸ "Regulation of Plant-Based Pharmaceuticals," CRS Report for Congress, p. 4.

⁹ "Opportunities and Challenges: States and the Federal Coordinated Framework Governing Agricultural Biotechnology," Pew Initiative on Food and Biotechnology, May 2006, pp. 9–10.

Forty percent of California rice was exported, mainly to Japan, Taiwan, Korea, and Turkey. The rest was consumed domestically in food, pet food, and beer. Although the United States produced only 2 percent of the world's rice, it accounted for 14 percent of the international rice trade; the nation was second only to Thailand and Vietnam in rice exports.¹⁰ However, the U.S. share of the world rice trade was declining; it had dropped from 28 percent in 1975 to 12 percent in 2003.¹¹

Rice producers in California, as in much of the developed world, used highly sophisticated technology. Farmers used laser-guided grading equipment to position perimeter levees and level their fields precisely to enable an even covering of five inches of water during the growing season. From the fourth week in April to the second week in May, weather permitting, skilled pilots used low-flying, small aircraft guided by global positioning systems to deposit pregerminated seeds onto the flooded fields. Within a few days, the plants would emerge above the surface of the water, and within a few weeks the fields would be densely covered with bright green, grasslike stalks. The grains of rice—the plant's seeds—developed in late summer, when the rice was about three feet tall. When the rice matured in September and early October, farmers drained the fields and harvested the crop with combines, which separated the grain from the stalks. After the harvest, the rice was transported to a drying facility and from there to a mill. At the mill, the rice was processed to remove the inedible hull and then either sold as brown rice or further polished into white rice. Many mills used laser sorters to remove broken or immature grains.¹²

The two stages of rice production, farming and milling, defined the two major segments of the industry. California was home to more than 2,000 rice farmers, many of whom continued to operate as family-owned businesses. They were organized through their trade association, the Rice Producers of California. Rice mills, which required significant capital investment, tended to be owned by larger organizations. Leading millers in California included agribusiness giants ADM, Far West Rice, Pacific International, and Sun West. The Farmers Rice Cooperative, owned by a cooperative of 800 growers, also operated several mills.

To protect the interests of its rice industry, the California state government had established a body known as the California Rice Commission (CRC), declaring, "The production and milling of rice in this state is . . . affected with a public interest."¹³ The commission's work was supported by an assessment on farmers and millers, based on their volume of production. The CRC was authorized by law to "promote the sale of rice, educate and instruct the wholesale and retail trade with respect to the proper handling and selling [of] rice, and conduct scientific research."¹⁴

In 2000, California had passed the Rice Certification Act (known as AB 2622), empowering the CRC to appoint an advisory board, which would have the right to review any varieties of rice "having characteristics of commercial impact," except for rice planted for research purposes on 50 or fewer acres. The enabling legislation stated,

There is a growing need to maintain the identity of various types of rice to satisfy increasing consumer demand for specialty rices. This demand requires providing the industry with the ability to establish the terms and conditions for the production

¹⁰ California Rice Commission Statistical Report, May 1, 2005.

¹¹ "Tending the Fields," p. 92.

¹² Information from the California Farm Bureau Federation, the U.S. Rice Foodservice, and personal observation.

¹³ California Food and Agricultural Code, Section 71005.

¹⁴ California Legislative Counsel's Digest, <http://www.leginfo.ca.gov>.

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and handling of rice in order to minimize the potential for the commingling of various types of rice, and in order to prevent commingling where reconditioning is infeasible or impossible.¹⁵

By statute, the advisory board was composed of four producers (farmers), four handlers (millers), and four public representatives.¹⁶ The job of the advisory board was to recommend to the Secretary of Agriculture “proposed regulations [on] planting, producing, harvesting, transporting, drying, storing, or otherwise handling rice . . . including, but not limited to, seed application requirements, field buffer zones, handling requirements, and identity preservation requirements.” Once the secretary had received a recommendation from the advisory board, he was required within 30 days to issue the proposed regulation, decline and give the advisory board a written explanation, or request additional information.¹⁷ Although the advisory board could not legally prohibit the production of any particular rice, including genetically modified rice, as a practical matter its recommendations to the secretary carried considerable weight. As the CRC itself pointed out, “No other commodity in the U.S. has a similar mechanism to protect its industry.”¹⁸

The CRC Advisory Board Considers Ventria’s Protocol

In 2003, as Ventria ramped up to commercial-scale production, Deeter and his team made plans to expand their acreage of rice planted. Their goal was to plant 120 acres during the 2004 growing season, an amount that, for the first time, exceeded the 50-acre rule and therefore fell under the CRC advisory board’s authority. Accordingly, the company began discussions with members of the advisory board to develop an acceptable production protocol. During these talks, Ventria stipulated that its rice had a “commercial impact” and agreed to a number of provisions to address the rice industry’s concerns. For example, the company agreed to establish buffer zones around its plots, to transport its rice in covered trucks, and to use dedicated processing equipment.

On Monday, March 29, 2004, the advisory board of the CRC held its regular meeting at the Best Western Bonanza Inn in Yuba City, in the heart of the Sacramento Valley rice belt. Heading the agenda was a discussion of Ventria’s draft protocol. Discussion was animated. Members who had been involved in the discussions with Ventria recommended that the board approve the draft protocol. Several farmers, however, expressed concern that the presence of genetically modified rice in California posed a serious commercial threat, particularly to the state’s export markets. Their concern seemed to be validated by the Japanese Rice Retailers Association, which wrote the advisory board:

From the viewpoint of rice wholesalers and retailers in Japan, it is certain that the commercialization of GM [genetically modified] rice in the U.S. will evoke a distrust of U.S. rice as a whole among Japanese consumers, since we think that it is practically impossible to guarantee no GM rice contamination in non-GM U.S. rice. As you know, most Japanese consumers react quite negatively to GM

¹⁵ Ibid.

¹⁶ The public representatives were drawn, one each, from the California Crop Improvement Association, the California Warehouse Association, the California Cooperative Rice Research Foundation, and the University of California.

¹⁷ Legislative Counsel’s Digest.

¹⁸ “California Rice Certification Act,” California Rice Commission: *Serving the California Rice Industry* [newsletter], 6, no. 3 (March/April 2004).

crops. If the GM rice is actually commercialized in the U.S., we shall strongly request the Japanese government to take necessary measures not to import any California rice to Japan.¹⁹

Representatives from Californians for GE-Free Agriculture²⁰ and the Center for Food Safety both submitted written comments expressing opposition to the protocol.

After further debate and the passage of several amendments to strengthen the protocol—including a provision that Ventria plant its rice in southern California, far from the Sacramento Valley—the advisory board voted 6 to 5 to approve Ventria's protocols. Voting in favor were all four public members, one farmer, and one miller. Most of the farmers and millers voted "nay."²¹ Whether for or against, all seemed to agree that the industry was moving into uncharted water. "There's a learning curve here for producers," said Ronald Lee, a farmer. "Some have some knowledge. Some have very little. We're entering new territory here."²²

At the request of the company, the CRC recommended "emergency status" for Ventria's protocol review. This designation would give the California Secretary of Agriculture 10 days to approve or reject it, without a period of public comment, so the company could move forward in time for the spring 2004 planting season. Over the next 10 days, the Secretary of Agriculture was lobbied from both sides. The Biotechnology Industry Association expressed its support for the emergency status:

[We] are writing to express strong support for your authorization of a protocol approved by the California Rice Commission. . . . Plant-made pharmaceuticals offer an exciting approach to scalable, economically attractive biopharmaceutical manufacturing, producing broad access to exciting new health products to address many of the most prevalent human diseases.²³

Several environmental and consumer groups asked the secretary to deny the request for an emergency exemption. A number of rice farmers also spoke out in the press. "Consumers in Japan and many of California's other major rice export markets have already shown strong resistance to GM crops," said Greg Massa, a grower of organic rice. "Approval of this [Ventria] rice could shatter our years of hard work in building these markets and spell trouble for all California rice farmers."²⁴ Joe Carrancho, a grower and former president of the Rice Producers of California, commented, "If the Japanese have the perception—underline perception—that our rice has [genetically modified organisms] in it, then we're done. You can put a bullet in our head." He and environmentalists "may be apart on some issues, but on this one we're together," he said.²⁵

On April 9, the Secretary of Agriculture rejected the recommendation for emergency status for the protocol review, saying, "It is clear that the public wants an opportunity to comment prior to any authorization to plant."²⁶ He called for more information about federal permits and asked the CRC to consult with affected groups.

¹⁹ Quoted in Greg Massa, "Pharmaceutical Rice Is a No-Grow," *Sacramento Bee*, May 14, 2004.

²⁰ In this context, GE refers to "genetically engineered."

²¹ Minutes of the March 29, 2004, AB 2622 Advisory Board, provided to the author by the president of the California Rice Commission.


²² "State's Rice Farmers Fear Biotech Incursion," *San Francisco Chronicle*, April 8, 2004.

²³ Biotechnology Industry Association, letter to the Honorable A. G. Kawamura, April 5, 2004.

²⁴ "Plan Calls for Altered Rice Crops in State," *San Diego Union-Tribune*, March 27, 2004.

²⁵ "State's Rice Farmers Fear Biotech Incursion."

²⁶ "Modified Rice Won't Be Planted," *San Francisco Chronicle*, April 10, 2004; "Protein Rice Suffers Setback," *Sacramento Bee*, April 10, 2004.



Ventria's Opponents Mobilize

Even after the secretary's decision, the controversy continued to mount. In July, four advocacy organizations—Friends of the Earth, the Center for Food Safety, Consumers Union, and Environment California—produced a detailed report detailing their concerns about pharmaceutical rice in California. The groups submitted their report to the California Department of Food and Agriculture, the California EPA, and the California Department of Health Services, as well as to the public. In the document, the groups called for “a moratorium on the cultivation of Ventria's pharmaceutical rice and other pharm crops.”²⁷

The activist alliance made four arguments for a moratorium on pharmaceutical rice. First, it argued that contamination of food rice by genetically modified pharmaceutical rice grown outdoors was “inevitable,” because of multiple potential pathways:

Contamination of human foods with plant-made pharmaceuticals can occur through dispersal of seed or pollen. Wildlife, especially waterfowl, can transport seeds for long distances, as can extreme weather events such as floods or tornadoes. Harvesting equipment can carry seed residues to conventional fields, seeds can be spilled from trucks, or unharvested seeds can sprout as volunteers amid the following year's crop. Cross-pollination occurs at considerable distances in high winds or by insect, even with self-pollinating crops such as rice.²⁸

The report argued that Ventria's protocols did not offer sufficient protection against contamination:

The lack of detailed plans to prevent birds from spreading the pharm rice is particularly disturbing. California's Central Valley is one of the most important wintering areas for waterfowl in North America. Viable seed are known to pass through the gut of many waterfowl species, making waterfowl effective dispersal agents for many wetland plant species, including rice. . . .

Ventria's protocol also does not deal with the possibility of seed dispersal through flooding. . . . Historical records show that floods of various magnitude occur not infrequently in the Sacramento Valley. . . .

Ventria's . . . one-year fallow period following cultivation of its pharm rice means a greater likelihood of pharm rice volunteers contaminating a commercial rice crop grown subsequently in the same field. . . .

The 100-foot isolation distance from food-grade rice . . . may not be adequate to prevent cross-pollination.²⁹

What would happen if Ventria's rice did contaminate the food supply? Once commingling had occurred, the report continued, the potential for adverse impacts to human health was great. Possible consequences included infections, allergies, and autoimmune disorders:

While human lactoferrin has antimicrobial properties, it paradoxically poses the potential hazard of exacerbating infections by certain pathogens capable of using it as a source of needed iron. Such pathogens include bacteria that cause

²⁷ “Pharmaceutical Rice in California: Potential Risks to Consumers, the Environment, and the California Rice Industry,” Friends of the Earth, Center for Food Safety, Consumers Union, and Environment California, July 2004, p. 1.

²⁸ *Ibid.*, p. 6.

²⁹ *Ibid.*, p. 7.

gonorrhoea and meningitis, as well as [those] implicated in causing ulcers and certain forms of stomach cancer. . . . Ventria's rice-expressed lysozyme and lactoferrin have two characteristics of proteins that cause food allergies: resistance to digestion and to breakdown by heat. . . . Pharmaceutical proteins generated by inserting human genes into plants . . . are usually different from their natural human counterparts. These differences may cause the body to perceive them as foreign, resulting in immune system responses.³⁰

Finally, Ventria's rice could have serious environmental consequences if it crossbred with existing weed species, creating noxious "super weeds," the report argued:

Ventria's rice-produced pharmaceuticals have antibacterial and antifungal properties. If these traits are passed to related weed species such as wild and annual red rice, they could lend these weeds a fitness boost, promoting their spread.³¹



Moving Forward

In discussions with representatives of the CRC advisory board over the past year and a half, Deeter and his team had offered numerous concessions to address the concerns of rice farmers and others. The company had agreed to grow rice many miles away from any rice grown for food. It had promised to use dedicated equipment for field production, storage, and transportation and to use only processing equipment that was restricted to bio-engineered rice or had been thoroughly sanitized before reuse. The company had agreed to keep detailed logs and to allow third-party inspections. None of this, however, had been enough to satisfy the company's critics. In biotechnology, things always seemed to take longer, cost more, and face hurdles that could not have been anticipated when the company was started. Now another planting season had come and gone, and Ventria's investors appeared no closer to successful commercialization than they had been a year earlier.

Discussion Questions

1. What is the problem facing Scott Deeter and Ventria?
2. What groups have a stake in Ventria's actions? Identify the relevant stakeholders and for each, state its interests and sources of power.
3. What options might emerge from a dialogue between Ventria and its relevant stakeholders?
4. If Ventria chooses to employ a political action strategy, how might it go about influencing relevant regulators?
5. If Ventria chooses not to engage in dialogue or political action (or dialogue and political action are unsuccessful), what other options does the company have?
6. What do you think Ventria should do now, and why?

³⁰ *Ibid.*, p. 3.

³¹ *Ibid.*, p. 3.