



Galloping Gene Giants

**How big corporations are
re-organizing their push for a
biotech future and what can be
done to challenge this agenda.**

A Polaris Institute Report
Prepared by Tony Clarke with Brenda Inouye

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About the Polaris Institute

The Polaris Institute was initially launched in response to the new age of globalization that was moving into full swing by the late 1990s. One of the cardinal features of this new era was the extent to which transnational corporations had seized control over the reigns of democratic governance and public policy making. In most countries, many laws, policies and programs were no longer being determined by democratically elected legislatures. Instead, corporate think tanks and big business lobby machines were setting the national economic and social agenda. As a result, systems of corporate governance were put in place which effectively rendered the majority of citizens politically disenfranchised. If citizen movements were going to be able to fight for democratic social change in this new political era, then new methods, tools and strategies would have to be developed.

In short, Polaris is primarily designed to assist peoples' organizations or citizen movements in reskilling and retooling themselves to effectively act for democratic social change in this age of corporate-driven globalization. Essentially, the Institute works with a variety of citizen movements — mainly labour unions, environmental associations, public interest organizations, and youth networks — in developing the kinds of methods, strategies and tactics required to unmask and challenge the corporate power that is the driving force behind government decision making around public issues of vital concern to their constituencies. The term 'polaris' itself is the Greek word for the north star. Just as ships lost at sea have, down through the ages, turned to the north star to guide them home, so the Polaris Institute tries to provide a compass for citizen movements in this era of corporate globalization. The prime objective, in effect, is to guide ourselves 'home' to the essence of democracy and our role as citizens.

One of the main characteristics of this new era of corporate globalization is the revolution in biotechnology that threatens to radically alter life and humanity as we know it on this planet. At Polaris, we have been developing a program called 'Gearing-Up for the Biotech Century.' Through this program, we will be working with various environmental networks and citizens groups concerned about issues of genetic engineering to develop the kinds of strategies and tactics required to take on the corporate players which are the engines of this biotech revolution. This document, **Galloping Gene Giants***, is meant to provide a basic overview and platform for this program. It will be supplemented by three background papers which we are preparing at Polaris on Agro biotech, Food biotech, and Pharma biotech. These three background papers are scheduled to be available on the Polaris website by April 2002 at www.polarisinstitute.org. **Galloping Gene Giants** was written by Tony Clarke, founder and director of the Polaris Institute, with the assistance of Brenda Inouye, a researcher at Polaris, who is currently coordinating the preparation of the three background papers. The Institute itself is associated with the Canadian Centre for Policy Alternatives in Ottawa.

**The term Gene Giants was coined by the ETC group, formerly known as RAFI [Rural Advancement Foundation International], www.etcgroup.org.*

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Introduction:

In the closing months of the first full year in the 21st century, the world was suddenly exposed to two dramatic events that served to highlight the revolutionary changes in society resulting from developments in biotechnology. The first was the anthrax scare in the U.S. following the September 11th terrorist attacks on New York and Washington. The second was the announcement by scientists that progress was being made on the cloning of a human being. Both events sent shock waves through a society that had already become marked by hypertension.

Yet, these events merely served to remind us of the realities of what Jeremy Rifkin had earlier dubbed “The Biotech Century.” In thousands of biotechnology laboratories run by universities, corporations and government agencies around the world, scientists are now using the tools of biology to radically alter life as we know it on this planet. Through the use of recombinant DNA technologies, genes are isolated, identified and pooled in new ways to create genetically engineered substances that are, in turn, used to alter everything from the production of crops and food along with healthcare products like pharmaceutical drugs, to natural resources like fish and forests plus military weapons for bio-warfare and bio-terrorism. In short, we are on the verge of one of the great transformations of humanity and nature itself.

It was, however, the so-called “Frankenfoods Campaign” of the late 1990s that began to awaken a new generation of people to the biotech revolution of the 21st century. Unbeknownst to people in many parts of the world, the genetic engineering of crops and animals in our daily food chain had been quietly and quickly making its way onto the dinner tables in our homes and restaurants, radically changing the quality of what we eat. Close to 75% of all pre-packaged food in North America was estimated to contain genetically engineered substances by the year 2000. Most of the main staples in our food chain — corn, soy, potatoes, canola — were being grown as genetically engineered plants, mixed with regularly grown crops and then processed into food products that appeared in our supermarkets.

What the anti-GE food campaign managed to do was to cast the public spotlight on the engines of the biotech industry, namely, the Gene Giants like Monsanto, Novartis, Aventis, AstraZeneca, DuPont and Dow Chemicals. Like most corporations, however, the biotech industry is particularly sensitive to public exposure and the glare of the public spotlight. Just as chameleons change their colours to survive, so the biotech engines were quick to restructure their operations and cultivate a new public image when the anti-GE food campaign began to expose some of the leading Gene Giants. We call this ‘cosmetic corporate surgery.’ It is a procedure designed to give, in this case, the major biotech corporations a cosmetic facelift when they are in danger of losing their market share and profit margins due to increasing negative exposure of their role in producing GE crops and foods.

Take the example of Monsanto. In 1998, Monsanto’s CEO was the poster boy of the business world and the toast of the Global Fortune 500. Robert B. Shapiro, biotechnology’s corporate evangelist, had successfully transformed Monsanto from a sleepy chemical company into the leading Gene Giant of

an emerging life science industry. Since taking over as CEO in 1995, Shapiro had turned Monsanto from the company that made the Agent Orange defoliant used by American bombers in the Vietnam War into a biotech agricultural and pharmaceutical conglomerate.¹ 'Food, Health and Hope' was the slogan used by Shapiro to remake Monsanto's image as a 'life science' corporation. As the world's largest producer of GE seeds, Monsanto's market value skyrocketed to a peak of \$40 billion. Cheered on by Wall Street every step of the way, Shapiro pushed Monsanto's stock value from around \$14.50 in 1995 to \$62.75 in the fall of 1998.

Thereafter, Robert Shapiro was pegged as the whipping boy of the biotech industry and the business world. Under Shapiro's reign, Monsanto's products — Roundup Ready, Bollgard, and YieldGard seeds, GE corn, cotton, soybeans and canola — had become the leading brand names of the burgeoning biotech food industry. But, by the Spring of 1999, consumer confidence in GE foods took a nosedive, especially in Europe. Prompted by the outbreak of mad cow disease in the U.K., mounting public pressure had already compelled the European Union to ban imports of hormone treated beef and slap a moratorium on any new GE products. Pointing to Monsanto's debt load which had risen from \$1.9 billion to \$6.2 billion in 1998, nervous Wall Street investment brokers began pressing Shapiro to unload the company's agro biotech operations. By the Fall of 1999, Monsanto's share price had sunk to \$32.75 on the stock market.

Monsanto's declining fortunes sent shockwaves throughout the new life science industry. The other major biotech corporations — Novartis, AstraZeneca, Aventis — quietly began to trim their own agricultural components. Distancing themselves from Monsanto, they quickly focused their sites on developing a long-term plan for salvaging the industry. Plagued by a heavy debt load and tumbling stock values, Shapiro soon went shopping for merger or buyout options for Monsanto. Initially, American Home Products had shown interest, but merger discussions ended before they got off the ground. Then, DuPont flirted but soon backed away from a possible deal. Meanwhile, Monsanto had been put on a temporary credit watch by the credit rating company, Duff and Phelps. Indeed, if Monsanto's own pharmaceutical unit, Searle Co., was not about to go to market with a new wonder drug called Celebrex, it would have been in much more serious financial straits by the end of 1999.

Finally, by December 1999, Monsanto had entered serious merger negotiations with the British pharmaceutical conglomerate, Pharmacia & Upjohn. The following Spring, the two biotech companies sealed their merger with a new public identity, namely, the Pharmacia Corporation. As a result, Monsanto slipped into the background as Pharmacia's agribusiness subsidiary. But, Shapiro's journey from hero to villain at the helm of Monsanto does not end here. In late November 2001, twenty months after the merger deal, the CEO of the Pharmacia Corporation, Fred Hassan, announced plans to spin off Monsanto as a separate agro biotech company, in the second half of 2002. Having secured Monsanto's drug company Searle, including its biotech expertise in pharmaceuticals, through the merger, it appears that Pharmacia was no longer interested in running the risk of being associated with a major target of continued resistance to genetically engineered crops and food products.

If anything, the Monsanto saga reveals the lengths to which the Gene Giants are prepared to go to protect their investments in the biotechnology revolution. As one industry analyst put it, “biotechnology is a one hundred year plus industry.” Too many billions of dollars have been invested in the development of the technology to let it go down the drain. Like chameleons, the Gene Giants have changed their colours and will do so again in order to survive and expand their reach. The question is whether or not

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campaign activists and concerned citizens are going to be in a position to detect what the Gene Giants are up to and what to do about them.

For these reasons, it is instructive to re-examine the anti-GE food campaigns of the late 1990s to see what lessons can be learned for the sake of future action. This report attempts to do this by examining five questions:

- [1] how the major corporate players have given shape and form to the emerging biotech industry;
- [2] how the growing resistance to GE food products compelled the biotech corporations to temporarily retreat;
- [3] how the biotech industry has responded with its own counter offensive for the next decade or so;
- [4] how new systems of global economic governance serve the interests of the biotech industry for expanding markets;
- [5] how the emerging bio-justice movement needs to develop new strategies and tactics in response to these challenges.

Although the Frankenfoods Campaign initially awakened people to the dangers of biotechnology, it should also be kept in mind that the revolution taking place today goes far beyond crops and food. The task, therefore, is not only to continue mounting a campaign against GE foods, but also to build a movement that effectively challenges the biotech revolution from the standpoint of justice and democracy. To do so, we must learn what it means to follow both the money and the technology itself in the biotech industry. We need to be able to detect what strategic and tactical maneuvers are being used by the biotech corporations to ensure their survival and expansion. By doing so, we will develop the capacity to confront the engines of the biotech revolution in the 21st century.

1. Biotech Industry

At the outset, we need to come to grips with the major corporate players in the biotech industry, namely, the Gene Giants themselves. These are the corporations that make extensive use of both gene science [i.e. recombinant DNA technologies for the pooling and splicing of genes] and patent laws [i.e. to secure ownership and control over genes, cell lines, tissues, organs and organisms] to produce genetically engineered products for sale.

At the outset, we need to come to grips with the major corporate players in the biotech industry, namely, the Gene Giants themselves.

Although the Gene Giants appear in many shapes, forms and sizes, they can be portrayed in terms of three main categories of the biotech industry itself — *agro biotech* [those corporations specializing in genetically engineered production of agricultural crops]; *food biotech* [those corporations engaged in the processing of genetically engineered food products]; and *pharmabiotech* [i.e. those corporations using genetically engineered substances in the production of pharmaceutical drugs]. As noted above, the biotech industry encompasses much more than these sectors, including the application of genetic engineering tools and substances in the reproduction of fish, forests, minerals, energy, biological weapons and the human genome itself. But, for the moment, the mainline Gene Giants are consolidated in the agricultural, food processing and pharmaceutical sectors.

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Agro biotech:

The agro biotech corporations, specializing in the production of GE agricultural crops, can be divided into two major groupings. The first group is composed of those Gene Giants who portray

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themselves primarily as “life science” corporations. They include AstraZeneca, Aventis, Monsanto and Novartis. The second group is made up of those who define themselves more in terms of being “industrial science” corporations. These include BASF, Bayer, Dow and DuPont. In varying ways, the first group represents a more soft approach to the use of biotechnology while the second exemplifies what might be called a hard approach.

The Gene Giants that currently occupy the agro biotech sector are themselves the product of a series of large-scale mergers between major chemical, agribusiness and pharmaceutical corporations that took place during the late 1990s. Monsanto, for example, originally started as a chemical company. In 1997, however, it refashioned itself as an agribusiness corporation. To do so,

it bought up a string of seed companies and spun-off its chemical unit through a separate corporate entity known as Solutia. Meanwhile, Novartis was created in 1996 through a merger between two Swiss chemical and pharmaceutical giants, namely, Sandoz and Ciba Geigy. A year later, Novartis divested itself of its chemical arm, Ciba Specialty and its subsidiaries, in order to cultivate a new public image. This consolidation trend continued throughout 1999. Aventis, now based in France, was formed out of a merger between the world's two largest agro-chemical corporations, Hoechst of Germany and Rhône-Poulenc of France. Similarly, AstraZeneca emerged in 1999 from a merger between a British agrochemical and pharmaceutical corporation known as the Zeneca Group and Astra, a Swedish pharmaceutical company. As part of the deal, their chemical unit, Zeneca Specialties was sold for \$2 billion.

Agro biotech Corporations

Corporation	Total Sales 1999	Agribusiness Sales 1999
Aventis	\$20.5 billion	\$4.6 billion
Novartis	\$20.3 billion	\$4.4 billion
Monsanto (98)	\$8.6 billion	\$4 billion
Bayer	\$27 billion	\$3.1 billion
DuPont	\$26.9 billion	\$3 billion
AstraZeneca	\$15.8 billion	\$2.7 billion
Dow	\$18.9 billion	\$2.3 billion
BASF	\$29.5 billion	\$1.7 billion

**combined agricultural sales of Novartis and AstraZeneca through Syngenta was 6.9 billion in 1999*

At the same time, these agro biotech corporations seized control over the global seed industry through a maze of acquisitions, alliances and joint ventures involving seed, plant biotechnology and genomics companies. Monsanto, for example, went on a buying spree between 1996-98, spending approximately \$8 billion on new acquisitions of seed and related GE companies, making it the second largest seed company worldwide.²

Before establishing

Syngenta as a joint venture with AstraZeneca in 1999, Novartis had already established itself as the third largest seed company in the world. Meanwhile, Advanta, the seed company set up by Astra Zeneca, was ranked sixth in global sales. And, DuPont finalized its acquisition of Pioneer Hi-Bred for \$7.7 billion in 1999, thereby securing control over the world's largest commercial seed company.

To date, these agro biotech corporations have been the Gene Giants and the prime engines of the biotechnology industry. At the same time, the broad applications of GE technologies coupled with the need for access to mass markets for GE products has necessitated working alliances with both food processors and the pharmaceutical industry.

Food Biotech:

The second major component of the biotech industry are the world's largest food processing companies. Since the early 1980s, the leading food processing companies like Nestlé, Philip Morris, Unilever, Cargill, ConAgra, Sara Lee and Archer Daniels Midland have been investing in biotechnology,

More specifically, the 1999 revenues of Nestlé alone of \$74.7 billion far outstripped total sales in the commercial seed industry [approximately \$25 billion] and the entire agro-chemical industry [estimated at \$33 billion].

building on their connections in the industrial food chain with the agro biotech companies and the marketing of genetically engineered crops.³ Today, the major food and beverage conglomerates are increasingly investing in the production of a wide range of new GE products, including functional foods, nutraceuticals and dietary supplements.

The largest food processing corporations are well positioned themselves to gobble up the entire agro biotech sector itself. The total retail value of food sales worldwide is estimated to be over \$2 trillion annually. More specifically, the 1999 revenues

of Nestlé alone of \$74.7 billion far outstripped total sales in the commercial seed industry [approximately \$25 billion] and the entire agro-chemical industry [estimated at \$33 billion]. Meanwhile,

recent large-scale acquisitions have contributed to a further concentration within the food processing industry. Unilever, for example, bought out Bestfoods for \$20.3 billion, making it the largest food and beverage corporation in the world. Philip Morris followed soon after with its acquisition of Nabisco Holdings Corp. for \$14.9 billion. General Mills purchased Diageo's Pillsbury unit for \$10.5 billion while ConAgra bought International Home Foods Inc.

Top Ten Food & Beverage Corporations

Corporation	Total Sales 1999	Food Sales 1999
Nestlé	\$49.4 billion	\$34.9 billion
Unilever	\$55.3 billion	\$32.4 billion
Philip Morris	\$78.6 billion	\$27.8 billion
Cargill	\$48 billion	\$21 billion
PepsiCo. Inc.	\$20.4 billion	\$20.4 billion
Diageo	\$19.5 billion	\$19.5 billion
ConAgra	\$24.6 billion	\$19 billion
Coca-Cola Co.	\$19 billion	\$19 billion
Sara Lee*	\$17.5 billion	\$17.5 billion
ADM**	\$14.3 billion	\$14.3 billion

*2000 figures **Archer Daniels Midland

Source: based on Prepared Foods, New York Times, June 7th, 2000, from ETC group, Nov/Dec 2000

As a tactical manoeuvre, some of the leading food processing companies have removed genetically engineered ingredients from their products in response to widespread resistance to GE foods. In Europe, for example, corporations like Nestlé, Coca Cola, Nabisco, General Mills, Kraft, Quaker Oats and Proctor & Gamble have declared themselves to be GE free. Not so in North America, where the resistance to GE food products has been much less intense. At the same time, the major food conglomerates continue to invest in functional foods, nutraceuticals and dietary supplement markets which are particularly strong in North America, Western Europe and Japan. Global consumption in this sector of the food market is estimated to be in the \$70 billion range now, rising to \$500 billion by 2010.⁴ Between 2000 and 2003 alone, the annual growth rate in consumption of dietary supplements, functional foods, and nutraceuticals is expected to be 15 percent, compared to 2 to 3 percent in the conventional food sector.

Pharma Biotech:

The third major sector of the biotech industry are the pharmaceutical corporations who are investing heavily in GE technologies and substances for the invention and manufacturing of drugs. Since the late 1990s, the pharmaceutical industry, aided by biotechnology, has brought a battery of drugs onto the market for treatments ranging from cardiovascular and cholesterol problems to hypertension, arthritis and angina. For the pharmaceutical industry, the future of GE technologies lies

in the production and manufacturing of “life saving,” “cancer fighting” and “disease and disability preventing” drugs.

Indeed the pharmaceutical industry has emerged as one of the most profitable sectors of the global economy

Indeed, the pharmaceutical industry has emerged as one of the most profitable sectors of the global economy. While the average Global Fortune 500 corporation brings in annual profit margins of 4.6 percent, pharmaceutical companies

generally rake in profit margins close to 15.5 percent. The global market for prescription drugs has been growing exactly twice as fast as the gross domestic product [GDP] worldwide. In 1999, 15 of the world’s highest revenue generating corporations were drug companies. What’s more, consolidation within the pharmaceutical industry has been growing at a rapid rate. Since the mid-1990s, there have been close to \$100 billion worth of mergers. In 2000 alone, there were two mega mergers in the industry — the union between SmithKline Beecham and Glaxo Wellcome to form Glaxo SmithKline and the marriage of Pfizer and Warner Lambert that resulted in Pfizer.

Top Ten Pharmaceutical Corporations

Corporation	Total Sales 2000	Drug Sales 2000
Glaxo SmithKline	\$27 billion	\$23 billion
Pfizer	\$29.6 billion	\$20.5 billion
Merck	\$40.4 billion	\$17.5 billion
AstraZeneca	\$15.8 billion	\$14.8 billion
Aventis	\$21 billion	\$14.8 billion
Bristol-Myers Squibb	\$21.1 billion	\$14.3 billion
Novartis	\$21.2 billion	\$12.7 billion
Pharmacia	\$18.1 billion	\$11.2 billion
Roche	\$17.8 billion	\$11 billion
Johnson & Johnson	\$29.1 billion	\$10.7 billion

Like the major food conglomerates, the leading pharmaceutical corporations today could also position themselves to absorb the agro biotech sector in the future. Ironically, four of the top ten pharmaceutical corporations are leading players in the agro biotech industry as well — AstraZeneca, Aventis, Pharmacia [Monsanto's parent company] and Novartis. Each of these Gene Giants has a strong pharmaceutical operation which, for the moment at least, is seen as being the foundation or backbone of their corporation. One of the prime reasons for

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this development is the rise of highly lucrative blockbuster drugs on the market. A few years ago, a blockbuster drug would net revenues of \$500 million over a three to five year period following its launch. Today, a new drug on the market must be able to rake in at least \$1 billion a year to be considered a blockbuster. Aided by GE technologies, the world's leading pharmaceutical giants are hoping to launch and market one new blockbuster drug after another. While each new drug requires a considerable outlay of funds for R&D

[research and development] before the product comes to market, these costs are usually recovered quickly, especially if the drug is a blockbuster on the market.

Although the agro biotech companies continue to be the prime engines, they could be gobbled up at any point in the future by either the food biotech or the pharma biotech industries.

Life Science Experiment

So, what is to be made of all these mergers, alliances and joint ventures in the biotech industry? If the major agro biotech corporations have been the prime movers of genetically engineered products,

If the major agro biotech corporations have been the prime movers of genetically engineered products, then why have close alliances been developed with food processors and pharmaceutical corporations?

then why have close alliances been developed with food processors and pharmaceutical companies? Well, one obvious reason is that the agro biotech corporations need the food processors and the pharmaceutical conglomerates in order to get their GE products to a mass market. But this internal restructuring has also been necessary for the agro biotech companies to create a more credible public image for themselves, thereby securing their position as leading forces in the emerging biotechnology industry of the 21st century.

After all, the major corporate players in agro biotech today were originally based in the chemical industry. Monsanto, Novartis, Aventis and AstraZeneca as well as DuPont and Dow, were initially corporations that produced a variety of chemical products. Given the fact that the chemical industry itself has a poor reputation from environmental and health standpoints, it became clear that these corporations, in particular, would have to undergo a major transformation in their public image if they were to create worldwide markets for their GE products. All the more so, since their main biotech products had to do with food and healthcare.

To generate a new public image, these chemically based agro biotech corporations began to refashion themselves as 'life science' companies. The central message was that this new 'life science' industry would create a better world through the application of biotechnology — less pesticides, easier farming, more nutritious foods, and more food to feed a hungry world. To achieve these goals, the new 'life science' corporations would integrate, in varying degrees, seeds and agro chemicals, animal and human drugs, vitamins and food products through GE technologies.

Beginning in 1997, Monsanto and Novartis led the way in forging this new 'life science' image. Shedding its image as a sleepy chemical company, Monsanto began to promote itself as a 'life science' corporation by donning a new corporate slogan — 'Food, Health and Hope.' At the same time, Novartis began portraying its 'life science' image in a new publication, *Who We Are*, declaring:

Your world is our world. Startling new revelations in medicine, science, agriculture and nutrition at the cutting edge of scientific discovery enable us to realize the potential of products and develop complete solutions to ensure that people, plants and animals thrive, rather than simply survive.

Cosmetic Corporate Surgery:

In effect, this transformation of agro-chemical corporations into a 'life science' industry marked the first phase of what we are calling 'cosmetic corporate surgery.' For the most part, this phase took place between 1997 and 1999. It involved, however, a great deal more than adopting new corporate

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slogans and public relations strategies. To be seen as 'life science' corporations, these agro-chemical giants had to undergo some restructuring of their basic operations as well. This restructuring generally entailed at least four steps.

Step one involved, as we have seen, several fairly large-scale mergers between some of the leading agribusiness and pharmaceutical corporations with biotech interests during the mid 1990s. These mergers included the formation

of Novartis from Ciba Geigy and Sandoz, AstraZeneca from Astra and Zeneca, and Aventis from Rhône-Poulenc and Hoechst. To be seen as 'life science' corporations, the application of GE technologies to pain relieving and life saving drugs was an important step. This required direct linkages with pharmaceutical companies making use of GE technologies. Moreover, the pharmaceutical components were highly lucrative. In 1999, Aventis' agribusiness sales reaped \$4.6 billion while its pharmaceuticals brought in \$13.9 billion. AstraZeneca and Novartis' agribusiness sales that same year totaled \$6.7 billion but their combined pharmaceutical sales amounted to \$24.6 billion. Even Monsanto was beginning to turn to its pharmaceutical division, Searle, for its major revenue boost by 1999. That year, Monsanto's sales from all its GE agricultural products came to \$2.3 billion, but the blockbuster success of its new arthritis drug, Celebrex, alone raked in \$1.5 billion. Thus, mergers with pharmaceutical companies were considered to be strategically important not only for public image but also cash flow purposes.

Step two had to do with the divestment of the company's chemical operations. As noted above, Monsanto spun off its chemical operations into a separate company called Solutia in 1997, ensuring that the parent corporation maintained majority ownership and control. Novartis soon followed suit. After being created through the merger of major Swiss based chemical and pharmaceutical conglomerates in 1996, Novartis promptly divested its Ciba Specialty Chemical Holding Inc. along with its subsidiaries the following year. In 1999, as part of their merger to form Aventis, Hoechst and Rhône-Poulenc both divested their chemical operations in separate companies called Rhodia and Celanese. Similarly, as part of the merger deal to create AstraZeneca, its specialty chemicals unit was directly sold off to the Cinven Group and Investcorp S.A. Even the chemical giant, DuPont, took measures to promote itself as a 'science' corporation by selling off its petrochemicals operations, Conoco, the 9th largest oil company in the world. However, while each of these leading agro biotech corporations got rid of their pure chemical operations in a bid to refashion themselves as 'life science' companies, they retained and even strengthened their agro-chemical capacity to produce pesticides and herbicides.

Step three involved the purchase of seed companies. Consolidating themselves as agro biotech companies in the 'life science' mould, the linkages between GE seed technologies and proprietary pesticides provided new opportunities for maximizing profits. In the case of first generation crops [those which have GE input traits], for example, the application of herbicide resistance gives agro-chemical corporations the opportunity to control the exact seed variety and the exact chemical sprayed on the crop. Monsanto's Roundup herbicide [active ingredient being glyphosate], for instance, is to be applied to Monsanto's Roundup Ready cotton, soybean and corn seed. The same goes for Novartis and DuPont's herbicide resistant products and Aventis' (AgrEvo's) Liberty Link products. For the new agro biotech conglomerates, therefore, the purchasing of seed companies became a top priority. The capital liquidated by the sale of their pure chemical operations provided the means. By 1999, the big six — Monsanto, Novartis, AstraZeneca, DuPont, Aventis and Dow — controlled 21.6 percent of the global seed market and almost 100 percent of the GE seed market worldwide.

Step four entailed the forging of links with other smaller biotech and genomics companies. These are the companies that mainly do research on plant and animal genomics [i.e. the identification and application of genes] which, of course, is essential to the development of GE products. A significant portion of the R&D funds of the major agro biotech corporations was earmarked for these purposes during the late 1990s, either in the form of joint ventures or direct purchases. In 1998 alone, Monsanto entered a research agreement with Gene Trace to do innovative work on plant and animal genomics; Dow Agro Sciences formed research alliances with smaller companies like Performance Plants Inc. and Bio-Source Technologies; Zeneca [before becoming AstraZeneca] signed a ten year research deal with the John Innes Centre and Sainsbury Laboratory in the UK to develop GE wheat; Aventis [through Rhône-Poulenc] and other companies created a joint venture called Génoplante to work on the genomics of corn, wheat and canola; and DuPont developed research alliances with CuraGen and Lynx Therapeutics to work on GE corn, soybeans and rice.

In short, these were the four main strategic steps undertaken by the major agro biotech corporations to transform themselves into a viable life science industry in the late 1990s. Through this stage of their cosmetic surgery, these leading corporate players in the biotech industry were able to successfully shed their public image as dirty chemical companies engaged in the production of GE food and health products. While retaining their agro chemical operations, the big six — Monsanto, Novartis, AstraZeneca, Aventis, DuPont and Dow — were well on their way to creating a new public image for themselves as 'life science' or 'industrial science' corporations by 1999. Through the purchasing of seed companies, the forming of alliances with small genomics research companies, and the build up of their pharmaceutical operations, the leading agro biotech corporations had diversified and broadened their image as a base for creating new markets for their GE products.

The following chart provides data showing how diversified the major agro biotech corporations had become in the restructuring of their operations by the end of 1999. While all eight of these corporations had significant investments in agribusiness, a distinction needs to be made between

them in terms of their restructuring goals during this period. For Aventis, AstraZeneca, Monsanto, and Novartis, the makeover was about changing their public image as chemical companies and creating a new image as 'life science' corporations. For DuPont, BASF, Bayer and Dow, however, the goal was not to shed their image as chemical companies but to establish themselves more as 'industrial science' corporations.

Leading Agro biotech Corporations 1999

Corporation	Total Sales	Agribusiness Sales	Seed Production Ranking (global)	Agro-chemical Sales Ranking (global)	Pharmaceutical Sales	Research & Development
'Life Science' Group						
Aventis	\$20.5 billion	\$4.6 billion	n/a	1	\$13.9 billion	\$3 billion
Novartis	\$20.3 billion	\$4.4 billion	3	2	\$9.8 billion	\$2.2 billion
Monsanto (98)	\$8.6 billion	\$4 billion	2	3	\$2.8 billion	\$1.3 billion
AstraZeneca	\$18.4 billion	\$2.7 billion	6	5	\$14.8 billion	\$2.9 billion
'Industrial Science' Group						
Bayer	\$27 billion	\$3.1 billion	n/a	6	\$5 billion	\$2.1 billion
DuPont	\$26.9 billion	\$3 billion	1	4	\$1.6 billion	\$1.6 billion
Dow	\$18.9 billion	\$2.3 billion	—	8	—	\$0.85 billion
BASF	\$29.5 billion	\$1.7 billion	—	9	\$2.5 billion	\$1.3 billion

Yet, these agro biotech corporations would soon be going through another phase of cosmetic surgery in response to the mounting biotech resistance.

2. Resistance Campaigns

Just as the agro biotech corporations were undergoing their initial round of facelifts, the anti-GE campaign was moving into full swing.

Just as the agro biotech corporations were undergoing their initial round of facelifts, the anti-GE campaign was moving into full swing. In effect, GE food products became the Achilles heel of the emergent 'life sciences' industry. This should come as no surprise. After all, there is little else that is more important to peoples' physical and personal well being than the daily intake of food to nourish our bodies and energize ourselves. Eating food that is safe, let alone nourishing, is a top personal priority for most people. GE foods, therefore, was considered to be a winnable issue from the standpoint of a campaigner. It touches peoples' sensibilities. What's more, casting the campaign in terms of ' Frankenfoods' served to further dramatize the issue and personal dangers involved.

In Europe, the personal connection to food is especially significant, occupying a place of high importance in peoples' daily lives. Although food has this special place in European culture, a series of technological fiascos also helped to set the stage for mass resistance to GE foods. The mismanagement of "mad cow disease" in Britain, for example, caused Europeans to question, if not reject, new food technologies. After telling the British public in June 1987 that there was no evidence to prove that people would catch the disease, the U.K. Government allowed infected cows to be sold for human consumption. Protecting its \$3.1 billion market for the sale of beef and veal was deemed more important than human health. As a consequence, citizens became increasingly suspicious of government regulation of the new food technologies. Later, the discoveries of dioxin in Belgian feed, poultry, beef and butter plus the scare over tainted Coca-Cola from bottling plants in Antwerp, heightened suspicion and resistance in the rest of Europe.

In Asia and other parts of the Third World, there is an additional cultural basis for resistance to the use of GE technologies in food production. The land and soil are considered to be the source of life itself. The use of GE technologies to dramatically increase the production and yield of crops is often viewed with suspicion and seen as a violation of the Earth and Nature itself. In India, for example, thousands of farmers involved GE crop trials have committed suicide, not only because their crop yields fell far short of what was promised by the agro biotech companies, but also because of massive debt from purchasing seed and pesticides. What's more, there is a lingering fear that they may have done something harmful to the soil and land itself. In many ways, this cultural basis for biotech resistance has taken root in parts of the South, particularly Asia and Africa.

From 1997 through 1999, popular resistance campaigns were mobilized against GE crops and foods not only in Europe but in Asia, Latin America and North America as well. The following is a brief synopsis of the build-up of biotech resistance on a continental basis during this period.

Europe:

Building on the public outcry generated by the mad cow disease and the dioxin disasters, networks of consumers, farmers, environmentalists and food safety activists have led the way in mobilizing popular resistance to GE foods. In France, concerned farmers and food safety activists initially formed an alliance and used direct action tactics to prevent Monsanto and Novartis from proceeding with their Bt [*Bacillus thuringiensis*, for insect resistance] maize crop trials. In the U.K., a collective of food and environmental activists known as Genetix Snowball led the way in organizing a direct action campaign to pull out Bt crops in several strategically located field trial areas, thereby drawing considerable public attention. Consumers' groups in Germany successfully convinced Europe's largest grain merchants not to purchase GE crops and steps were taken by ASEED, the student activist network, to mount a public awareness campaign in Hungary and elsewhere in Eastern Europe. In the U.K. and several other European countries, consumer boycott campaigns were organized to get fast food chains like Burger King, McDonald's and Pizza Hut to refuse Bt potatoes for their fries. Similar boycotts aimed at getting superstores like Sainsbury's to ban GE food products, or at least segregate them from GE free foods, were also mounted. European resistance was further fortified when organizations like the British Medical Association called for a moratorium on commercial planting of GE crops, declaring that more "independent" research was needed to determine the possible toxicity of bioengineered food.

Asia:

The main countries for the build-up of resistance against GE foods in the Asia-Pacific appear to have been India, Malaysia, Japan, New Zealand and South Korea. The "Monsanto: Quit India" campaign, for example, was launched by an alliance of over 100 farmer and consumer groups. The campaign was organized in the wake of months of protests by Indian farmers and consumers in a region where close to 500 farmers had committed suicide in response to failures associated mainly with Bt cotton crops. Responding to a legal petition filed by the Research Foundation for Science, Technology and Ecology, the Supreme Court of India ruled on February 23, 1999 that all field trials of Monsanto's Bt cotton be halted. In Japan, the Consumers Union got 2 million signatures on a petition, plus the support of 2300 out of 3300 local government assemblies, calling on Tokyo to require mandatory labeling of GE foods. Due to public awareness campaigns organized by the Pesticide Action Network (PAN) in Asia-Pacific, the Korean government announced plans to require labeling of GE products and applications for the use of genetically engineered Bovine Growth Hormone in cows for milk were withdrawn from New Zealand. In Malaysia, PAN was also responsible for launching a major national debate on GE foods that later contributed to governmental action.

Latin America:

Initially, Brazil was the main country in Latin America where resistance to GE food production and sales was generated. After consumer organizations filed a lawsuit in the Brazilian courts, a temporary injunction was slapped on Brazil's Ministry of Agriculture regarding the approval of Monsanto's petition to market its Roundup Ready soybeans. Pressed by consumer actions, one of Brazil's largest supermarket chains, Carrefour, publicly opposed the sale of Roundup Ready soybean crops. In one Brazilian state, where public hearings were held that included representation by biotech corporations, the debate sparked considerable resistance against the production and marketing of GE foods. In March 1999, Brazil's main commercial newspaper reported that Monsanto had withdrawn its patent application for five varieties of Roundup Ready soybeans. Meanwhile, public information campaigns were initiated by farmer, consumer and environmental groups in Mexico, Columbia, Argentina, Uruguay, and Paraguay. In Mexico City, for example, Greenpeace activists sparked public debate and media coverage on the dangers of GE food products by hanging a banner on the historic monument, the Angel of Independence, protesting against "Genetic Imperialism."

North America:

In both the U.S. and Canada, public opposition to GE food products was also organized and expanded in the heartland of biotechnology. In November 1998, for example, pressure from citizens' groups in Maine caused Monsanto to withdraw its application to grow genetically engineered corn crops in the state while, on the other side of the country, biotech activists destroyed a test plot of Novartis Bt corn on the University of California campus in Berkeley. At the same time, several hundred U.S. restaurants joined a nation-wide campaign to expose the dangers of GE food products and call for mandatory labelling. Cotton farmers in North Carolina, Oklahoma, Texas and Arizona filed complaints about the performance of Monsanto's Roundup Ready seed. The Center for Food Safety also filed three separate lawsuits challenging the policies of both FDA and EPA as regulatory agencies. As well, a 'Frankenfoods 15' boycott campaign was launched by the Organic Consumers Association and Friends of the Earth. Meanwhile, in Canada, a coalition of farm, health and environment groups led by the Council of Canadians, organized a successful public campaign which, assisted by Senate hearings and the testimony of government scientists, compelled Ottawa to slap a ban on the use of bovine growth hormone in dairy cattle. More recently, the Council, Greenpeace and the Sierra Club shifted their campaign focus to super food store chains such as Loblaws, demanding that all GE food products be labelled. And, a legal petition was filed against the federal government for failing to protect public health and the environment in its regulation of genetically modified organisms.

What's missing from this synopsis is, of course, the continent of **Africa**. The reason is that resistance to genetically engineered food products has taken a slightly different path in that region. All the evidence points to a culture of resistance to genetic manipulation of life forms that is both widely held and deeply rooted in most African societies. But, unlike the other continents, the campaigns

of resistance have been mobilized more by governments in Africa than by civil society movements. Nothing illustrates this more clearly than the recent rounds of negotiations for a biosafety protocol. Taking a united stance, the African countries led the way in negotiating an international accord that would allow governments to regulate the use and movement of genetically engineered organisms in their territories, even if such moves contravene global trade rules.

The net effect of these resistance campaigns was a series of market shutdowns for certain GE crops and food products, which, coupled with several scientific studies showing the negative effects of GE technologies, eventually compelled the Gene Giants to go into retreat.

Market Shutdowns

For the Gene Giants, the principal goal over the past three years has been to open new markets for the export of their GE crops and food products, starting with Europe. In 1999 alone, U.S. agricultural exports were valued at \$50 billion, more than 7 percent of total U.S. exports. Testifying before the U.S. Senate in June 1999, Deputy Treasury Secretary Stuart Eizenstat declared:

For the Gene Giants, the principle goal over the past three years has been to open new markets for the export of their GE crops and food products, starting with Europe.

Almost 100% of our agricultural exports in the next five years will be genetically modified or combined with bulk commodities that are genetically modified ... The EU fear of bio-engineered foods ... is the single greatest trade threat that we face.

In effect, Eizenstat's comments confirmed the fact that the biotech corporations and their GE products now occupy a strategic place in the U.S. economy and global trade agenda. By 1999, there were more than four dozen genetically engineered foods and crops being grown or sold in the U.S. The "hidden menu" included soybeans, soy oil, corn, canola oil, cotton seed oil, potatoes, squash, papaya, tomatoes and dairy products. Over 70 million acres of GE crops were then under cultivation in the U.S. alone. Close to 500,000 dairy cows were also being injected with recombinant Bovine Growth Hormone in order to expand their daily output. In order to meet the 100 percent target for GE agricultural exports in the next five years, several dozen more GE crops were in their final stages of development, soon to be released for production and marketing purposes.

For anti-GE food campaigners, therefore, shutting down global markets for the export of these products became a strategic priority. By dampening consumer demand and closing down markets for GE agricultural and food products, the biotech corporations would be compelled to drastically curtail and eventually stop their production. In June 1999, a defining moment occurred when the EU decided to maintain their ban on the import of hormone treated beef, despite the WTO ruling that allowed the U.S., Canada and other major beef exporters to slap economic sanctions on European exports

in retaliation. At the same time, the EU's three year moratorium on any new biotech agricultural and food products until more stringent safety regulations are put in place in 2002, served to consolidate the European resistance. In turn, the European momentum soon began to spread to markets elsewhere, notably, Japan, Brazil, and even the U.S. and Canada.

European State Actions to Block GE Crop and Food Markets

1997

February: Austria and Luxembourg ban sale, and France prohibits commercial growing of Novartis' Bt maize.

March: Italy and Spain ban commercial growing of Novartis Bt maize.

April: European Parliament calls on European Commission to suspend market consent for Novartis Bt maize crops.

September: Italy withdraws its ban on Novartis Bt maize.

November: France announces a moratorium on commercial cultivation of all GE crops with the exception of Novartis Bt maize.

December: France announce moratorium on commercial use of all GE crops containing antibiotic resistance marker genes with the exception of Novartis maize.

1998

July: France declares moratorium on the growing of GE crops [beet and rapeseed/canola] that have wild relatives in Europe.

September: France's highest court suspends authorization to grow Novartis Bt maize.

All of Austria's main supermarket chains take GE products off their shelves.

October: Greece bans import of GE rapeseed/canola.

The U.K. announces a de facto three-year moratorium on GE insect-resistant plants.

November: France bans import and sale of two varieties of GE rapeseed/canola.

1999

February: European Parliament calls for labelling of GE crops and foods plus a ban on antibiotic resistant marker genes.

March: Retailers' consortium formed — Sainsbury [UK], Marks & Spencer [UK], Carrefour [Fr.], Superquinn [Ire.] — to jointly buy non-GE products.

Greece rejects all pending applications for experimental GE crop plantings.

April: Nestlé UK and Unilever UK announce they will phase out use of GE ingredients in their products.

Tesco, the largest retailer in the UK, announces its own brands will be free of GE ingredients.

May: European Commission suspends approval processes for all new GE crops.

Source: C&EN, Deutsche Banc Alex. Brown, "Ag Biotech: Thanks but no thanks," p.7. July 12, 1999 [edited]

In Europe, the campaigns to shutdown markets for GE soy and corn used for animal feed proved to be effective. U.S. soybean exports to Europe, for example, had dropped from \$2.1 billion in 1996 to \$1.1 billion in 1999. By 2001, the European market for GE soybeans from the U.S. was expected to be zero. Numerous food and restaurant chains in Europe also announced that they would be going GE free. So, too, did several U.S. fast foods chains with growing markets in Europe. At the Agra Europe Potato 2000 Conference in Rome, for example, it was reported that McDonald's, Burger King and

Wendy's were refusing to use genetically engineered potatoes for their french fries. However, not all of these fast food giants have been willing to officially declare they are going GE free, largely because of binding contracts they have with suppliers.

For U.S. biotech corporations, the Japanese market has also been of strategic importance. Japan imports 77 percent of its soybeans and 87 percent of its corn from the U.S. Indeed, Japan is the largest feed grain importer in the world, purchasing 30 to 40 percent of all U.S. grain exports. In June 1999, the Japanese government announced that they were suspending approval of Bt crops for agricultural production, pending the establishment of national criteria to determine the safety of these products. Later that year, the Japanese Ministry of Agriculture, Forestry, and Fisheries laid down new rules regarding the labelling of GE foods. In some cases, Japanese agricultural and food processing companies stopped using genetically engineered products. Taken together, these trends signaled that Japan too was in danger of following Europe's lead in terms of potential market shutdown for GE food products.

Given its population of 160 million people, Brazil has been designated the most strategic market in Latin America for the production and export of GE foods. By the Spring of 1999, however, the clamps were being put on the production of soybean crops in Brazil. In the large soy-growing state of Grande do Sul, for example, the state government put a ban on the growing of Roundup Ready soybeans. Brazil's leading commercial newspaper, *Gazeta Mercantil*, reported that Monsanto's patent applications for five varieties of Roundup Ready soybeans, had been withdrawn, indicating that the major biotech corporations were losing the debate over GE food products in the country. At the same time, Brazil's own soybean producers have been steadily taking away the U.S. share of the market in Europe by exporting increasing quantities of GE-free soybeans to the E.U.

By mid-January 2000, Reuters news service was reporting that a straw poll held amongst U.S. farmers indicated they plan to "cut back sharply" on their planting of GE soybeans, corn and cotton. According to Reuters, reductions of 15 percent in Roundup Ready soybeans, 22 percent in Roundup Ready corn, 24 percent in Bt corn and 26 percent in Bt cotton were expected in planting season for Spring 2000. Moreover, U.S. food retail stores began to respond to a growing consumer demand for GE-free products. The two largest natural food supermarket chains in the U.S., Whole Foods and Wild Oats, announced a ban on genetically engineered ingredients in all their brand name products. In turn, other major U.S. food chains and manufacturers felt the pressure to provide their customers with GE-free or certified organic products. Following the lead of Gerber [owned by Novartis] and Heinz not to use GE ingredients in their baby foods, the largest U.S. corn chip manufacturer, Frito-Lay, in late January 2000 sent out new contracts to their corn suppliers calling GE-free corn only.

Meanwhile, Canadian-based McCain's Foods, the world's largest potato and french fry processor, announced in late November 1999 that they were no longer going to make use of Bt potatoes for their brand name products. Following the moves made by Archer Daniels Midland requiring farmers to segregate GE grown corn and soybeans, the Canadian Wheat Board also announced plans to "identify and segregate genetically modified wheat and barley from natural grain" in an effort to safeguard

Canada's multi billion dollar wheat export market. Seagram's, the Canadian based liquor giant, revealed in January 2000 that it would not use biotech grains in their products. What's more, the market squeeze has be felt by Canada's canola farmers, who use GE products to grow over one half of Canada's canola crop. Not only did Canadian farmers lose close to a billion dollars in canola sales to Europe since 1997, but markets in Japan and China also threatened to dry up.

Scientific Doubts

At the same time, nothing could be more damaging to the Gene Giants than to be faced with a series of scientific studies and experiments raising serious concerns and doubts about the health and environmental impacts of genetic engineering.

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One of the more damaging blows was dealt in 1999 when Dr. Arpad Pusztai of Britain's Rowett Institute released a set of explosive research results indicating that GE potatoes, spliced with DNA from the snowdrop plant and the Cauliflower Mosaic Virus [CaMv], are poisonous to mammals. The studies showed that GE snowdrop potatoes, which have a considerably different chemical composition from that of regular potatoes, damage the vital organs

and immune systems of lab rats. The suspected cause of the severe viral infection to the rats' stomach lining was CaMv, which is a commonly used viral promoter spliced into nearly all GE crops and food.

Although Dr. Pusztai was unable to complete his studies—he was fired for having spoken out publicly—his initial findings rang alarm bells in the biotech industry. By switching on genes that produce poisons, Pusztai and other scientists warned that genetic engineering can increase the natural plant toxins in foods or even create entirely new toxins. What's more, the real impacts remain unknown, since the kind of chemical and feeding tests conducted by Pusztai are not required by government regulatory agencies. As Pusztai put it: "Think of William Tell shooting an arrow at a target. Now put a blindfold on the man doing the shooting and that's the reality of the genetic engineer doing a gene insertion." In short, Pusztai's studies warned that people consuming GE foods all over the world today have become "involuntary guinea pigs in a vast genetic experiment."

Indeed, Pusztai's work was reinforced by other scientific warnings about GE products. In 1996, Nebraska scientists found that a Brazil nut gene spliced into soybeans ran the risk of causing fatal allergies in people who are sensitive to Brazil nuts. Given the fact that most of the foreign proteins that are now gene-spliced into common food products today have never before been eaten by humans, it is not at all certain what new allergens and toxins may be produced and what existing allergens and toxins may be increased by genetic engineering. "There is no known way to predict the allergenic

potential of GE foods,” says British scientist Dr. Mae-Wan Ho. “Allergic reactions typically occur only sometime after the subject is sensitized by initial exposure to the allergen.” To prevent future public health disasters, says the U.S. Campaign for Food Safety, stringent pre-market safety is essential, including long term animal feeding and volunteer human feeding studies.

Scientists also warned that genetic manipulation increases antibiotic resistance in the body and decreases food quality and nutrition. When gene engineers splice a foreign gene into a plant or microbe, for example, the antibiotic resistance marker gene to which the foreign gene may be linked can, say researchers, unexpectedly recombine with disease-causing bacteria or microbes in either the environment or the guts of animals and/or people who eat GE food products, thereby contributing to the growing public health dangers of infections that cannot be cured with antibiotics. Other studies showed that GE foods could mean lower quality and nutrition. In his 1999 study published in the *Journal of Medicinal Food*, Dr. Mark Lappe reported that GE soybeans contained lower concentrations [i.e. 12-14 percent lower] of beneficial, naturally occurring phytoestrogen, which are said to protect against heart disease and breast cancer, than traditional strains of soybeans.

The potential environmental hazards of GE crops were also highlighted in May 1999 when *Nature*, the British science journal, published a letter by Cornell University scientists indicating that pollen from Bt corn crops is poisonous to Monarch butterflies. Dr. John E. Losey, assistant professor of entomology and two other scientists at Cornell found that three-day-old larvae reared in a laboratory on milkweed leaves dusted with Bt pollen had a 41 per cent mortality rate. The study sparked headlines stories about “butterflies bearing grenades” and “the Bambi of the insect world.” With millions of acres of GE crops under cultivation, many Americans began to fear that serious damage may be done to the environment and insects. Complaining that the studies were conducted in laboratories rather than open fields, the biotech corporations tried to undermine the credibility of the Cornell study. But similar results had already been found by Iowa State University scientists who had conducted field studies on the impacts of Bt corn crops.

The Bt-Monarch controversy came on the heels of several other disturbing studies on the impacts of Bt crops on insects and soil. Scientists revealed, for example, that Bt spliced crops harm beneficial insects such as ladybugs and lacewings, damage soil fertility and do harm to insect-eating birds. There were also signs that GE crops could generate “superweeds” and “superpests” which are evermore pesticide and herbicide resistant, thereby requiring more toxic chemicals to get rid of them. As GE canola, for example, spread their herbicide resistant traits to weeds such as mustard plants, “superweeds” begin to emerge. Similarly, lab and field studies showed that common pests like cotton boll worms will soon evolve into “superpests” which are completely immune to Bt sprays.⁵

To make matters worse, the scientific tests used to validate the environmental safety of Bt crops with regards to insects, were declared to be flawed. In April 1999, a prestigious panel of Swiss scientists commissioned by Greenpeace issued a peer critique of the scientific methods and tests conducted by the U.S. Environment Protection Agency [EPA]. The EcoStrat report showed that shoddy science had

been used in tests submitted by two biotech corporations, Novartis and Mycogen, in determining whether Bt corn crops harm non-target insects. The Swiss scientist panel found that the tests were designed in such a way that no adverse effects of GE crops could be observed. Not only did the EPA accept the Novartis/Mycogen tests as scientific evidence that gene spliced crops are harmless to non-target insects, but they continued to use these same flawed testing procedures in granting approval to applications from other biotech companies.

What's more, field researchers reported that GE crops were generating lower yields than conventional crops. Studies conducted by Dr. Charles Benbrook indicated "overwhelming" and "indisputable" evidence that farmers planting Roundup Ready soybean crops were receiving significantly lower yields than farmers planting conventional, non-GE soybean crops. Nor does GE crop production result in less use of pesticides, as promised by the biotech corporations. Benbrook's conclusions were substantiated by an article published in the *New Scientist* in the United Kingdom in July 1999, using data from the U.S. Department of Agriculture. Reported Kurt Kleiner of the *New Scientist*: "Most American farmers who have turned to genetically engineered crops seem to be getting yields no better than farmers who grow traditional varieties. They also appear to be using similar quantities of pesticides."

Even the established National Academy of Science could not let the biotech industry completely off the hook. Before releasing its long awaited report on GE crops and food, the NAS had been plagued by charges of conflict of interest. Not only were the majority of the dozen scientists on the NAS panel in the employ of the biotech industry, directly or indirectly, but the former head of the panel left to become a public relations executive for the Biotechnology Industry Organization itself. Nevertheless, the NAS report proved to be quite condemnatory of the biotech industry and government regulatory agencies in the U.S. Indeed, the NAS report admitted that: new allergens and toxins could be introduced into foods, pollen and the environment; existing toxins may reach new levels or be moved into edible portions of plants; and the nutritional content of plants may be diminished while previously unknown protein combinations produced by adding new genes to plants could have unforeseen effects.

Corporate Retreat

For anti GE food campaigners, however, the clincher was delivered by one of the world's leading investment rating firms, Deutsche Banc. Alex Brown. In May 1999, the food and seed analyst for this prominent investment firm, Tim Ramey, issued two reports: "The Trouble with GMO's" and "GMO's are Dead." Sparked by ADM's decision to segregate GE from non-GE grains, Ramey's report declared that the emergence of a two-tiered grain market spelled "very bad news" for farmers, seed companies and seed stocks. If a bifurcated grain market takes hold, said Ramey, then GE corn and soybeans will sell at a discount to non-GE products. As a result, price premiums for high value added GE seeds are bound to collapse. Instead of being a driver of growth in agricultural markets, the producers of GE seeds are likely to become a liability, thereby depreciating their stock value.

In July 1999, Deutsche Banc. Alex Brown issued another report entitled “Ag Biotech: Thanks, But No Thanks?” Although the investment firm maintained that GE crops are safe and may well have environmental benefits, the biotech industry had effectively lost this round in the war of perception. GE food products had been successfully demonized by their opponents in the eyes of the public. What’s more, said the Deutsche Banc. report, the concerns raised by the European Union were real and cannot be dismissed as simply a political trade barrier. According to the investment analyst, “Consumers may very well decide that biotechnology derived foods are not as appealing as all-organic or current offerings: ‘Thanks, but no thanks.’” “Prudence dictates,” they warned, “that a longer time horizon will be required for consumer acceptance of ag-biotechnology.”

“Ag is a drag” was the word that began to spread throughout investor circles. While Deutsche Banc. maintained its ‘market performance rating’ for DuPont, it reported that “the growing negative sentiment for GE food products” creates problems for Monsanto, Novartis and major seed companies

"Ag is a drag" was the word that began to spread throughout investor circles.

like Pioneer Hi-Bred and Delta & Pine Land. In the case of Monsanto, its long term debt rose from \$1.9 billion in 1997 to \$6.2 billion in 1998. At the same time, the corporation’s all important debt-to-capital ratio also increased from 47 to 59 percent. After its merger negotiations with American Home

Products collapsed in the Fall of 1998, Monsanto’s credit rating on Wall Street was downgraded while one credit rating company, Duff & Phelps, put Monsanto on a temporary credit watch. If its pharmaceutical division was not about to go to market with its new wonder drug, Celebrex, Monsanto would have been in much more serious financial straits at the end of 1999.

Similar downgrades were also issued by other investment rating firms like the Boston Suisse Credit Bank. Quietly, the Gene Giants began to distance themselves, scale back their operations or unload their GE agricultural divisions. Novartis and AstraZeneca, for example, announced that they were combining their biotech agricultural operations in the form of a newly named company called Syngenta which, in turn would be spun-off on its own axis. Nervous Wall Street investors pressured Monsanto to do the same. Not only had Monsanto’s stock value plunged but the company had become the target of two major law suits: a class action by farmers claiming Monsanto had conducted inadequate research on its transgenic seeds and an antitrust suit charging Monsanto with monopolizing the cotton and seed business.

To conclude that agro biotech was about to disappear, however, would be somewhat naive and illusionary. After all, too much had already been invested in both the technology and the industry for it to suddenly self-destruct. As the editor of the webzine, *AgBioForum*, and agribusiness professor Nicholas Kalaitzandonakes put it: “Ag biotech is not going away. I just think for the next five years it will have to prove itself on its own.” As a visiting professor with Monsanto, Kalaitzandonakes predicts: “You’re looking at a technology with a life cycle of 100-plus years that’s just beginning.” Besides Monsanto, the other major players in agro biotech like Novartis, AstraZeneca, Aventis, DuPont and Dow signaled their intentions to keep their heads low. But this did not mean they were throwing in the towel. On the contrary, it would soon become clear that they were simply biding their time and preparing for a comeback.

3. New Counter Offensive

By mid-1999, the major biotech corporations had resolved to quiet down the public uproar over GE, get the majority of people onside and create a less controversial market for their products. For the agro biotech and food biotech corporations, this meant promoting 'value added' crops as a solution to the farming crisis, to 'improve life threatening nutritional deficiencies' and 'feed the hungry' of the

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world. For the pharmaceutical conglomerates, the main agenda was to promote GE technologies that would provide people with 'life saving' and 'disease preventing' wonder drugs.

To advance this counter offensive strategy, public relations campaigns were organized like the Council for Biotechnology Information (CBI) in North America — a 5-year, \$250 million USD operation,

fully supported by AstraZeneca, Aventis, BASF, DuPont, Dow, Monsanto and Novartis — in April 2000. It is designed to promote pamphlets and produce television commercials to reach a wider public. In one of its pamphlets, the CBI states: "Biotechnology is becoming an important tool that can improve our quality of life in many ways. Both now and in the future — from life saving medicines to more nutritious foods."

What's more, the major corporate players were prepared to bide their time to win public opinion. Corporate strategists have stated that this counter offensive will take 4 to 5 years in North America [up to 2004-05] and 9 to 10 years in Europe [until 2009-10] to win the debate. In the meantime, the strategy involves action on at least five major fronts.

1. Agribusiness Spin-offs:

The first key action in this new counter offensive taken by the Gene Giants was to spin-off their agribusiness components. After Monsanto's merger with Pharmacia & UpJohn in December 1999, it was decided that the new corporation, Pharmacia, would spin-off its agribusiness operations under the name of Monsanto. The divestment, however, did not mean that Monsanto would become a separate, independent corporation. Pharmacia's new CEO, Fred Hassan, expressed confidence in the agribusiness sector, indicating that its value has a "huge upside" while Monsanto's Shapiro told analysts that the divestment plans are not a move away from agribusiness, and stated that GE applied in agribusiness will eventually be known as "a very important tool in feeding people and moving toward sustainable development." Pharmacia's divestment was only 19.9 percent of Monsanto's stock, giving the parent corporation the legal option to buy-back this portion of its agribusiness operations after a two-year period. What's more, Monsanto's original shareholders were said to own 51 percent of

Pharmacia's shares, thereby providing further assurances that the agribusiness unit would remain in the Pharmacia family.

In December 1999, AstraZeneca and Novartis announced plans to merge their agribusiness units, and divest them as a public offering into one company, called Syngenta. However, certain factors make it clear that this is more of a facelift than a total divestment of agribusiness operations. For one, based on 1998 figures, Syngenta will be the leader in agrochemicals with \$7 billion per year and third in seed production, generating \$1 billion per year. Secondly, parent company shareholders remain in control of Syngenta, whereby AstraZeneca shareholders own 39 percent of Syngenta, while Novartis shareholders own 61 percent. Thirdly, in September 2000 Novartis and AstraZeneca announced that they would initiate a 10 percent buyback strategy of Syngenta, worth \$1 billion, apparently in order to encourage shareholders to retain Syngenta shares. And, in November 2000, Aventis announced that it would divest its agribusiness unit, Aventis CropScience, as well as its animal nutrition unit. The divestment took the form of a public offering, and Bayer expressed initial interest. The new agribusiness company will be known as Agreva and the spin-off was expected to be completed by the end of 2001.

In addition to creating a temporary distancing between the parent biotech corporations and their agribusiness operations, these spin-offs were also spurred on by other developments. The agricultural sector, for example, was already in a downturn, experiencing depressed commodity prices for corn, wheat and cotton. With farmers, their direct customers, in a slump, agro biotech companies were also downsizing. Novartis, for example, laid off 1100 workers during this period while DuPont let 15 percent of its agrochemical division workforce go. As for Monsanto, its massive spending spree on seed and plant biotechnology companies had saddled the corporation with a heavy debt load. As noted above, Monsanto's debt-to-capital ratio had risen to the point where Wall Street slashed its credit rating on bond markets and, by the end of 1999, Monsanto was compelled to withdraw its plans to purchase the number one cotton seed company, Delta & Pine Land Co. Add to this the industry's public relations blunders surrounding the mad cow disease in Europe and the market shutdowns for GE products, there were plenty of reasons why it made sense for the Gene Giants to create some space between themselves and their agro biotech operations.

Yet, there were still other factors that contributed to this spin-off strategy, like the Terminator technology and the StarLink fiascos. The 'Terminator' was the term coined by RAFI [Rural Advancement Foundation International now known as the ETC group] to describe a new kind of biotechnology that rendered seeds sterile, thereby disabling farmers from collecting seeds from the crops they have planted and making them even more dependent on the agro biotech corporations. Monsanto, Novartis and AstraZeneca had all taken out patents on Terminator technologies. After public resistance quickly mounted, Monsanto announced that it would not pursue, develop or ever use the Terminator seed. As a result, Monsanto withdrew its proposal to purchase Delta Pine & Land Co., which had initially developed the technology in collaboration with the U.S. Department of Agriculture. Similarly, Aventis decided to divest its agribusiness operations just three days after

evidence of contaminated StarLink corn had been revealed and confirmed in September 2000.

The U.S. Environmental Protection Agency's Scientific Panel confirmed that StarLink Bt corn, which Aventis was heavily involved in producing, contained Cry9C_x protein which runs the risk of causing allergic reactions in humans. As a result, over 300 products were pulled from U.S. grocery shelves and U.S. grain exports suffered major losses.

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Nevertheless, Novartis CEO Daniel Vasella denied that these agribusiness spin-offs had anything to do with the rising tide of public resistance to GE products. In the 1999 Annual Report of Novartis, Vasella stated:

...Our decision (to create Syngenta) was mainly driven by the desire to focus and simplify our business portfolio...it was not influenced by the hostile stance of certain activists who refused to consider alternate perspectives, spoke only of 'Frankenstein Foods' and went so far as to destroy field tests...It is not by chance that other 'Life Science' groups have also begun to contemplate similar moves since our announcement... Novartis will be able to concentrate its future efforts on its healthcare businesses.

Though Vasella and other corporate representatives will use such arguments, there are many indications that suggest otherwise. For example, Heinz Imhof of Novartis Seeds says,

It's a slow down of at least three to five years (in North America). That doesn't prevent product development and you can still test and distribute transgenic seeds to processors willing to use them. But in Europe the story will be one of using conventional breeding techniques...[In some cases] it will take at least 10 years to develop the new varieties and win consumer acceptance for them.

2. Functional Foods:

The second major piece of the counter offensive is to promote a new line of GE food products, namely, functional foods and nutraceutical products. RAFI has dubbed these functional food and

Functional foods are generally defined as foods containing special ingredients with claimed positive health benefits

nutraceutical products as the Generation 3 of GE products.⁶ As distinct from Generation 1 [input trait crops like herbicides and pest resistance] and Generation 2 [output trait crops like high starch potatoes], Generation 3 products are designed to offer health and nutrition benefits to consumers, primarily affluent people in the industrialized countries of the North.

Functional foods are generally defined as foods containing special ingredients with claimed positive health benefits. They can range from calcium-enriched orange juice and fortified soy beverages to

high stearate and/or low calorie oils for “healthier” margarines and shortenings made with GE soybean and canola crops. Under functional foods are nutraceuticals which are traditional foods, isolated nutrients, herbs, plants, dietary supplements or genetically engineered ‘designer foods’, that can prevent, treat and cure disease. Nutraceuticals could include dietary supplements or rice genetically engineered to contain three foreign genes that increase the grain’s beta carotene (a precursor to vitamin A) or GE bananas that contain vaccines or canola crops with antibodies for cancer.

For functional foods and nutraceuticals, the current estimate of global market sales ranges widely, depending on how the products are defined. Functional foods, nutraceuticals and dietary supplement markets are particularly strong in North America, Western Europe and Japan. One estimate indicates that the global consumption of functional foods and nutraceuticals is estimated at \$70 billion, while future projections indicate figures around \$500 billion by 2010. Between 2000 and 2003, the annual growth rate of dietary supplements, functional foods and nutraceuticals is expected to be 15 percent, which compares to a 2-3 percent annual growth rate of the conventional food sector.⁷

The development and marketing of Generation 3 products require cooperation amongst agribusiness, food and pharmaceuticals corporations, whether in terms of developing the products, securing gov-

The development and marketing of Generation 3 products require cooperation amongst agribusiness, food and pharmaceutical corporations, whether in terms of developing the products, securing governmental approval, or opening markets.

ernmental approval, or opening up markets. Because the food and beverage industry pursues mass consumer audiences, as opposed to the agribusiness and pharmaceuticals whose direct consumers are more specific, it becomes an attractive sector in which to develop markets for GE products. At the same time, food and beverage corporations are currently experiencing slow market growth, and in addition to securing large-scale merger deals with each other, are seeking as many new and competitive market opportunities

as possible. It is therefore also in the interests of food and beverage conglomerates to work with the technological resources of agribusiness and pharmaceutical corporations, which could enhance food products’ marketability by targeting and promoting specific health concerns.

A survey by Arthur D. Little, a consulting company based in Cambridge, Massachusetts, indicates that 90 percent of pharmaceutical and food companies plan to develop, manufacture and/or market functional food products or ingredients.⁸ So, while certain corporations claim to be taking a step back from agribusiness because it has not yielded the successful synergies with pharmaceuticals first anticipated, they continue to be involved with the development of GE-based functional foods and nutraceuticals. The vested interests of the food and beverage, agribusiness, and pharmaceuticals corporations become clear in the following chart which indicates recent investment trends in GE-based functional food and nutraceutical products.

Recent Biotech Investments and Alliances for Functional Foods and Nutraceutical Products

- In January 2000 **General Mills** and **DuPont's Protein Technologies International (PTI)** business announced that they would collaboratively develop and market soy-based "functional foods." This deal follows a recent announcement made by the US FDA stating that companies can label the health benefits of soy protein to consumers on their products.
- In February 2000 **Quaker Oats** and **Novartis Consumer Health** – a unit that was not divested with its agribusiness unit – announced a joint venture called Altus Food, which will develop and market functional foods in the US, Canada and Mexico. Products will target women, children, athletes and young adults. Novartis operates a number of food product lines through its Consumer Health division. Novartis also markets its Aviva line of cereal bars, cereal, drinks and biscuits, in the UK and Switzerland, as well as its line of Ovaltine products internationally and its breakfast drink Ocléa in Switzerland. Also beginning in 2000, the **Novartis Agricultural Discovery Institute (NADI)** and **SemBioSys** (Canada) agreed to develop proprietary products for nutraceutical, cosmeceutical and pharmaceutical markets over the next few years.
- In May 2000, **Zeneca Agrochemicals** and **Greenovation** (a spin-off GE company from the University of Freiburg, Germany) announced that they would take over the ownership and distribution of a GE vitamin A enriched rice, also known as 'Golden Rice.' Zeneca, Greenovation and agencies worldwide want to distribute this technology "free-of-charge for humanitarian purposes in the developing world." Zeneca hopes that 'Golden Rice' will be on the market by 2003.
- In July 2000, **Archer Daniels Midland, Aventis CropScience, SKW Trostberg** and **Burrill & Co.** announced the joint establishment of a new \$30 million venture capital fund for nutraceuticals.
- In July 2000, one of the world's leading food conglomerates, **Unilever**, officially opened its \$14 million Biosciences Laboratory at the corporations' research facilities in Sharnbrook, Bedfordshire (UK), where R&D will be carried out for uses of GE in food production. Unilever is a strong supporter of the use of GE in foods. In a speech delivered in May 2000, Unilever CEO Antony Burgmans, states: "Unilever is, and remains, an advocate of modern biotechnology and genetic modification. We take the view that biotechnology offers us possibilities for making innovative products that improve people's health and vitality."
- In November 2000 **Nestlé** agreed to purchase one of **LION Bioscience's** 'integrated bioinformatics system,' for an undisclosed sum. According to Professor Dr. Andrea Pfeifer, Director of the Nestlé Research Center (Switzerland), "Bioinformatics offers exciting opportunities to improve and accelerate our research efforts. Nestlé has a strong interest in this key technology to strengthen and consolidate its leading position in Food Research and Development in order to meet the needs and desires of our consumers." LION has a number of alliances in informatics and genomics with such corporations as Aventis, Bayer, Celera, DuPont, Glaxo Wellcome, Merck Inc., Novartis, Pharmacia, and SmithKline Beecham.
- **Monsanto**, has been working through its **Agracetus** subsidiary with **John Hopkins University, ReProtect** and **Protein Design Labs** to develop soybean plants that produce antibodies to such things as the herpes virus, bacteria causing tooth decay, sperm and serious infections. Other nutraceutical crops that Monsanto is working on through its Agracetus subsidiary, include corn and soybean crops with monoclonal antibodies for lung, breast and colon tumors. Monsanto is also developing an "antiviral chicken feed," which will act as a drug against virus infection, and serve as an alternative to vaccines.
- **BASF** has become very optimistic about the functional foods and nutraceuticals markets — particularly for dietary supplements and animal feed ingredients — investing already some \$83 million in new plants and technologies, with plans to invest over \$40 million more between 2000 and 2002.

The biggest obstacle to marketing functional foods and nutraceuticals, according to the results of a survey conducted amongst 367 U.S. food companies in 1998, is the lack of awareness of these GE products.

The biggest obstacle to marketing functional foods and nutraceuticals, according to the results of a survey conducted amongst 367 U.S. food companies in 1998, is the lack of awareness of these GE products.⁹ A major part of the Generation 3 strategy, therefore, will

be targeted marketing campaigns on the health benefits of functional foods and nutraceutical products in the coming years.

3. Feeding the Hungry:

A third component of the new counter offensive is the promotion of GE crops and food products to feed a hungry world. Highlighting the specter of hunger and malnutrition that continues to stalk much of the globe — an alarming 680 million people are expected to suffer from malnutrition by the year 2025 — food biotechnology is being heralded by the agro biotech corporations as the new hope for salvation.

Here, the new wonder product from the Generation 3 line is Golden Rice which is rich in vitamin A. Originally developed by the public sector, the rights to Golden Rice were handed over to private sector corporations like AstraZeneca when the competition over patent claims became complicated and intense. Since approximately 200 million children die each year, indirectly due to causes associated with vitamin A deficiencies, these children have become the prime target of the Golden Rice proponents. Recent studies, however, indicate that Golden Rice could have negative impacts on hungry children. For example, Dr. Marion Nestle, from the Department of Nutrition & Food Studies at New York University, has shown that beta carotene and vitamin A are fat soluble, and therefore require an adequate amount of fat and protein intake in the diet to be absorbed through the intestinal wall. In a number of countries in Africa, Asia and Latin America, people lack sufficient amounts of fat and protein in their diet, as well as have intestinal diarrhea diseases, and thus would not be able to obtain vitamin A from Golden Rice.¹⁰

Meanwhile, the Gene Giants have begun to expand the commercial production of GE crops in the developing countries of Africa, Asia and Latin America. In China, over 50 GE organisms have already been approved for commercial products, environmental release or small-scale field-testing. In Mexico, virus-resistant potatoes have been commercialized for use by Mexican farmers and in South Africa insect-resistant cotton is being grown commercially. Moreover, in Thailand, GE molecular diagnostics for the diagnosis and control of virus diseases in shrimp exports have already been put into commercial use and, in Kenya and Zimbabwe, GE vaccines against animal diseases are in use. Agro biotech corporations have also invested in the export of cash crops such as bananas, coffee, citrus fruit and cotton. Aventis, for example, has targeted Madagascar, Columbia, Brazil and China for the development

of certain rice varieties, while in Benin the crop is cotton, in Cameroon it is plantain, and in the Dominican Republic it is coffee.

It is through international agencies like CGIAR [Consultative Group on International Agricultural Research] and ISAAA [International Service for the Acquisition of Agri-biotech Acquisitions] that the Gene Giants have been able to gain and/or extend their access in the South. As an international body, CGIAR functions under the World Bank, overseeing a network of agricultural research centres that house germplasm for 3000 agricultural crop species. Its membership includes 43 national governments plus regional financial institutions like the African Development Bank, the Asia Development Bank and the Inter-American Development Bank. What's more, Novartis, Aventis plus Monsanto are all active members of CGIAR's Private Sector Committee. But, when it comes to dumping GE technologies in the South, the ISAAA plays a key role. It's main objective is to promote biotechnology by creating partnerships between research institutes in the South and companies in the North. ISAAA is financed directly by agro biotech companies like Aventis, DuPont, Monsanto and Syngenta, as well as the World Bank and the U.S. Agency for International Development [USAID].¹¹

Yet, these same companies have been playing a highly dubious role in the South. While pushing GE seeds on developing countries, these corporations have been able to take advantage of less stringent regulations on agrochemical use to sell more hazardous pesticides. Novartis Seeds, for example, goes out of its way to provide Bt strains for the production of GE sweet potatoes in Vietnam, yet Novartis/Syngenta is busy producing for sale in China an old pesticide called monocrotophos, which has been banned in its home country, Switzerland.

Although companies like Novartis/Syngenta are willing to provide some of their GE seed technologies free of charge to farmers and research institutes in certain developing countries, there are grounds to believe that this is just another ploy to win public support in the North. As Charles J. Arntzen, president emeritus of the Boyce Thompson Institute for Plant Research in New York puts it: "I see no driving motivation for a company to give away technology unless they have exhausted all possible avenues for getting a return for their stockholders."¹² What this comment suggests, of course, is that the presence

of the agro biotech giants in the South is little more than a desperate attempt to generate a positive image of themselves amongst consumers in the North. It is simply a part of the cosmetic facelift that is taking place, trying to show that biotechnology can feed and save the world, regardless of what the cost may be.

But, like the Green Revolution of the 1960s, the introduction of monocrop agriculture for the production of GE crops is bound to destroy traditional farming systems

in Third World countries. While often including more than 100 species in a single field, traditional farming practices make use of crop diversity in order to minimize the risks of pest and disease epidemics,

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as well as drought, frost and other climatic factors. Maximizing yields over the long term, these systems provide a variety of dietary foods as well as a number of significant plant uses other than food. In India, as Dr. Vandana Shiva has shown, women use up to 150 different plant species — or ‘weeds’ as the agro biotech companies would have it — as medicine, food or fodder.¹³ GE monocrop production would destroy this biodiversity. What’s more, the operations of agro biotech corporations threaten the livelihood of small producers in the South. Monsanto, for example, has developed a GE canola that produces a high lauric acid used in the production of soap and food products. While currently estimated to be a \$350 million annual business in the U.S., high lauric acid has traditionally been produced in the South through palm kernel and coconut oils. Now, Monsanto’s production of high lauric canola threatens to wipe out the livelihood of local coconut and palm oil producers in Third World countries.

4. Life Saving Drugs:

One of the most attractive features of the new counter offensive is the use of GE technologies to produce life saving drugs. With the right kind of marketing and public relations schemes, the pharma

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The pharmaceutical industry believes this to be a winning formula for the GE debate. While the push for GE drugs is a strategy to create new market opportunities for the pharmaceutical giants, it is also being used to set

the pace for the larger drive of gaining public acceptance for a biotech future. Recognizing the public relations blunders committed in the past, those pharmaceutical companies with significant investments in biotech, along with their counterparts in agribusiness and food processing, want to take control of the GE debate. While their goal is to continue attractive profit margins and to achieve pay-offs on their R&D investments, they also want to play a winning hand in the biotech sweepstakes. These corporations can be expected to use whatever public relations and lobbying tactics necessary to accomplish these goals.

Although only a small percentage of drug therapies are currently based on GE technologies, genomics based therapies are predicted to take off rapidly in the next few years. According to Decisions Resources, an internationally based research market consulting firm, 20 percent of all central nervous system drugs are currently genomics-based. By 2005, 40 percent will be genomics based. As well, 25 percent of existing cardiovascular drugs are considered to be genomics-based, rising to 30 percent by 2005.¹⁴ Percentages are similar, if not greater, for other treatments for

autoimmune diseases, infectious diseases and cancer itself. Through genome mapping, say researchers, there could be as many as 25,000 molecular targets for new drugs.

To develop GE drugs for market, the pharmaceutical giants develop alliances with two types of smaller biotech companies. The first type are called 'toolkit' companies which provide access to gene databases, plus identify and analyze information on genes and proteins. The second type are referred to as 'content' companies which actually develop and test various drugs and therapies. The following chart provides some examples.

Examples of Working Alliances between Major Pharmaceutical Corporations and Smaller Biotech Companies for the Production of GE Drugs and Therapies.

- In 1999, **Johnson & Johnson** acquired **Centocor** – one of the leading producers of monoclonal antibody technology – for \$4.9 billion. As a result of this merger, Johnson & Johnson considers themselves “one of the largest biotechnology companies in the world. Johnson & Johnson is also the parent company of **Ortho Biotech** since 1990. Ortho Biotech develops and markets monoclonal antibodies for the treatment of organ transplant rejection. Ortho also has an agreement with leading biotech drug developer **Amgen** for a drug treatment for anemia. Through this agreement Ortho has rights to market Epoetin Alfa [a version of the naturally occurring erythropoietin protein] created through GE technologies for the regulation of red blood cell production.
- In 1999, **Roche** acquired **Genentech** in full for \$4.3 billion – the second largest acquisition that year in the pharmaceuticals industry. Some of Genentech's products include a humanized monoclonal antibody for the treatment of breast cancer and a number of recombinant/GE growth hormone products for growth hormone deficiency in children and adults. Roche also has a development and licensing agreement with genomics-based drug development company **Millennium Pharmaceuticals** since 1994 to identify genes influencing obesity and type II diabetes. Roche has invested at least \$70 million in this agreement. A gene, and the protein it encodes for, has been selected as a target around which drug development has begun.
- In 1998, **Novartis** founded the **Genomics Institute of the Novartis Research Foundation (GNF)**. Focus has been on “many of today's major diseases,” including Alzheimer's, diabetes, asthma, depression and cancer. Novartis has invested \$250 million over 10 years into the Institute, which is based in La Jolla, California. Novartis also has a licensing agreement with **Chiron Corporation**, whereby Novartis has invested \$60 million from 1996 to 2001 for gene therapy R&D for glioblastoma multiforme – a form of brain tumor. Novartis also has a number of research agreements for xenotransplantation with such companies as **BioTransplant Inc.** and institutions such as **Deaconess Hospital at Harvard University** and the **Vienna International Research Cooperation Centre**. Meanwhile, Novartis acquired xenotransplantation company Imutran in 1996.
- **Bristol-Myers Squibb** and **Genzyme Transgenics** have been involved a development agreement since 1995 for the production of monoclonal antibodies from GE goats for the treatment of cancer, psoriasis, organ transplant rejection and autoimmune disorders. Initially, Bristol-Myers Squibb invested \$2.7 million for the deal. The agreement was renewed in January 2001.

In an increasingly globalized market, pharmaceutical sales have been greatly enhanced by the introduction of direct-to-consumer marketing techniques. Although many doctors and other medical workers continue to perform sales function as drug prescribers for the pharmaceutical industry, patients themselves are increasingly being targeted directly. DTC or direct-to-consumer drug advertising has been authorized in the U.S. and will likely be so in the European Union in the near future. Through DTC drug advertising, pharmaceutical companies can advertise their drugs and therapies directly in magazines and on television or radio, the same way that clothes, cosmetics or cars are sold to a mass consumer market. Spending on DTC drug advertising by U.S. based pharmaceutical companies doubled between 1996 and 1998 to \$1.3 billion and is now estimated to be well over \$2 billion annually. In terms of profit margins, DTC marketing has already proven to be very effective. When Schering-Plough spent \$185 million in 1998 advertising its Claritin allergy drug, its sales more than doubled to \$2.1 billion.¹⁵

The first products based on gene therapy are expected to be released to market by 2003, with revenues projected at \$171 million. If few barriers are met, sales are expected to rise to \$4.77 billion by 2008. The main areas of R&D for gene therapy products are in cancer, cardiovascular disease and HIV infection, and not necessarily single-gene diseases. American Home Products, Novartis and Aventis are some of the leading pharmaceutical corporations involved with gene therapy through either alliances or acquisitions. Aventis, for example, is considered a major player in this area with its establishment of RPR Gencell and numerous collaborations with such biotech companies as Enzon, Genetix Pharmaceuticals and Virogenetics.

Meanwhile, GE insulin, the first GE drug to ever hit the market, produced by drug manufacturers Eli Lilly and Novo Nordisk, has caused potentially life-threatening effects in diabetics. A class action suit was launched against the two drug companies in April 2000, alleging that they held back on information on the side effects of GE insulin. The suit also charges that neither company conducted adequate clinical trials prior to getting FDA approval. According to a study, which was suppressed, undertaken by the British Diabetes Association – a group sponsored by Eli Lilly – between 15 and 20 percent of diabetics using the product complained of such side effects as reduced hypoglycemic awareness, arthritis and myalgia-like symptoms and weight gain. Meanwhile, in the U.S., several diabetics have been faced with lawsuits for negligence after going into a coma while driving because they were not aware they had become hypoglycemic.

Yet, not all of the Gene Giants saw pharmaceuticals as the wave of the future in biotech. In December 2000, both DuPont and BASF sold off their pharmaceutical units.

5. Industrial Biotech:

The fifth component of the new counter offensive involves a different strategy that emphasizes the industrial uses of GE technologies. The major corporate players here include DuPont, Dow, and BASF. Their strategy entails a more aggressive approach in promoting the positive benefits of GE technologies for industrial uses, including a wide range of chemically based products.

As the CEO of DuPont, Chad Holliday, states:

*The current public debate over biotechnology remains too narrowly focused on the genetic enhancement of food and is primarily about risk. We believe that this debate needs to be expanded to include the broader potential uses of biotechnology, and to include a full discussion of benefits as well as risks...the potential applications of modern biology are too diverse for even a company with DuPont's resources to do justice to the full spectrum. We have chosen select areas where our traditional science, new biological tools, and our strong market presence continues to give us unparalleled competitive advantage: food, feed, agriculture, health care, wellness materials, sensors and electronics.*¹⁶

As distinct from their life science cousins, DuPont, Dow and BASF want to emphasize the tremendous industrial applications of biotechnology as a science. After all, these companies never adopted the 'life science' makeover by divesting their basic chemicals units. Indeed, the majority of their current annual sales are generated from basic chemical operations. BASF still specializes in chemically based products [e.g. laundry detergents and rinses, antibacterial cleaning products, additives to keep engines clean] that make up approximately 80 percent of annual sales. For Dow, chemical products make up 79 percent of annual sales, while for DuPont, 83 percent of its sales are from chemicals. What's more, in contrast to the major agro biotech players, BASF, Dow and DuPont have little to lose on the pharmaceuticals front. Even in 1999, before divesting their pharmaceutical operations, less

than 20 percent of BASF's and 6 percent of DuPont's sales came from pharmaceuticals, while Dow has not had operations in this sector. Therefore, they do not need to downplay chemicals in order to present a more positive public image.

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enzymes are biological catalysts that help speed up chemical reactions. They are widely used in industrial processes to increase efficiency by reducing the amount of water and/or energy required. The use of industrial enzymes is particularly important for the processing and/or manufacturing of: alcohol; animal feed; baked and brewed goods; dairy foods; detergents; leathers; oils and fats; pulp and paper; starches and sugars; textiles; and wines and juices. The industrial enzyme sector is big business. The current dollar estimate of this market is valued at \$2 billion.¹⁷

Dow, for example, plans to release its line of GE industrial enzymes by 2003. In June 2000, Dow and Diversa, a leading genomics company, formed a joint venture company to produce and market industrial enzymes derived from GE bacteria, yeast or fungi. DuPont and Genencor are working together to develop polyesters and other fibers using GE bacteria. Genencor has taken genes from yeast and bacteria and spliced them into *E. coli* to create a new strain of bacterium, which then consumes glucose from cornstarch, in turn producing the enzymes needed to convert sugar into the desired chemical, 3-carbon glycol terephthalate for polyester production. This chemical is supposed to keep stretchy fabrics from going limp. In 2001 DuPont expected to mass-produce the new chemical at a fraction of the costs when using non-GE technologies. And, BASF is also very active in the production of enzymes from GE microorganisms. BASF's Fine Chemicals unit, which produces vitamins for humans and animal feed, uses GE to produce vitamin B2 and vitamin C products. In 1997, products developed through GE technologies at BASF amounted to some \$246 million.

Meanwhile, Monsanto has invested in the R&D of 'green plastics' derived from GE corn. Corporate researchers have found that by isolating the gene in the *Ralstonia eutropha* bacterium, which causes plant sugars to convert directly into plastic through a fermentation process, and inserting these genes into corn plant cells, a 'green plastic' can be produced. To date, the largest investment in green plastics has been made by Dow and Cargill, a \$300 million investment to produce a non-GE green plastic line, known as 'Nature Works,' for use in the manufacturing of clothing, cups, food containers, candy wrappers, and home and office furnishings. It remains to be seen whether Monsanto, which also has substantial ties to Cargill, will convince Dow and Cargill that GE technologies should be used in their 'Nature Works' production. Yet, ironically, recent scientific studies have demonstrated that both GE and non-GE production methods for green plastics up to this point consume a greater amount of fossil fuels than do most petrochemical manufacturing processes.¹⁸

What's more, the environmental health impacts of industrial biotechnology demand serious scrutiny. The production of industrial enzymes from GE bacteria, yeast and fungi leaves behind a sludge that contains residues of the microorganisms and raw materials involved in the process. In turn, this bacterial sludge is released into the environment, including the food chain, through various waste disposal methods. For example, Novozymes (once a subsidiary of pharmaceutical corporation Novo Nordisk), the largest producer of industrial enzymes in the world, recycles its bacteria sludge by transporting it to local farms to be used as fertilizer. The potential health hazards of the use of GE bacteria were dramatically demonstrated when, in 1989, a Japanese company, Showa Denko, produced a chemical called L-tryptophan [used as a dietary supplement to treat depression, sleep disorders and a number of other physical and psychological conditions] employing GE bacteria. Soon after Showa Denko released the product on the market, over 1500 Americans became ill, with symptoms ranging from severe muscle pain and heart problems to memory defects and paralysis. During the outbreak, 37 people died. Nearly all victims had taken Showa Denko's GE-based L-tryptophan, which was later found to contain traces of toxic compounds.¹⁹

4. Global Governance

The Gene Giants have no intention of leaving anything to chance. Both the leading agro-chemical and pharmaceutical corporations know that the future of the biotech industry lies in terms of global markets. They also know that there are now global institutions of governance in place, like the World

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Trade Organization or the International Monetary Fund, that can be used to establish rules and disciplines in favour of the marketing of biotech products. Indeed, the Gene Giants know how to get on the ground floor of writing global trade rules to serve their own interests.

The classic case is the writing of the intellectual property rights rules in the global trade regime. During the Uruguay Round of the General Agreement on Tariffs and Trade (GATT) negotiations in the early 1990s, the biotech industry led the way in negotiating an agreement on Trade Related Aspects of Intellectual Property Rights [TRIPS]. Several U.S. corporations

— including Bristol Myers Squibb, DuPont, Pfizer, and Monsanto — constituted themselves as the Intellectual Property Rights Committee [IPC]. Their prime objective was to secure guaranteed protection for their claims to intellectual property throughout the world by compelling all countries to adopt U.S.-style laws such as those granting monopoly sales rights to patent holders for extended periods of time.

The IPC drafted their own set of rules to protect intellectual property rights. Representatives of the IPC traveled to Japan and Europe to meet with big business lobbies like the Japanese Keidanren and the European Round Table of Industrialists. With the support of the Japanese and Europeans, the TRIPS Agreement was adopted at the end of the Uruguay Round as part of the GATT, to be administered thereafter by the newly formed WTO. The rules and disciplines in the TRIPS Agreement turned out to be, almost word-for-word, the same as those originally drafted by the IPC which was heavily weighted in the interests of the biotech industry.

As we shall see, these new trade rules provide protection for the biotech industry at the expense of policies and programs originally designed to serve the needs of people and the environment in countries both North and South. To date, the main victims have been Third World countries where up to 80 percent of all patents for technology and products are held by corporations based in the industrialized North. What's more, those countries in the North and the South that provide pharmaceutical drugs for their people by supporting generic drug industries, are forbidden to do so under the TRIPS rules.

The political lobby machinery is also well oiled at regional levels. For example, EuropaBio, which comprises 600 companies with biotech interests, plays a major role in shaping public policies and public opinion in Europe. Its membership includes corporations ranging from pharmaceutical companies

like Bayer and Rhône-Poulenc, agro biotech corporations like Novartis and Monsanto Europe and food conglomerates like Nestlé, Unilever and the Danone Group. Like the U.S. based Biotechnology Industry Organization, EuropaBio not only plays a pro-active role in countering anti-biotech movements like the GE food campaign, but also in mounting aggressive lobbying artillery to ensure that the WTO adopts and enforces global trade rules which favour the industry.

WTO Regime

As far as global institutions go, the World Trade Organization is relatively new. It was established in 1995 at the end of the Uruguay Round of the GATT negotiations with a mandate to oversee the liberalization of the global economy through the new world trade regime. In five short years, the WTO has emerged as the most powerful institution of global governance. What the global managers wanted to do by creating the WTO was to put in place an institution that would not only administer the world trade system, but one that would have the power to enforce its trade rules on governments. Unlike any other global governing institution, the WTO can exercise effective enforcement powers through its own dispute settlement mechanism.

Under the WTO's dispute settlement mechanism, any of its 144 member countries can, acting on behalf of their own corporate clients, directly challenge the laws, policies and programs of another country as violations of global trade rules. When this happens, panels of unelected experts are appointed with the power to adjudicate claims of alleged violation of WTO rules and hand out punishments through economic sanctions. Not only do these panels operate in secret, but also all documents, hearings and briefs are kept confidential, and there are no conflict of interest rules. In effect, the WTO possesses the judicial and legislative powers to override the decisions of democratically elected legislatures and strike down the laws, policies and programs of countries, including those designed to ensure food safety, health and environmental protection.

In particular, there are three WTO agreements that are currently used to govern the production and marketing of biotech products in the global economy, namely: the Agreement on Sanitary and Phytosanitary Measures [SPS]; the Agreement on Technical Barriers to Trade [TBT]; and the Trade Related Aspects of Intellectual Property Rights [TRIPS].²⁰ Each of these agreements contains a body of rules that serve, in effect, to protect the interests of the biotech industry. If a country has strict food safety and health protection laws that prohibit the import of certain biotech products, then corporations marketing those products can, through their governments, invoke the WTO's dispute settlement mechanism to compel the country either to change or eliminate this unwanted legislation.

The SPS Agreement is primarily designed to facilitate world trade by eliminating differences in food regulations by governments that fragment global markets. The SPS rules cover not only food safety regulations, but also livestock, fisheries and plant health. In setting domestic food standards, for example, Article 2.2 of the SPS requires that governments use 'risk assessment' methods. What

this means, in effect, is that any country intending to put restrictions on imports of GE food products must first provide scientific data proving a threat to justify the regulatory measure. This must be done even though the lack of scientific evidence about the safety of GE foods is precisely why some governments have taken regulatory action.

Indeed, the SPS effectively eliminates the Precautionary Principle which stipulates that potentially dangerous substances must be proven *safe* before they can be put on the market. The SPS rules also

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insist that domestic regulations not be any more trade restrictive than is necessary to achieve its WTO-permitted objectives. Nor can countries adopt regulations or standards that exceed those established by international agencies like Codex Alimentarius of the United Nations or the industry funded International Organization on Standards (ISO) in Geneva. To date, all rulings by the WTO dispute panels on cases involving the SPS Agreement have judged all domestic regulatory measures for safeguarding public health to be barriers to trade that must be weakened or eliminated.

The TBT Agreement is also used to require governments to roll back laws and policies that include standards regulating the imports of GE products. As with the SPS, the TBT Agreement puts heavy emphasis on both the least trade restrictive rule and international standards established by the ISO or Codex Alimentarius. Here, even modest forms of product regulation such as the labeling of GE food products could be challenged as being WTO illegal under the TBT rules. Unless the government in question can prove that its labeling regulations for food safety purposes qualifies for one of the limited exceptions allowing variation from Codex or ISO standards, then the TBT Agreement could be used to weaken or eliminate such labeling requirements as a hindrance to global trade. Under the TBT rules, for example, the U.S. claims that mandatory food labeling is an illegal trade barrier in violation of the WTO.

The TRIPS Agreement, as we have seen, provides corporations with the tools to protect intellectual property and technology while, at the same time, undermining the ability of governments to protect their own citizens, especially when it comes to public health care needs. To ensure that basic necessities such as food and medicines are accessible and affordable, many developing countries have adopted laws and policies designed to prevent these resources from being subject to private monopoly control. Under the TRIPS, however, these basic necessities can be privatized and controlled through global patent laws. By granting monopoly sales rights to patent holders for extended periods of time [e.g. 20 years], the TRIPS rules allow the Gene Giants to protect their own profit making interests by making it more costly for poor and developing countries to procure seeds for crops and make medicines more accessible to their people.

Although the current TRIPS Agreement does allow developing countries to be exempt from full application of its rules until 2005, this has not stopped biotech corporations from challenging their laws and policies through WTO actions initiated by the U.S. government. When India's patent laws were challenged by the U.S. in 1997, the WTO disputes panel ruled that the Indian Government was required to establish statutory procedures not only for the immediate receipt of patent applications by agro-chemical and pharmaceutical corporations, but that these patents would be back-dated to the date of filing once the TRIPs Agreement was fully implemented in 2005. And, as we shall see, while the TRIPs rules do make allowances for governments to adopt measures that promote and protect public health, this has not prevented the U.S. and other governments from using the WTO to safeguard the interests of the pharmaceutical industry against developing country laws designed, for example, to make desperately needed AIDS drugs more affordable and accessible.

Under the WTO regime, the TRIPs Agreement requires that countries adopt very high standards for the protection of corporate property while the SPS and TBT Agreements are designed to get countries to lower or weaken their national standards for food, health and environmental protection of their populations. In both cases, through the process of harmonization, diverse national standards are replaced by uniform global standards. In addition to the adoption of uniform international standards, two mechanisms are employed by the WTO to facilitate this harmonization process. First, "equivalence determinations" are mechanisms used to declare that a 'foreign standard' is the same and must be treated as if it were a 'domestic standard'. These 'determinations' are based on subjective comparisons rather than clear cut criteria and procedural guidelines. Second, "mutual recognition agreements" are increasingly used in bilateral trade negotiations to harmonize regulatory regimes. By harmonizing test standards between trading partners, these MRA's can serve to expedite product approval and deregulate health and safety standards.

Food Safety:

Over the past six years, these WTO rules have been used to substantially weaken the capacities of governments to ensure imports of food and agricultural products are safe. The classic case is the WTO ruling on the EU's ban on artificial beef hormone residues in imported meat products. In a nondiscriminatory approach to both domestic and imported beef products, the EU issued a ban in 1988 on the sale of beef from cattle treated with artificial hormones which had been linked with cancer and premature pubescence in girls. Based on public demand, the EU adopted a "zero risk" standard by eliminating public exposure to the risk altogether, instead of trying to assess a tolerable degree of indeterminable risk or wait for the appearance of negative human health effects. The U.S. formally challenged the EU ban in 1996 and two years later a WTO disputes panel ruled that the EU ban on hormone treated beef was illegal under the SPS rules. After the panel's ruling was affirmed by the WTO Appellate Body, the EU was ordered to open its markets to U.S. beef imports treated with artificial hormones in May 1999.

The food safety implications of the WTO beef hormone ruling are far reaching.²¹ By declaring that a country cannot enact health safety regulations before threats are scientifically proven, the WTO effectively ruled the Precautionary Principle out of order. At the same time, the beef hormone ruling revealed that factors such as cultural values, attitudes and the priorities of individual societies have no role to play in the WTO standard setting process. Under the SPS rules, the burden of proof lies with governments enacting the regulatory measures, not the biotech corporations responsible for making and selling the product. Public health regulations, says the SPS, must be based on “sound science.” If no conclusive scientific evidence exists to back its claim, a government is unable to meet the WTO burden of proof that its regulatory measures are necessary, despite the risk of negative results appearing over a longer period of time.

The WTO’s restrictions on food safety regulations have been further reinforced by the strict requirements it now imposes on government standards for the protection of plant and animal health. A case in point is the WTO ruling against Australia’s quarantine on raw salmon imports.²² Since the 1960s, Australia had restricted the import of uncooked salmon, in part, to protect that country’s indigenous fish population and also to prevent the introduction of infectious and contagious diseases. When challenged by Canada and the U.S. under WTO rules in 1994, Australia conducted a risk assessment as required by Article 5 of the SPS Agreement and found, among other things, 20 bacteria in Canadian and U.S. salmon imports that were not present in Australian salmon. The Australian report concluded that since Canadian uncooked salmon could infect live Australian salmon, the quarantine should remain in place to prevent the possible spread of disease. In 1998, however, a WTO panel ruled in favour of Canada, declaring that Australia’s salmon ban violated the SPS Agreement by not being grounded in ‘sound science’, exceeding international standards, and was therefore discriminatory.

Although appeals are still pending, the Australian salmon case shows how the WTO’s SPS rules can be used by exporting countries, acting on behalf of their corporations, to strike down laws and policies designed to ensure food safety through protection of animal health. Once again, only when precise risks to animal or plant health and the spread of infectious or contagious diseases can be quantified with scientific certainty, does a government have the grounds to adopt strict standards under the SPS rules. Once again, the burden of proof lies with the importing countries rather than the exporting

The threat of WTO action also generates a 'chill effect' when it comes to food safety regulations by governments.

corporations. Indeed, the Australian salmon case shows that the WTO rules do not even allow importing countries to request that exporting countries and their corporations demonstrate that their products are disease-free.

The threat of WTO action also generates a ‘chill effect’ when it comes to food safety regulations by governments. In 1995, South

Korea changed its food safety rules on two occasions in response to threatened action by the U.S. under WTO rules. After complaints about the length of food safety inspection procedures for imported fruit, the South Korean government bowed to pressure by not only lowering its inspection time from

25 to 5 days but even allowing fruit shipments to be made before test samples were analyzed. Later, when the U.S. filed another complaint over South Korea's policy of maintaining a shorter shelf life for meat products for food safety reasons, the government agreed to substantially extend the shelf life limit from 30 to 90 days. In both cases, the South Korean government preferred to reach a settlement rather than risk a lengthy and costly battle with the U.S. and its exporting corporations before a WTO disputes panel.

What's more, one of the most pressing problems emerging in the global trade regime today is the fact that food safety inspection at borders is actually weakening at a time when rapidly expanding food trade is resulting in increasing incidences of food-borne illness. Under the International Monetary Fund, developing countries are constantly being pressured to expand their food exports, on the one hand, and slash spending for public health care and sanitation, on the other hand. Given the IMF's "structural adjustment" programs, most developing countries are simply unable to enforce their food inspection laws themselves. In the case of Mexico, for example, government funding for food safety inspection was slashed from \$25 million to \$5 million in 1995, following structural adjustment demands imposed by the IMF following the collapse of the Mexican peso.

Public Health:

The TRIPS Agreement is largely designed to significantly expand the profit margins of the major pharmaceutical corporations by guaranteeing patent protection for their pharmaceutical products. Under the TRIPs rules, all member countries of the WTO are required to put in place legislation providing 20-year protection for intellectual property rights regarding pharmaceuticals by 2005. With this kind of patent protection, pharmaceutical corporations would be granted the exclusive monopoly rights to market particular drugs and medications in all WTO member countries for a 20-year period. These rules will put considerable burdens on those governments which strive to ensure access to drugs and medicines at lower costs, especially for the poor, by supporting generic drug industries.

Article 31 of the TRIPs Agreement does, however, allow governments to modify some patent holder rights for public purposes through the use of compulsory licensing and parallel importing devices. With compulsory licensing practices, governments can suspend exclusive marketing rights by allowing generic drug companies to produce a pharmaceutical product while paying a royalty to the patent holder. Through compulsory licensing, the inventor gets a return on investment and the public has access to lower priced drugs. Parallel importing practices allow governments to import drugs and medicines through wholesalers or third party intermediaries from countries where these products are sold at cheaper costs, rather than buying them directly from the pharmaceutical manufacturer. In the EU, common use is made of parallel importing of pharmaceutical products, thereby allowing smaller countries to take advantage of larger economies' scale of production by importing through their more populated neighbours.

Despite these positive provisions, the U.S. government and the pharmaceutical industry have threatened several developing countries with the threat of WTO challenges if they adopt compulsory licensing or parallel importing measures for the sale of drugs and medicines. Take the case of Thailand's 1992 patent law which empowered the government to establish the Pharmaceutical Review Board with control over drug prices in Thailand as well as use compulsory licensing practices.²³ The PRB lowered prices on life extending drugs such as flucanazole, marketed by the Pfizer corporation, from \$14 a daily dose to \$1. Although compulsory licensing is permissible by the TRIPs Agreement, the U.S. government waged a relentless battle to have the Thai patent law and the PRB declared illegal under the WTO. Finally, the Thai government gave into the U.S. threats in 1999, amending its patent law in compliance with the U.S. interpretation of the TRIPs rules.

Similarly, South Africa's 1997 medicines law has come under attack.²⁴ In addition to encouraging the generic drug industry and prohibiting pharmaceutical corporations from paying doctors a bounty for using their products, the South African Medicine Law calls for parallel importing as a means to lower and control pharmaceutical prices. The South African Pharmaceutical Manufacturers Association, which is largely composed of subsidiaries of foreign-based pharmaceutical corporations and is known to have close ties with PhRMA, the U.S. Pharmaceutical Research and Manufacturers Association, has threatened the South African government with a WTO challenge if it does not amend its medicine law. In particular, the U.S. government has formally requested that the parallel import provisions be dropped from the South African medicine law, backed by former President Clinton and Vice President Gore's interventions during their 1998 state visit to South Africa.

In short, the TRIPs Agreement has become a powerful weapon for the pharmaceutical industry and their government allies to use in prying open profitable markets for their products around the world, especially in the developing countries, thereby undermining international measures to improve public health care. Moreover, the WTO's TRIPs Agreement effectively trumps codes adopted by the World Health Organization [WHO]. For example, the WHO and UNICEF's Breast Milk Substitute Marketing Code, ratified by 104 of the WTO's 135 member nations in order to stem the tide of infant mortalities caused by the widespread promotion of artificial infant formula products, especially in the Third World, could be effectively challenged as being WTO illegal, particularly under Article 20 of the TRIPs Agreement. In fact, the WHO Executive Board has called on its member governments to carefully review their commitments under the TRIPs Agreement to "ensure that public health rather than commercial interests have primacy in pharmaceutical and health policies' and "to safeguard access to essential drugs."

At the fourth ministerial meeting of the WTO held in Qatar in November 2001, developing countries like Brazil insisted on the right of governments to provide pharmaceutical drugs to AIDS patients for public health reasons, without any interference from the WTO. Besides Brazil, this had already become a critical issue in South Africa and throughout the African continent. At the Qatar meetings, the U.S. and Brazil held closed-door meetings and eventually agreed on the wording of an interpretive note

acknowledging the right of governments to take action for the protection of public health. Since no changes to this effect, however, were actually made in the TRIPS rules themselves, the interpretive note is not subject to binding enforcement. It remains to be seen what effect this will have.

Bio-Piracy:

The WTO TRIPs Agreement also trumps other international agreements designed to preserve and protect biological diversity and the subsistence rights of indigenous peoples and farmers. The 1992 Convention on Biological Diversity, for example, calls on all its signatory nations to “respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities” and the role they continue to play in safeguarding the rich biodiversity of their regions. Yet, as we have seen, agrochemical and pharmaceutical corporations now lay claim to this rich biodiversity as source

By exercising their WTO patent rights, agro-chemical and pharmaceutical corporations are in a position to claim ownership rights over indigenous seed, herbs and traditional ways of securing medicinal benefits from local fauna and flora.

material for their products. Once again, the TRIPs Agreement provides these corporations with the legal tools they need to claim ownership over traditional seeds and plant varieties through its patent system based on the protection of intellectual property rights.

In effect, TRIPs has become the principal weapon for this form of bio-piracy. By exercising their WTO patent rights, agro-chemical and

pharmaceutical corporations are in a position to claim ownership rights over indigenous seed, herbs and traditional ways of securing medicinal benefits from local fauna and flora. It doesn't matter that these seed and plant varieties have been cultivated by local indigenous and rural communities for hundreds, if not thousands, of years. All these corporations have to show is that they have made some alterations of the plants they intend to patent through their labs. Although these alterations or so-called 'new traits' do not have to be substantial or significant, it is difficult to verify the validity of these claims without having access to appropriate testing facilities. Given this obstacle, plus the costly procedure of pursuing civil litigation against corporations taking out these kinds of patents, it is fair to say that most of these incidents of bio-piracy go unchallenged.

There are, of course, some exceptions. Take, for example, the corporate patent on Basmati rice.²⁵ While admitting that the people of India and Pakistan have grown Basmati rice for countless generations, RiceTec, a U.S. corporation based in Texas, applied for and was granted a patent in 1997. RiceTec had only made very slight alterations to the traditional traits of Basmati rice. For India, Basmati rice is an important export crop with markets in Europe, the Middle East and North America. In a letter to the U.S. ambassador, several prominent civil society groups in India declared: “The truth is that the U.S. is pirating the intellectual property of the farmers, healers, tribals, fisherfolk of India and other developing

countries.” The TRIPs rules, however, will be used to uphold RiceTec’s patent rights over the subsistence rights of India’s farmers.

Perhaps the best-known example of bio-piracy has to do with corporate patent claims on the neem tree. In India, the neem tree has been the source of medicinal and bio-pesticide products for indigenous and rural communities down through the centuries. Since 1971, several U.S. and Japanese corporations have secured patents on various products of the neem tree. The prime example is the W.R. Grace Co. Not only was W.R. Grace one of the first corporations to secure patents on products of the neem tree, but it has set up a plant in India to manufacture and sell its neem-derived products, notably a pesticide extract. While over 200 civil society organizations from 35 countries have directly challenged W.R. Grace on its neem seed patent for this production of pesticide extract, through the U.S. Patent and Trademark Office, the corporation insists that India has no other option but to fully protect its patent, given the government’s obligations under the TRIPs Agreement.

Prompted by its pharmaceutical industry, the U.S. has also threatened WTO action against Thailand for its proposed law to promote traditional medicine registration. For several years, Thailand has experienced numerous raids on plants and insects by pharmaceutical companies. When, for example, the Thai plant traditionally used to cure ulcers, called Plao Noi, was patented by a Japanese company, Thais lost the chance to market this medicinal product themselves. As a result, the Thai government introduced legislation to protect traditional medicines and plant life by allowing Thai indigenous healers to register their traditional medicines. Any biotech or pharmaceutical corporation seeking patents on these products would have to negotiate with the indigenous healers. So far, the Thai government appears to have resisted U.S. demands to withdraw its proposed legislation or face the possibility of WTO retaliation.

Meanwhile, the TRIPs Agreement serves to facilitate greater corporate consolidation and monopoly control over food and healthcare by the biotech industry. Article 27.3 [b] of the TRIPs Agreement requires that WTO member countries protect corporate patents on plant varieties by agribusiness and pharmaceutical companies. We have already seen the consolidations and mergers taking place amongst agrochemical and pharmaceutical corporations, leading to greater concentration and monopoly control in the biotech industry. By shifting ownership and control over plant varieties [including seed stocks] away from local farmers and communities, the intellectual property rights and patent protection regime built into the TRIPs Agreement provides the Gene Giants with a powerful set of tools and incentives for consolidating their power in the hands of fewer corporations.

5. Bio-Justice Movement

If nothing else, the new counter offensive demonstrates that the Gene Giants are here to stay. Above all, they are determined to make their self-fulfilling prophecy of the Biotech Century come true. All of this, of course poses a fundamental challenge to biotech activists and concerned citizens around the world. It is not enough, however, to respond with a series of piece meal forms of resistance.

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In fact, the Gene Giants and their government allies have been forging ahead with an even more hard-line message than before. "We will not be able

to stop this technology," declared former U.S. Agriculture Secretary Dan Glickman on a PBS television special, "Harvest of Fear," in April 2001. "Science will march forward." One month earlier, during the wake of the StarLink corn fiasco which potentially dumped allergy causing substances into the food chain, a top executive from Aventis publicly admitted that "the food supply will never be rid of the new strain of corn [StarLink]" and later called "for a change in federal regulations to allow some level of the engineered corn, known as StarLink, in any human food."

Yet, according to update reports in *Biodemocracy News* [a news service for campaign activists run by the Organic Consumers Association], there are signs that public resistance too continues to escalate. In Asia and the Pacific, Thailand and Sri Lanka issued bans on the growing of all GE crops in their countries while Australia and New Zealand passed laws requiring mandatory labeling of all GE products in May, 2001. In India, a million farmers marched in New Delhi demanding, among other things, a ban on GE technologies and life form patents, while protests were organized against the field testing of GE rice and corn in the Philippines, GE cotton in Indonesia, and U.S. corn imports to Japan in the Spring of 2001. And then, in what amounts to a major body blow to Monsanto and other Gene Giants, China announced in April 2001 that it was banning the cultivation of GE rice, corn, soy and wheat for fear of losing its own major export markets.

In Europe, there were also few signs that biotech resistance was subsiding. During July and August of 2000, government authorities in France and Greece ordered the destruction of thousands of acres of GE soy, canola, and cotton after discovering that imported seed shipments were contaminated. In Denmark, eight consumer products were pulled off the shelves when it became clear that they contained more than one percent of GE soy and corn while, in Italy, the sale of four varieties of GE corn were blocked. In Latin America, public debate over GE crops erupted in Ecuador, Chile, Columbia and Peru and, in Brazil, corn acreage increased 27 percent in 2000 due to the demand for GE free corn. Meanwhile, in the U.S., a series of anti GE resolutions were passed by city councils across the country while a national

day of action was organized on July 17, 2000 and activists mounted direct action sabotage of GE crops in Maine, Wisconsin, and Washington. And, in Canada, the world's largest distributor of wheat, the Canadian Wheat Board, called on the federal government to ban the growing of GE wheat, for fear of losing overseas grain markets.

In effect, the ingredients of a movement for bio-justice and democracy are already in place. Pockets of biotech resistance are now quite firmly rooted in different regions of the world, notably in Europe and Asia-Pacific, and increasingly, in North and Latin America. Networks of farmers, consumers and youth activists have cultivated alliances with one another, collaborating on common events and campaigns. The series of Biodevastation/Biojustice conferences, which have been organized at least once every year since 1998, sometimes as counter events to annual gatherings of the biotech

In particular, based on analysis outlined here, there is a need to develop a more strategic focus on the Gene Giants themselves, a common plan of action in response to their new counter offensive, and a longer term strategy for broadening the constituency of the bio-justice movement in relation to the continuing expansion of biotechnology and the applications of GE technologies.

industry, provide opportunities for bio-justice or bio-democracy activists to come together, share experiences and develop some common strategies. While this movement has yet to name itself, calling it a 'bio-justice movement' will, hopefully, suffice for the time being.

Yet, despite these positive elements, there are some serious gaps and deficiencies in movement building that need to be overcome. In partic-

ular, based on analysis outlined here, there is a need to develop a more strategic focus on the Gene Giants themselves, a common plan of action in response to their new counter offensive, and a longer term strategy for broadening the constituency of the bio-justice movement in relation to the continuing expansion of biotechnology and the applications of GE technologies.

Strategic Focus:

For the most part, the biotech resistance movement has put strategic priority on challenging governments and government agencies. The objective has been to press governments to regulate the

As long as the Gene Giants are able to buy monopoly control through patents, conduct the research required for product approval, and spend substantial funds on political lobbying, the capacity of governments and their agencies to regulate GE technologies and products in the public interest is considerably undermined.

application of GE technologies and the sale of GE products through labeling, moratoriums, bans or other regulatory measures. While this strategic focus has

proven to be successful in some regions and countries, notably Europe, it has not been particularly effective in most of the campaigns waged. The fact that transnational corporations have taken control of the machinery of state and policy making in most countries, including institutions of global governance like the World Trade Organization, makes the exclusive focus on governments questionable as the strategic target of campaigns. As long as the Gene Giants are able to buy monopoly control through patents, conduct the research required for product approval, and spend substantial funds on political lobbying, the capacity of governments and their agencies to regulate GE technologies and products in the public interest is considerably undermined.

In short, corporate rule is the name of the game in the political life of most countries and regions today. Unless the Gene Giants become the strategic focus of biotech resistance campaigns, the major

But, as long as the biotech engines are not made a prime focus of our campaign strategies, the system of corporate rule is bound to prevail when it comes to regulating GE technologies and products, let alone developing new policies and laws.

corporate players who are driving the GE agenda will continue to virtually escape unscathed. It is imperative, therefore, that the biotech engines themselves be unmasked, exposed, and confronted. This does not mean that campaigns should be organized to focus exclusively on the main corporate players. Governments and their

agencies should also be the focal point of our campaigns. But, as long as the biotech engines are not made a prime focus of our campaign strategies, the system of corporate rule is bound to prevail when it comes to regulating GE technologies and products, let alone developing new policies and laws.

So far, the Gene Giants like Novartis, Monsanto, Aventis, or AstraZeneca, as well as DuPont, Bayer, BASF and Dow have not become the prime focus of biotech resistance campaigns. To be sure, Monsanto emerged as the number one corporate target in campaign activities during the period between 1997 and 2000. But, this does not mean that dismantling Monsanto's operations was the strategic priority of campaign activists around the world. For all the talk about Monsanto as the bad boy of the biotech industry, it was not made the prime focus of a concerted campaign, except in India. Given the financial trouble that Monsanto was experiencing throughout 1999, it is quite possible that, had an effective campaign strategy been mounted, serious damage could have been done to one of the leading Gene Giants. Although other corporations that make use of GE inputs in their products like Starbucks coffee, Campbell Soup and Kellogg's cereals, or fast food chains like McDonald's, Burger King, and Pizza Hut have been the objects of biotech resistance campaigns, the Gene Giants, which are the big GE pushers, have not.

Of course, campaigns that have been waged against food retailers, fast food chains and super food stores has been an important strategic factor in shutting down the markets of the biotech engines, namely, the Gene Giants themselves. Often the threat of market shutdowns is the only

language that these corporations understand. But, we have also seen how the Gene Giants are able to effectively outmaneuver their opponents. By shifting the application of GE technologies, moving their GE crops and foods to other markets, or developing new GE product lines, these biotech engines have been able to stay ahead of the game for the most part. That's why they must become a prime focus of strategic action in our biotech resistance campaigns. What's more, the strategic links between the biotech engines and the companies that process and sell GE products needs to be exposed.

In short, the name of the game is to follow the money and the technology. To do so, we need to focus our strategic attention on the Gene Giants themselves. This does not by any means rule out campaign strategies aimed at mobilizing consumer demand to shutdown markets. But the nature

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and structure of the Gene Giants needs to become a strategic priority in our campaign planning. The various operations of the agro biotech companies, as well as the food processors and the pharmaceutical conglomerates, are found in most cities,

thereby providing concrete opportunities for organizing action. [see Appendix for list of locations of the main agro biotech corporations in the U.S. and Canada]. The strengths and vulnerabilities of these corporations need to be strategically analyzed along with their major customers, suppliers, creditors, workers, and lobby machines. More creative use of direct action as well as legal action strategies and tactics needs to be incorporated into campaign planning.

It should also be kept in mind that the new counter offensive requires greater collaboration and integration of the major corporate players in the main sectors of the biotech industry. The future of

The future of the agro biotech corporations is interlocked with that of the food biotech and pharma biotech industries.

the agro biotech corporations is interlocked with that of the food biotech and pharma biotech industries. Although the mainline food processors and pharmaceutical companies may have reason for keeping their distance from their agro biotech cousins, they also know that, for the time being at least, the agro biotech corporations are the main

engines producing GE technologies and marketing GE products. Increasingly, the food and pharma biotech corporations are becoming major stakeholders themselves in the biotech industry. Through their own alliances with genomics and small biotech companies, the food and pharmaceutical giants are becoming more and more integrated in the industry. As a result of their investments, the food and pharma biotech players have a major stake as well in the future of biotechnology. Here, the blurring of the lines between crops, food and drugs poses a unique set of challenges for campaign organizers in the bio-justice movement. In developing campaigns, it is important to critically monitor these integration trends, as well as the prospect that either the food conglomerates or the pharmaceutical giants could gobble up the agro biotech corporations, when the time is ripe.

Campaign Fronts:

The Gene Giants new counter offensive provides both a framework and a timetable within which to further build this bio-justice movement. The six components of the new counter offensive constitute major fronts for organizing campaigns over the next ten years [keeping in mind the time lines projected by the biotech industry: 4-5 years for North America; 9-10 years for Europe].

1. Agricultural Spin-offs:

The objective here would be to continue organizing campaigns aimed at banning, labeling or shutting down markets regarding the production of GE crops and herbicides, but with an emphasis on unmasking, exposing and confronting the major corporate players. The prime targets would likely be Monsanto, Syngenta, and Aventis, plus their various subsidiary seed companies. Specific campaign issues [e.g. GE corn, wheat, soy etc.] would, of course, continue to be chosen on the basis of what makes sense in particular countries and regions. For example, herbicide resistant crops [rice and wheat] are planned along with more publicly acceptable vitamin-enhanced crops. Strategies would have to be developed to take full advantage of industry setbacks like the StarLink fiasco. Special attention should be given to the use of the Terminator seed and related technologies that have been patented for use in controlling crop production. And, the parent corporations [Pharmacia, Novartis, AstraZeneca, Aventis] will need to be closely monitored to see if they completely sell off their agribusiness operations or whether they hold on to them for the arrival of the Generation 3 product lines of functional foods and nutraceuticals. Given Pharmacia's plans to sell off Monsanto, it is more likely that the 'life science' advocates will divest their agribusiness operations than 'industrial science' promoters like DuPont, Dow or BASF.

2. Functional Foods:

The main objective here would be to organize campaigns in response to the planned release of Generation 3 product lines dealing with nutraceuticals and functional foods on the market beginning in 2003. The prime focus of such campaigns would be those agribusiness and food processing corporations that already have functional foods and nutraceutical products in the pipeline such as DuPont and General Mills, Novartis and Quaker Oats, AstraZeneca and Archer Daniels Midland, and Unilever. A strategy would have to be developed for the purpose of challenging the health benefits of using GE technologies in the production of dietary supplements, nutraceuticals and functional foods. Since this is one of the cornerstones of the Gene Giants plan to revitalize commitment to GE technologies and products in the affluent countries of the North, attention needs to be given to developing effective ways of countering the propaganda that has begun and will continue to escalate on this front. At the same time, this set of issues also provides opportunities for cultivating and expanding our bio-justice constituency by focusing attention on certain segments of the population like teenagers as well as those more specifically concerned about healthcare issues, such as women and seniors.

3. Feeding the Hungry:

The main objective here would be to expose and confront the false promise of the Gene Giants to save the world from hunger and starvation through the dumping of GE technologies and products in the South. Strategic priority would be put on those agribusiness corporations which are actively promoting GE solutions in the South, particularly Monsanto, Syngenta/Novartis, and Aventis. The role of ISAAA in facilitating links between these agro biotech corporations in the North and business allies in the South, would have to be exposed, along with the dumping of GE crops in the South through foreign aid programs. Golden Rice, for example, could be a key campaign issue. Any campaign strategies developed on this front in the North, however, would have to be based on cues taken from bio-justice activists and allies in the South. Working relationships with peasant movements in the South like Via Campesina would be important and necessary. Special attention should also be given to recalling and highlighting lessons learned from the Green Revolution fiasco of the 1960s and how this relates to the current agenda to promote the false promises of GE as the solution to the problems of world hunger and starvation. New constituencies in the North could include international development agencies and religious groups involved in issues of world hunger.

4. Life-Saving Drugs:

The objective here as well would be to develop new campaigns designed to expose and challenge the use of GE technologies to produce life-saving or life-enhancing drugs. The prime focus would be on those pharmaceutical corporations which have working partnerships with genomics companies to provide DNA data or design and test new drugs for market such as Novartis, Pharmacia, Johnson & Johnson, and Bristol Myers Squibb, to name a few. Obviously, there are some sensitive issues to be dealt with on this front. Providing life-saving and life-enhancing drugs is generally viewed as a noble endeavor. Special attention, therefore, would need to be given to developing campaigns against GE drug products [e.g. ailments like arthritis, plus diabetes, cardiovascular diseases and cancer] in such a way as to attract rather than alienate the majority of people. The case of GE insulin could be highlighted as an example of the negative effects of GE technologies in pharmaceutical products. Health care workers, seniors, women, patients, people with disabilities and religious communities could be become new constituencies in organizing campaigns on GE drugs, thereby expanding the movement. As well, the lucrative profits and the monopoly control of the pharmaceutical industry should be exposed and confronted through campaigns on this front.

5. Industrial Biotech:

The objective on this front is to challenge the myth that the industrial uses of GE technologies do not cause harm to humans and are environmentally friendly. The prime focus for such campaigns would be those corporations which are specializing in research and production of industrial enzymes

like DuPont, Dow and BASF. New constituencies could be cultivated here for the bio-justice movement, including miners, energy workers, and other industrial workers, along with environmental groups involved in waste management issues. The harmful effects, for example, of using GE bacteria in industrial production processes and then disposing it in ways that endanger the water and food chains of communities should be exposed and challenged. Local communities where production plants make use of these GE technologies could provide a starting point for developing campaigns on this front. At the same time, steps would also have to be taken to counter the propaganda that industrial uses of GE technologies are safe, possibly by highlighting Showa Denko and related cases. Through these issues, bio-justice activists can broaden their outreach to include key constituencies, especially organized labour.

At the same time, all of these campaign fronts are bound to be affected by the rules established at the WTO and other arenas of global economic governance. In developing campaigns on any of these five fronts, it is important to expose and confront the ways in which global trade rules, not only at the WTO but in the proposed FTAA as well, are [or will be] used by the biotech engines to open up markets for their GE technologies and products around the world. The prime targets would be the major agribusiness, food processors and pharmaceutical companies which are actively using TRIPS [Trade Related Intellectual Property Rights] and other trade rules to eliminate barriers to the global marketing of GE products, including their high powered lobbying machinery such as EuropaBio and the Council for Biotechnology Information in North America. The current review of the TRIPS Agreement taking place at the WTO would be a useful starting point.

Throughout the developing world, there are signs of grassroots movements beginning to build popular resistance to the TRIPS regime in the WTO. Various indigenous peoples movements, for example, have been mobilizing support for the demand that there be no patents allowed on life forms. Similarly, AIDS activists have challenged the TRIPS rules in their fight for the responsibility of governments to ensure that generic drugs are provided free or on a low cost basis to people suffering from AIDS in the South. Campaigns have also been mounted for the protection of biodiversity and resistance to bio-piracy by agrochemical and pharmaceutical corporations. In India, for instance, a movement called *via panchayat* or 'living democracy' is mobilizing people in their own villages to register their traditional plant life and to take out communal patents on them before the biotech corporations move in and claim ownership. Through this movement, people are making their own claims to intellectual property rights. By plugging into these and related campaigns, bio-justice activists can develop working alliances with a broader network of groups engaged in struggles against corporate globalization.

Movement Building:

In the long run, however, the building of a bio-justice movement must go beyond the issues and challenges of the Gene Giants counter offensive. As the Biotech Century unfolds, the increasingly

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The leading forestry corporations are currently engaged in the plantation

of GE trees which are expected to be ready for market in 2005. To develop and commercialize GE tree seedlings, forestry giants International Paper, Fletcher Challenge and Westvaco announced a joint venture in April 1999, known as ArborGen.²⁶ In collaboration with the Genesis Research and Development Corporation, ArborGen's work will focus on Eucalyptus and poplar tree species, Radiata pine, loblolly pine and sweetgum, along with Roundup resistant trees. Meanwhile, the world's most active program on GE trees, the Tree Genetic Engineering Research Cooperative based at Oregon State University, is funded and supported by big forest enterprises like Boise Cascade and Weyerhaeuser [MacMillan Bloedel], and Champion International as well as Monsanto. At least 18 countries are involved in GE tree trials, 61 percent of which are being conducted in the U.S. and Canada. The potential ecological hazards of biotech forests are many, including food chain impacts, the spreading of GE tree pollen and the fertility of trees. In the U.S., the U.K. and Canada, forestry and environmental activists have already organized direct action campaigns to terminate GE tree field test trials.

GE fish are also in the process of being produced for market. Partner companies, A/F Protein and AquaBounty Farms, plan to commercially release GE salmon eggs in 2001/02.²⁷ Currently, over 100,000 GE salmon are growing in the A/F Protein/AquaBounty offshore seawater tanks in Newfoundland and Prince Edward Island, Canada. GE salmon are designed to grow to market size in 16 to 18 months, compared to the normal three-year cycle. Orders for 15 million GE salmon eggs have been received with initial marketing planned for the U.S., Chile, parts of Asia as well as Canada. Similar GE fish farms are now in operation in Norway, Scotland, New Zealand, Thailand, Cuba and China, as well as Canada and the U.S. San Diego's Aquatic Systems, for example, is developing GE technologies for striped bass and hybrid striped bass, particularly for rapid growth and disease resistance. One of the main ecological concerns is the interbreeding of GE and non-GE fish stocks, especially given the fact that a substantial number of farmed fish have already escaped from coastal net pens. At the same time, serious problems have surfaced regarding the lack of government regulation of GE fish in the U.S.

The emerging uses of GE technologies in energy, mining and bioremediation sectors pose another challenge. Like the use of GE to produce industrial enzymes, this application of biotechnology is being heralded as much less harmful and controversial than is the case with food and even pharmaceutical

products. Enzymes, derived from GE bacteria, are used in the large-scale production of ethanol as well as bioremediation processes for cleaning up from oil spills and waste disposal from heavy metal production. However, the ecological impacts of releasing active GE bacteria can be devastating. Often, the victims are indigenous communities where mining operations and toxic waste sites are located. As noted with regards to other industrial enzymes, the dangers of genetic pollution resulting from the release of GE bacteria in the environment and food chain raises serious concerns. Biologists are also becoming increasingly concerned about the dangers to biodiversity caused by the harvesting of microorganisms which are then genetically engineered for use in chemical clean-up operations. What's more, biotech corporations are taking patents out on the microorganisms, based on exclusive deals worked out with wildlife management agencies.

Yet, perhaps the most far-reaching challenges for movement building have to do with the two developments in biotechnology we referred to at the beginning of this report, namely, the scientific advances in human cloning and the spread of bio-terrorism and bio-warfare.

The application of GE technologies for human cloning purposes took another leap forward when an Italian scientist announced that a woman would soon be pregnant with the first human clone. The cloning of humans and animals is bound to increase the scope of biotech resistance. But, the Gene Giants are quick to emphasize the distinction between 'reproductive cloning' techniques used to create a baby and 'therapeutic cloning' techniques used to create new medicines, diagnostics and vaccines. In May 2001, the U.S. based Biotechnology Organization issued public statements saying that the biotech industry generally opposes human cloning but that therapeutic cloning is critically important for the future treatment of Alzheimer's, diabetes, Parkinson's, heart attacks, cancers and hundreds of other genetic diseases. The pharmaceutical corporations, in particular, have invested heavily in GE cloning technologies for these purposes and see that the public reaction to cloning could become as big or a bigger threat to their industry as the resistance to GE foods has become to agribusiness.

Despite the fact that human cloning has been banned by most countries, government support for cloning is rapidly growing. In August 2001, the Bush Administration in the U.S. announced its intention to spend \$250 million on stem cell research in the coming year, while governments in Europe, particularly the U.K., are also earmarking public funds for cloning research. The dilemma here is that research developments in technology used for 'therapeutic cloning' lays the groundwork for 'reproductive cloning.' Already, there is a network of biotech companies on the cutting edge of research on cloning technologies. The Geron company in California, for example, is leading the way in terms of embryonic stem-cell research. BioTransplant of Massachusetts and Stem Cells Sciences of Australia are collaborating on technologies related to immune systems stem cells work. And, companies like Cryo-Cell International sell such services to parents as the freezing of the cells from a child's umbilical chord. If the bio-justice movement is to going to expand its base, therefore, it is imperative that serious attention be given to developing campaign strategies in response to cloning technologies.

Undoubtedly, the most devastating application of GE technologies could come in the form of weapons for bio-warfare or bio-terrorism. Generally speaking, bio-terrorism and warfare involves the use of disease to harm or kill people, whether civilians or enemy forces, crops or livestock. While bio-warfare dates back several hundred years, the use of GE technologies for these purposes began in the 1980s. Compared to chemical and nuclear warfare, bio-warfare weapons are considered to be far more efficient. According to one estimate, harming a target population within one square kilometre, using conventional weapons would cost \$2000, nuclear weapons \$800, chemical weapons \$600, and only \$1 for bio-warfare agents.²⁸ GE technologies have been used to create a microorganism with the same fatal effects as anthrax. During the former apartheid regime in South Africa, a bacterium was developed by the Rodeplaat Research Institute designed to harm only people of African origin with dark skin. Today, according to the Sunshine Project which monitors the military uses of biotechnology, the work being done by corporations and governments to develop biowarfare agents is a matter of secrecy.

What's more, as RAFI has shown, the Terminator technology can be used as an agro or eco-warfare weapon. Through the Terminator technology, a 'suicide sequence' can be implanted into seeds which, in turn, could be switched on or off with a chemical promoter [such as the use of a particular herbicide]. By inserting the Terminator in seed exports, it is possible for a government or a corporation to destroy the agricultural crops of another country. The Terminator, says RAFI, could be buried for several generations of planting or activated by some remote command, chemical or atmospheric conditions. Although food has been used as a political weapon throughout history, the Terminator technology has catapulted this strategy to here-to-fore unimaginable dimensions. In 1999, the U.S. and the U.K. argued that the use of the Terminator Technology should be protected in the UN Biodiversity Convention. Both countries, it turns out, are working together on the development of fungi weapons to be used in destroying narcotics crops. Here, as in the case of other biowarfare weapons development, new opportunities exist for revitalizing the environment and peace movements in a common cause.

In effect, the Gene Giants are here to stay. For them, GE is the dominant technology of our times, with a 100 year plus lifeline. They are determined to make it the defining force of the 21st century. What is at stake is nothing less than the future of Humanity and Nature. Our last, best hope, is to build a dynamic bio-justice movement, both North and South, as an effective counterweight to the Gene Giants. Whatever cosmetic surgery they try to perform to change their spots, bio-justice activists need to be there — targeting, unmasking, and confronting these biotech engines. They may run, but they can't hide!

Notes

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20. Lori Wallach and Michelle Sforza, *Whose Trade Organization: Corporate Globalization and the Erosion of Democracy*, Public Citizen, 1999. See also www.citizen.org
21. Wallach and Sforza, pp 59-61.
22. Wallach and Sforza, pp 62-64.
23. Wallach and Sforza, p 113.
24. Wallach and Sforza, pp 119-123.
25. Wallach and Sforza, p 109.
26. For information on GE trees see Greenpeace New Zealand news releases at www.greenpeace.org and the Native Forest Network at www.nativeforest.org
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28. Dane Jones, "Biological Warfare and the Implications of Biotechnology," Spring 1996. For more information see the Sunshine Project at www.sunshine-project.org

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