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# CASHING IN ON LIFE

**Operation Terminator**

*Genetically modified organisms (GMO) are under fire. But the multinational firms which make up the genetic-industrial complex - like the military-industrial complex we used to talk about before - are hiding behind all sorts of committees of "experts", most of which they have infiltrated, in their effort to dodge questions from a worried public: is it acceptable to play with living things, or even sterilise them, in order to increase profits? Can the heads of public research establishments, and the ministers they report to, continue - through ignorance, thoughtlessness or self-interest - to back this complex so little concerned with the common good? In December, the French Council of State will rule on the authorisation by the agriculture ministry last February for the marketing and cultivation of three varieties of transgenic maize developed by Novartis. This follows suspension by France's highest administrative court on 25 September of any implementation of the ministerial decree on grounds of caution.*

by *JEAN-PIERRE BERLAN* and *RICHARD C. LEWONTIN* *

Life has two fundamental and paradoxical properties (1): the ability to reproduce and multiply (while preserving its characteristics) and the ability to adapt, change and evolve. The first has given us farming, the second selection.

Geological time has seen an extraordinary genetic variability develop both between and within species. In the course of their very short history, men have domesticated plants and animals, selecting them and adapting them to their needs by exploiting and expanding this natural variability. But towards the middle of the 19th century, these two complementary properties became incompatible. Selection was no longer a way of satisfying needs, but of making money. Seed-producing "investors" realised that their work could not become a source of gain if farmers sowed grain they had harvested themselves. Nature became set against the "natural law" of profit; farming and farmers against selection and breeders. As nature's unfortunate property of reproducing itself and multiplying could not, at the time, be legally taken away by political means, the only way of achieving the same result was to use biological methods. Agricultural genetics was to devote all its efforts to doing this.

In March 1998 genetics scored a new victory with the Terminator patent granted to the United States Department of Agriculture and a private company, Delta and Pine Land Co. The technique consists of introducing a killer "transgene" that prevents the germ of the harvested grain from developing. The plant grows normally and produces a normal harvest but the grain is biologically sterile. In May 1998 the multinational Monsanto bought Delta and Pine Land Co and the Terminator patent - by now registered, or in the process, in 87 countries - and is currently negotiating exclusive rights to it with the Department of Agriculture. Also in May, Monsanto tried to woo French public opinion with an expensive advertising campaign about the philanthropic wonders of genetically modified organisms (GMO). Neither the scientists concerned nor the media nor the French Parliamentary Office for the Evaluation of Scientific and Technological Options went to much trouble to understand the issues at stake, let alone explain them to the public.

Terminator is merely the outcome of a long process of seizing control over living things (2) that began when biological heredity (3) started to become a commodity. In 1907 Hugo de Vries, the most influential biologist of his day who "rediscovered" Mendel's laws (4), was the only one to realise that in an applied science like agricultural genetics, economics took precedence over science: what is profitable affects, or even determines, what is "scientifically true" (5).

He investigated replacing the technique of improving cereals by isolation, which dated back to the early 19th century and was based on the fact that the plants go on to breed true - and therefore bring no profits to the investor - by the continuous selection method. According to this method, justified by the best science of the time, Darwinism, varieties "deteriorate" in the farmer's field. This method cannot improve the plants, as was demonstrated empirically by Nilsson at the Svalöf Institute in Sweden in 1892 and confirmed by the earliest work inspired by Mendel at the beginning of this century. Thus, even then, a technique that was profitable but incapable of bringing the slightest progress replaced one that was useful to society but generated no profits.

**Sterilising the harvest**

Ignorant of the history of their own discipline and of the work of de Vries in particular (6), the 20th century's agricultural geneticists repeated the same scenario. At the end of the 1930s they triumphed with "hybrid" maize, which was extravagantly fêted (7). The technique of hybridisation, which has become the model for agronomic research the world over, is now used in around 20 food species and a dozen others are likely to follow. Poultry of every kind and a large number of pigs are also "hybrids". On the strength of a sham theoretical explanation of hybrid vigour, heterosis-superdominance (8), geneticists have tried since the mid-1930s to get the hybrid technique generally accepted following their success with maize in the United States. "Hybrids increase yield", they say. This puts the theory of heterosis in a nutshell: having different genes - "hybridity" - is beneficial per se.

In reality, what distinguishes this varietal type from all the others is the reduction in yield in the next generation - that is, in plain terms, sterility. As a result, the farmer is obliged to buy his "seed" in every year. But varietal progress can only come from improving populations by selection, the very thing that this quest for hybrids prevents. Apparently unaware of what they are doing, the agricultural geneticists have dialectically overturned reality: they state they are using a biological phenomenon, heterosis, to increase yield, while actually using inbreeding to create sterility. But if they were politically successful in sterilising maize, they had to focus attention on the illusion created by selection - improvement - to mask their real objective. There is therefore no difference between the late 19th century "deterioration" technique - hybrids - and the Terminator technique. The only innovation is the political context.

Until recently, the investors could not reveal their true design - the sterilisation of living things - without making it unachievable. The peasantry were a powerful social group. Life was sacred. But peasants are disappearing: they have become farmers, eagerly awaiting the smallest sign of "progress" capable of delaying their ultimate demise. And life has been reduced to a source of profits in the banal form of strands of DNA.

Numbed by 20 years of neo-liberal propaganda, people have been conditioned to look to science and technology for the answers to society's major political problems, while politicians are content to "manage". Finally, the small breeding firms have given way to a powerful genetic-industrial complex with ramifications extending into the very heart of public research (9). Terminator shows this complex now feels so powerful it no longer needs to hide its quest for control over life itself.

For example, Monsanto, the firm that is most advanced in "life science" applications, has no compunction about publishing threatening display advertisements in American farming journals. Under a banner headline pointing out the cost of planting pirated seed, it reminds farmers who purchased Biotech seed - genetically

modified and including a gene for resistance to Roundup, its flagship herbicide - that they are not entitled to keep any of the harvested grain for use as seed the following year. This is "contractual sterility". But the farmer may have bought Roundup Ready grain without signing a contract - from neighbours, for example. In that case the company can prosecute him because the variety is patented. So now we have "legal sterility".

Monsanto, which has just made 2,500 people redundant, is using the old familiar response of hiring Pinkerton agency detectives (10) to track down farmers who "pirate" its seed as well as using more conventional informers: neighbours, crop-spraying companies and seed merchants. To avoid a potentially ruinous lawsuit, more than 100 farmers have been obliged to destroy their crops, pay compensation and allow Monsanto agents to inspect their accounts and their farms for years to come. It is perfectly legal to keep harvested grain to sow the following year: the farmer's only obligation is not to sell that grain to his neighbours. But according to Monsanto, that right does not apply to genetically modified seed that is covered by a patent (11).

As for the risks of "biological pollution" and the consequences - quite unknown - of genetically modified varieties for public health and the environment, the genetic-industrial complex's philosophy was clearly summed up by Monsanto's communications director Phil Angell when he said with unusual frankness that his company had "no need to guarantee the safety of genetically modified food products"; it was only interested in selling as many as possible and safety was a matter for the Food and Drug Administration (12). This from the people who paint the benefits of genetic manipulation in such glowing colours (13).

Monsanto and its ally-competitors, Novartis, Rhône-Poulenc, Pioneer-DuPont and many others, have specialised in the "life sciences". Strange life sciences that conspire against the marvellous property of living things to reproduce themselves and multiply in farmers' fields so that capital can reproduce and multiply in investors' bank accounts. Will we soon be forced to brick up doors and windows to protect candle makers from unfair competition from the sun (14)? There is no shortage of arguments that the sun should shine for everyone. Here are just four.

First, the wealth of variety was created by peasants all over the world, the third world in particular. It is a point always being raised by non-governmental and intergovernmental organisations like the United Nations Food and Agriculture Organisation (FAO). The domestication and selection/adaptation work done by peasants over thousands of years has built up a biological heritage from which the industrialised nations have greatly benefited - and which they have plundered and already partly destroyed. American agriculture was built from these genetic resources freely imported from all over the world, the only important species native to North America being the sunflower. If justice still means anything, the US - where there is much opposition to allowing a few companies to expropriate the universal biological heritage - should repay their "genetic debt" to the world.

Second, we owe the unprecedented increase in yields in the industrial countries, as well as the third world, to the free movement of knowledge and genetic resources and to public research. (Yields have increased four or five fold in two generations, after taking 12 to 15 generations to double and being no doubt much unchanged for thousands of years before that.) The contribution of private research has been marginal, including in the US with its hybrid maize.

For example, in the course of the 1970s nearly all the hybrids in the US Corn Belt were the result of crossing two public lines - from the universities of Iowa and Missouri. It is public research and public research alone that does all the basic work on improving the populations of plants on which everything depends. An expert from the National Agronomic Research Institute (INRA) recalled that at the start of his career packets of seed often came free with scientific publications. Thirty years later, he suspects some of these journals of deliberately misleading the reader - and the competition. Research work is being hampered by the privatisation of

knowledge, genetic resources and the techniques for their use. Tired of paying royalties on genetic resources that were snatched from them in the first place, many countries in the Southern hemisphere are now trying to stop their circulation.

Third, experience shows that the price of privatised "genetic progress" is and will be exorbitant. For example, in 1986 an INRA researcher estimated the additional cost of hybrid wheat seed - that is, the cost of bricking up doors and windows plus the cost of hybrid candles - at between 6 and 8 quintals per hectare (15). Another researcher, in charge of the INRA hybrid wheat programme - which is continuing despite this incredibly high estimate - recently came up with an even higher figure of 8 to 10 quintals per hectare sown (16). This means, at the very least, $500 million a year, or the entire INRA budget, for a net gain of scarcely a few quintals - a gain that can be more easily and quickly obtained using lines or varieties reproduced by the farmer. But those lines were of no interest to INRA's "partner", Lafarge-Coppée.

Fourth, giving up our rights in living things means giving the genetic-industrial complex a free hand to guide technical progress into the paths that will bring it the most profits rather than those that will be most useful to society. Rambling on about progress in general while ignoring how things are done in practice smacks of deception. As does invoking some alleged "social demand" in justification of the scientific choices made by the authorities. Public opinion is massively against GMO. So there is no "social demand" for GMO; the term is simply being used as a smokescreen for the demands of the genetic-industrial complex. And yet, in France, ministers have just opened a genetic research centre in Evry.

**Easy prey for investors**

The myth of hybrids is easily exposed. On the one hand, farmers want better quality varieties that are more productive per unit cost. But they are unable to specify in what form. Unfortunately, they can't rely on scientists to tell them that there are a number of routes to improvement and that the choice between a free variety and a hybrid is a political, not a scientific one. Scientists are not political animals, as we know.

On the other hand, investors, looking to maximise the return on their investment, choose the most profitable varietal type: they take the hybrid route of sterile varieties. Whether spontaneously or working to order, researchers set to work, devoting their efforts exclusively to the success of these hybrids. And, sooner or later, the technique is made to work, proving the initial choice was correct. A technical choice is like a self-fulfilling prophecy - the farmer's demand for better varieties is transformed into a demand for hybrids.

In the twin fields of applied biology, health and medicine, we are trying to get rid of the great scourges of cancer, obesity, alcoholism, etc. But we don't know how to reach this objective. The genetic-industrial complex, for its part, is trying to make more and more money. Confusing the agent with the cause, it drums into us that these social ills are genetic and therefore individual, transforming every well individual into a potential patient, expanding the market to the limit - as it previously did for seed with hybrids and as it will with Terminator.

By definition, we are all carriers of genetic diseases. Since genes produce proteins and proteins are involved in every function of life, to speak of a "genetic" disease is a virtual tautology. But in a society where the social and political causes of disease are absent, the genetic agent manifests itself very rarely, if at all (17). The deception of individualising and naturalising a social and political cause is the death knell of any system of social security. In France we see this every day with the endless debates about the chronic but oh-so-profitable social security deficit.

By cutting themselves off from society in the name of objectivity and technology, biologists are falling victim to their own narrow concept of causality and their "a-historicity" - easy prey for investors. But the way for researchers to work for that better world that the vast majority want is for them to open themselves up to the scrutiny of their fellow citizens. That means scientific democracy.

The genetic-industrial complex is trying to transform political questions into technical and scientific ones so that responsibility for them can be shifted on to bodies it can control. Its experts, dressed in the candid probity and the white coat of impartiality and objectivity, use the camera to distract people's attention. Then they put on their three piece suits to negotiate behind the scenes the patent they have just applied for, or sit on the committees that will inform public opinion - quite objectively, it goes without saying - and regulate their own activities. It is a serious thing when democracy no longer has any independent experts and has to depend on the courage and honesty of a few scientists and researchers, as it must, for example, in the nuclear industry.

Such abuses are beginning to elicit a timid reaction. American biological journals, for example, are asking their contributors to declare their personal or family interests in biotechnology companies and their sources of funding (18). This is the minimum level of transparency that should be asked of anyone who takes the floor or sits on committees of supposedly independent experts. We would then become aware of the genetic-industrial complex's many and various ramifications.

In short, do we want to allow a few multinationals to take control of the biological part of our humanity by granting them a right - legal, biological or contractual - over life itself? Or do we want to preserve our responsibility and our autonomy? Will farmers' organisations continue to allow ruinous techniques to be imposed upon them or will they debate what would be in the farmers' and the public's interest with renewed public research and a network of breeder-agronomists? Finally, what are the intentions of "public" agronomic research - which for decades has been privatising the material of life economically, and now biologically?

There is another way. Turn our backs on the present European policy of allowing life forms to be patented, which is nothing but a servile imitation of what is happening in the US, and declare living things "the common property of humanity". And reorganise genuinely public research around this common property in order to block the already well-advanced private hold that is seeking to eliminate any scientific alternative that would make ecologically responsible and sustainable agriculture possible. Guarantee the free movement of knowledge and genetic resources that have made the extraordinary advances of the last 60 years possible. Restore power over living things to the farmers, that is to each one of us. Replace economic warfare and the plundering of genetic resources with international cooperation and peace.

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Translated by Malcolm Greenwood

*(1) This article takes up the theme of a European workshop on the subject "Should we create a right in living things?" held, because of opposition from the board of the INRA, at the Montpellier Centre for Higher Agronomic Studies on 26-27 September 1997.*

*(2) In his article "Playing God in the Garden", Michael Pollan writes that with the rise of biotechnology, farming is entering the information age, and Monsanto, more than any other firm, looks set to become its Microsoft, providing the proprietary "operating systems", to use its own metaphor, that will manage the new generation of plants. The New York Times Magazine, 28 October 1998.*

*(3) The biological concept of heredity appeared in the mid-19th century, at the same time as the heredity of property. See the contribution by Jean Gayon to the European workshop mentioned in note 1.*

*(4) The botanist Johann Rehof ("Gregori") Mendel was the founder of genetics. He described the laws of hybridisation (or Mendel's laws) in a seminal article published in 1886 but generally unknown until rediscovered in 1900.*

*(5) Hugo De Vries, Plant-Breeding, The Open Court Publishing Co., Chicago, 1907.*

*(6) For the elimination of history from scientific projects, see Jean-Marc Lévy-Leblond, La Pierre de touche. La science à l'Épreuve de ... la société, Gallimard, coll. Folio, Paris 1996.*

*(7) From the start of the development of "hybrids" (1922) - when the Department of Agriculture imposed the technique on reluctant breeders - to their conquest of the Middle West in 1945-46, the maize yield increased 18% while that of wheat increased 32%. But the small wheat breeders only serve the general interest, while the "hybridisers" create a new source of profit and therefore become scientific heros.*

*(8) See "The Genetics and Exploitation of Heterosis in Crops", Book of Abstracts, International Symposium, Mexico City, CIMMYT, 1997. This symposium, whose purpose was to popularise the "hybrid" technique the world over and to extend it to new species, was sponsored by the cream the genetic-industrial complex, including Monsanto, Novartis, Pioneer, DeKalb and Asgrow, as well as by US Aid and the American Department of Agriculture. China was also among the sponsors.*

*(9) In France, a former chairman and director of INRA boasted in 1986 of being on the boards of Rhône-Poulenc, Entreprise minière et chimique, and Société commerciale des potasses d'Alsace et de l'azote. The present director of this public research institute was formerly (1989-94) on the board of Rhône-Poulenc Agrochimie.*

*(10) The Pinkerton private detective agency traditionally supplied employers with auxiliaries to break trade unions and whip up provocation.*

*(11) See Progressive Farmer, Birmingham, Alabama, 26 February 1998. Monsanto has recently spelled out the penalties to be imposed on farmers found to be "pirating" its varieties: they will have to pay a royalty and allow their farms to be inspected for a period of five years. Two farmers in Kentucky were obliged to pay it $25,000. In France, farmers belonging to the Confédération paysanne are actively fighting against GMO. See the Confederation's monthly, Campagnes solidaires (104, rue Robespierre, 93170 Bagnolet. Tel.: (+33) 143-62-82-82). See also the dossier on GMO published in the October 1998 edition of the monthly Regards, Paris.*

*(12) Reported by Michael Pollan, "Playing God in the Garden", op. cit.*

*(13) See interview with Axel Kahn, "Les OGM permettront de nourrir la planète en respectant l'environnement", Les Echos, 18 December 1997. Mr. Kahn, a member of the National Consultative Committee on Ethics and chairman of the Biomolecular Engineering Commission from 1988-1997, is director of research unit 129 at the National Institute for Health and Medical Research (INSERM) and assistant director of life sciences at Rhône-Poulenc.*

*(14) See Jean-Pierre Berlan and Richard C. Lewontin, "Plant Breeders' Rights and the Patenting of Life Forms", Nature, London, 322: 785-788, 28 August 1986.*

*(15) Michel Rousset, "Les blés hybrides sortent du laboratoire", La Recherche, Paris, No. 173, January 1986.*

*(16) Gérard Doussinault, report to the scientific committee of the Economics Department of the INRA, December 1996.*

*(17) See Richard C. Lewontin, The Doctrine of DNA. Biology as Ideology, Penguin Books, London, 1993.*

*(18) In his article "Study discloses financial interests behind papers" (Nature, vol. 385, 30 June 1997), Meredith Wadman shows that one third of the main authors of articles published in 14 cellular and biomolecular biology and medical journals had a direct financial interest in the work they were reporting. The definition of "financial interest" is narrow, however, since it does not include consultations, private shareholdings or fees.*



<http://www.monde-diplomatique.fr/inside/1998/12/02gen.html>