Intensive Farming, the CAP and GATT

Speech Given at The Royal Society, London, 16th October 1991

INTENSIVE FARMING is based on the belief that agriculture is like any industry and that growing food will respond to the same sort of technology as will the production of industrial products. Enhanced efficiency and productivity will follow. The elimination of rural jobs is no different to the daily loss of jobs in industry which flows from technological innovation. Large mechanised modern farms, the reasoning continues, will produce more food, more cheaply, for the benefit of the economy and of people throughout the world. What is more, men and women will be liberated from the land and will be free to participate in the more dynamic sectors of contemporary industry and therefore to contribute to the growth of G.N.P. and to public prosperity.

At first sight this seems obvious. But I would like to analyse the proposition. Initially, the direct costs per unit of production indeed are reduced through intensive farming. By assembling large farms, concentrating on monocultures, mechanising production and increasing yields with the magic of modern science, you start by increasing production and decreasing the use of labour.

But what of the indirect costs? When people leave the land, they gravitate to the cities where they seek work. But if there are insufficient jobs and infrastructure - such as lodgings, schools, hospitals, etc. - then there will be increased unemployment with the attendant costs of welfare as well as substantial expenditure on infrastructure. These indirect costs also must be taken into account.

There is another price. When, as a result of change, jobs are lost in industry the fundamental balance of society is not altered. Some declining companies suffer while other more competitive entities emerge. But loss of rural employment and migration from the countryside to the towns causes a fundamental and irreversible shift. It has contributed throughout the world to the destabilisation of rural society and to the growth of vast urban concentrations. These regroup deracinated individuals whose families have been atomised, whose cultural traditions have been extinguished and who have been reduced to dependency on welfare from the State. They form the alienated underclass. From the first world to the third, urban groupings have become tragic, morbid intumescences. The cost of contributing to such social breakdown also must be taken into account. But this cost can never be measured accurately. The damage is too deep. Throughout the world social breakdown in the mega-cities threatens the existence of free societies.

In any case, it is claimed that the only measure by which large farms are more productive is use of labour. If productivity is measured in terms of production per acre or per unit of energy or relative capital input, it is the small farm which comes out best.[1]

On these grounds alone, the assertion that intensive agriculture produces cheaper food needs to be reassessed so as to avoid superficial and deficient arithmetic. Both direct and indirect consequences and their costs have to be brought into account.

But intensive farming has other effects: those on the environment and on health. To illustrate these effects, I will provide some specific examples. Back-up literature and evidence is available but rather than quote them during this lecture, I will attach references to the printed version.

The physical conditions imposed on animals reared in factory farms are well known to you. So I will not dwell on the ethical questions that are raised. Instead I will describe some of the consequences of current intensive methods on the quality of food.

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[1] Herman Daly and John Cobb, For the Common Good, London, Green Print, 1991

The purpose of intensive rearing of animals is to achieve the greatest weight gain over the shortest period of time for the lowest cost. At present poultry, turkeys, ducks, pigs, veal and cows are commonly reared by intensive methods. Salmon and trout and some other fish are more recent recruits.

As an example, I will take the earliest animal to be produced by modern factory farming, chicken.

Broilers, typically, are reared in sheds each containing 40,000 growing birds. There are eight crops per year so eight times each year 40,000 one- or two-day-old chicks are delivered to each shed from incubators in a hatchery. They will remain there until they are ready for slaughter, 42 days later. Their feed contains very little natural vegetable material but instead consists of a considerable proportion of fish meal and what is discreetly called 'bone meal' which, in fact, is the physical remains of previous generations of their own and other species. In many cases, to their feed will be added artificial growth promoters such as antibiotics, virginiamycin for example, and anticoccidials. Regular feeding of antibiotics to intensively reared animals produces a weight gain of perhaps five per cent.[2]

Similar kinds of industrial processes are applied to other animals subjected to intensive rearing. What are the effects of such unnatural practices?

First of all, intensively reared animals are physically different from their free-living counterparts.[3] In the meat of free animals, the protein content is very much higher than the fat content. In intensively reared animals, the proportions are reversed. After converting the figures to their calorific value, one finds that the ratio of fat to protein is often nine times greater in domestically reared animals than in their free counter-parts.[4] In chicken, it has been demonstrated that since the end of the last century, the carcass fat content itself has risen by nearly 1000%.[5]

But the change goes further. Generally speaking there are three main types of fat, two of which concern us most - polyunsaturated and saturated. Polyunsaturated includes essential fatty acids, so called because they are essential for the growth and development of the brain and are components of all cell membranes which need them for their effective function.[6] They help to produce hormonelike substances which regulate, inter alia, the immune and vascular systems.[7] Saturated fats on the other hand serve no useful purpose and some consider them to be a contributory factor to heart disease and to breast and colon cancer.[8]

The proportion of essential fatty acids compared to saturated fats is transformed when animals are intensively reared. For example wild pigs would be expected to have twice the concentration of essential fatty acids than the saturated variety.[9] In contrast the ratio for the

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[2] Richard Lacey, Unfit for Human Consumption, London, Souvenir Press, 1991, p 32.

[3] M.A. Crawford, M.M. Gale, M.H. Woodford and N.M. Casperd, 'Comparative Studies on Fatty Acid Composition of Wild and Domestic Meats', lilt. J. Biochem., 1970, pp. 295-305.

[4] M.A. Crawford, 'Fat Animals - Fat People', World Health, WHO, July-August 1991.

[5] Michael Crawford & David Marsh, The Driving Force: Food Evolution and the Future, London, W. Heinemann, 1989, p. 228.

[6] FAO/WHO, Report of an Expert Consultation, The Role of Dietary Fats and Oils in Human Nutrition, Rome, FAO, 1978.

[7] S. Moncada and J.R. Vane, 'Prostacyclin, Thromboxane and Leukotrienes', Br. Med. Bull, 39, 1983, p. 209.

[8] WHO, 'Diet, Nutrition and the Prevention of Chronic Diseases', 1990.

[9] M.A. Crawford, M.M. Gale and M.H. Woodford, 'Muscle and Adipose Tissue Lipids of the Warthog (Phacochoerus Aethiopicus)" Int. J. Biochem. 1, 1970, pp. 654-8.

modern pig is reversed and is now 0.2 : 1 the other way[10] - a transformation by a factor of one to ten, the wrong way.

So the animal carcass produced by intensive methods will contain much more fat than protein and the quality of that fat will have been perverted.

But there is more. The conditions of intensive rearing can increase the spread of infections. The limited space in which the animals live facilitates the transfer of microbes. The unnatural living conditions are likely to reduce their health and resistance to disease. And as the animals are of uniform genetic stock constituting a form of monoculture, they are all vulnerable to particular infections. So vaccines, antibiotics and other drugs are administered prophylactically to control epidemics.

The use of antibiotics in this way may create resistant bacteria which can spread to man and some component genes of the resistant bacteria may become established in human bacteria.[11]

Every now and then a particular accident captures the attention of the media and we get a glimpse into the world of intensive farming. The epidemic of Mad Cow Disease or Bovine Spongiform Encephalopathy (B.S.E.) is a recent example. B.S.E. is one of a group of infectious diseases known as T.S.E. for Transmissible Spongiform Encephalopathies. Whereas B.S.E. affects cows, the T.S.E. which affects sheep is called Scrapie and the form which principally affects humans is known as Creutzfeldt-Jakob Disease. The diseases are always fatal and there is no known treatment. They act by causing the disintegration of cells throughout the brain and replacing them by microscopic holes causing a spongelike appearance, hence the name Spongiform.

The diseases are transmitted by infectious agents whose chemical nature is still unknown. They are very small, even smaller than all classified viruses. That is why there is no way of identifying infected animals before they have developed symptoms, except by injection into mice which may well take up to a year.

The infectious agents are extraordinarily tough and heat resistant. Experiments have shown that they can survive exposure of 360°C for one hour;[12] any dose of irradiation that is viable in practice;[13] formaldehyde;[14] and autoclaving under conditions that kill all other known infective agents.[15] They are durable and will persist for many years in the soil. [16]

TSEs affect mammals but not other species and various forms, naturally and experimentally, have infected a number of different animals. It is interesting to note that with the transfer from one species of mammal to another the properties of the infectious agents are changed. For example sheep Scrapie seems unable to be transmitted to Rhesus monkeys and in light of the affinities between the Rhesus monkey and humans this is consistent with the view that sheep Scrapie does not directly affect man. But if Scrapie is

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[10] 10 M.A. Crawford, W. Doyle, P. Drury, K. Ghebremskel, L. Harbige, J. Leyton and G. Williams, 'The Food Chain for n-6 and n-3 Fatty Acids with Special Reference to Animals Products'. In: Dietary w3 and w6 Fatty Acids: Biological Effects and Nutritional Essentiality, Plenum Press, 1989, pp. 407-414.

[11] Richard Lacey, ap. cit., pp. 38-40.

[12] P. Brown, P.P. Liberski, A. Wolff & D.L. Gajdusek, 'Resistance of scrapieinfectivity to steam autoclaving after formaldehyde fixation and limited survival after ashing at 360°: practical and theoretical implications', 1990, Journal of Infectious Diseases, 115, pp. 393-9.

[13] H. Fraser, C.F. Farquhar, 1. McConnell & D. Davies, 'The scrapie disease process is unaffected by ionising radiation,' Prog. Clin. Bioi. Res. 317, 1989, pp. 653-8.

[14] P. Brown, P.P. Liberski, A. Wolff & D.L. Gajdusek, op. cit., pp. 393-9.

[15] Ibid.

[16] P. Brown & D.L. Gajdusek, 'Survival of the scrapie virus after 3 years' interment', The Lancet, 337,1991, pp. 269-70.

transmitted experimentally first from sheep to mink, then the mink T.S.E. develops new properties and becomes experimentally transmissible to Rhesus monkeys. Thus it seems that T.S.E.s can be transferred directly or indirectly between different species.

The first cases of B.S.E. were identified in 1986. There seems to be a consensus amongst scientists that the infectious agents were transmitted to cows through feed which contained products from rendering plants. These are factories that deal with the remains of slaughtered animals, including cows, and which when assembled are added to animal feeds and described as concentrates, protein supplements or bone meal. Through this process, we are feeding cows to cows, in other words forcing cows into cannibalism.

It is interesting that in the first half of this century, there was another form of T.S.E. which affected humans - Kuru disease. It occurred in the Fore tribe, a stone age civilisation, which at the time practised cannibalism.

With the outbreak of the epidemic of Mad Cow Disease the government found itself in an extremely difficult position. Evidence was slim and the risks, although great, were unproven. As there is a considerable period of incubation it would take some years to establish whether the epidemic would spread from cows to humans. A full alert by the government could cause panic and would have a major impact on British farming.

So the government reacted by establishing advisory scientific committees and taking some precautionary measures to reassure the public.

'High risk' organs were to be removed from slaughtered cattle - a useful decision which might or might not be wholly successful because the localisation of the infectious agents in the tissues of cattle has not been established and therefore it is not possible to know which tissues are infected. For example all organs, including meat, contain nerves that are in physical connection with the brain. It is known that several infectious agents pass between an animal's peripheral organs and the brain by moving up or down the nerves. Therefore if the brain is infected it is not unreasonable to worry whether the nerves are also affected. Furthermore it was decided that cattle thought to be infected with B.S.E. were to be reported and milk from infected cows was banned from sale. This was also useful but, as I have explained, there is no ready way of identifying infected animals until the disease reaches the final stages, so the effects of these decisions are necessarily limited to those animals in which the disease is already obvious.

The committees further recommended a ban on the feeding of ruminant-based protein to ruminants. In other words, no more cannibalism to be imposed on ruminants. That was an excellent decision but the ban was not extended to pigs and poultry, which can continue to be fed on the remains of their own species.

One of the principal conclusions, in February 1989, of the government-sponsored Southwood Committee was, I quote:

> “From present evidence, it is likely that cattle will prove to be a 'dead-end host' for the disease agent and most unlikely that B.S.E. will have any implications for human health. Nevertheless, if our assessment of these likelihoods are incorrect, the implications would be extremely serious.[17]”

Dead-end host means that the B.S.E. will not be transferred from the cow to other species. Two years have gone by. During that period mice and a pig have developed T.S.E. as a result of the inoculation of B.S.E.-infected material and the existence of T.S.E. in other animals such as cats and antelope is thought to have resulted from the ingestion of B.S.E.-

[17] Sir Richard Southwood, Report of the TVorkillg Party on Bovine Spongiform Encephalopathy, 1989.

infected material.[18] The transfer to a pig is especially significant because pig tissues are close to human tissues and this is demonstrated by the fact that various connective tissue components from the pig have been used as human grafts. But what is more, it has been reported that a patient in a British hospital contracted Creutzfeldt-Jakob Disease, when bovine membranes, infected with B.S.E. or Mad Cow Disease, were grafted routinely into the patient's brain during an operation.[19] Thus it would seem that B.S.E. can be transferred to man experimentally. This is in line with the views of Richard Lacey, Professor of Clinical Microbiology at the University of Leeds, who has maintained that human tissues could be vulnerable to the B.S.E. agent and that B.S.E. and Creutzfeldt- Jakob Disease could in effect be the same. The conclusion to the Southwood Report now must be re-assessed in light of the new evidence.

The new frontier of intensive agriculture is biotechnology which includes genetic engineering. No doubt it will lead to some remarkable and unexpected results. The story of the Bovine Growth Hormone is an example of the way genetically engineered products destined for agricultural use are tested and presented to farmers and to the public.

That is why I will describe it in some detail. The Bovine Growth Hormone is a bio-synthetic hormone produced by genetic engineering. Industry changed its name to Bovine Somatotropin or B.S.T., probably so as to eliminate the word 'hormone' which causes some concern among consumers.

The industry claims made for B.S.T. are that it will

increase substantially the milk production of a cow; that it needs no capital investment; and that this will be achieved without augmenting the level of hormones in milk and without adverse or toxic health effects in treated cows. Milk produced in this way, it is claimed, is safe for humans.[20]

The initial reactions from the U.S. Food and Drug Administration and from the U.K. Government were positive. The British Minister of Agriculture is quoted as saying: 'The idea that Britain should stand aside while allowing everyone else to produce milk in the modern way is barmy ... Nobody has any doubts about damage being done to human beings, it is totally safe.'[21]

None the less there were dissenters, principally Samuel Epstein, Professor of Occupational and Environmental Medicine at the University of Illinois Medical Center. He questioned the benefits and safety of, in his words, pushing cows like high-performance machines with the aid of greater amounts of drugs.

The dissenters' case was much reinforced when documents were leaked to Professor Epstein, which detailed the results of B.S.T. tests carried out in the laboratories of the Monsanto chemical group. The Monsanto files undermined the claims made for B. S. T. Here are a few verbatim extracts from the leaked documents:

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[18] K.C. Meldrum, 'Transmission of Bovine Spongiform Encephalopathy to a Pig', The Veterinary Record, 6 October, 1990, p. 362.
M. Dawson, G.A.H. Wells, B.N.J. Parker & A.C. Scott, 'Primary parenteral transmission of Bovine Spongiform Encephalopathy to the Pig', The Veterinary Record, 23 September, 1990, p. 338.
H. Fraser, I. McConnell, G.A.H. Wells & M. Dawson, 'Transmission of Bovine Spongiform Encephalopathy to Mice', The Veterinary Record, 123, 1988, p. 472.

[19] Daily Telegraph, 10 August, 1991.

[20] Animal Health Institute, 'Bovine Somatotropin (B.S.T.) Report' No. I-S/88-15M, 1988.
U.S. National Institutes of Health (N.I.H.), Panel Conclusion on Bovine Somatotropin, December 1990.
E.c. Committee for Veterinary Medicinal Products (C.V.M.P.), 20 :vIarch, 1991.

[21] John Gummer at the Grassland South West Show as reported in The Independent on Sunday, 29 June, 1991.

'Significant increases in milk Somatotropin were noted at the five times level of treatment.'[22] Somatotropin, of course, is the hormone in Bovine Growth Hormone or B.S.T.

'From all groups ... adrenal to body weight percentages and adrenal to brain weight percentages of the right adrenal were significantly greater than those of the controls.'[23] That means that the right adrenal gland was inflamed when comparing B.S.T. treated animals with the untreated group used as controls to assess the results of the experiment.

'The left adrenal absolute weight ... for all treated groups were significantly increased.'[24]

'The absolute kidney weights ... were significantly greater than those of the control group.'[25]

'The heart to body weight percentages for the three times and five times groups were considerably greater than those of the control group ... '[26]

'The liver to body weight percentages ... Were significantly increased.'[27]

'Statistically significant weight increases also occurred for lung, pituitary and left ovary.'[28]

The Monsanto files also indicated that B.S.T. levels In treated cows' blood appeared in concentrations up to 1200 times higher than that of the natural B.S.T. in the blood of control animals.[29]

What is more, tests carried out by Monsanto in 1985 and 1986 show that lactating cows were administered drugs, some of them illegal, on more than 150 different occasions.[30] Following these disclosures, the Chairman of the Congressional Committee on Government Operations, whose members are drawn from the U.S. House of Representatives, wrote to the Inspector General of the Department of Health and Human Services and stated, inter alia, I quote:

"Specifically, I am seriously distressed with allegations concerning critical research information that has been withheld from public scrutiny by the Food and Drug Administration and the Monsanto Agricultural Company, in efforts to approve commercial use of Bovine Growth Hormone, without regard to the adverse health effects on animals and humans. More importantly, and contrary to the public assurances made by both the Food and Drug Administration and Monsanto, the industry

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[22] Leaked Confidential Monsanto File, 'Toxicity of CP11 5099 in a Prolonged Release System in Lactating Cows', 13 January, 1987, p. 28. 23 Ibid., p. 2.6.

[23] Ibid., p. 2.6.

[24] Ibid., p. 2.6.

[25] Ibid., p. 2.6.

[26] Ibid., p. 2.6.

[27] Ibid., p. 2.6.

[28] Ibid., p. 2.17.

[29] Samuel Epstein, Paper to the U.S. National Institutes of Health (N.I.H.) Conference on Bovine Somatotropin, 5-7 December, 1990.

[30] Samuel Epstein & Pete Hardin, New York Times, 23 December, 1990, p. 14.

> files indicate high levels of the hormone are found in the milk of cows treated with synthetic Bovine Growth Hormones ...
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> Further, I am deeply concerned that little actual research exists on the human safety aspects of Bovine Growth Hormone.[31]"

On 3 May this year, the Department of Health and Human Services sent a memo to the U.S. Assistant Secretary for Health and I quote the following extract:

> "In the case of Monsanto, the Food and Drug Administration sent a regulatory letter, dated January 9th, 1991, informing the firm to immediately stop the use of all materials that may lead persons to believe that B.S.T. is safe and effective.[32]"

It seems that one of the principal reasons for having suggested that Bovine Growth Hormone is safe for humans is that tests carried out in the 1950s indicated that there was no increased growth in human dwarfs fed with natural cow growth hormone.[33] Not only do these tests need upgrading now that it is proposed that B.S.T. be put into general use, but more importantly they are irrelevant because they were based on the use of natural cow hormone, which is structurally different to its genetically engineered relative.

For their part the European authorities have focused their attention on whether B.S.T. is needed at all during a time of surplus milk production and whether large supplies of cheap hormone-induced milk would drive small farmers out of business with the evident adverse social consequences. This has led to a temporary moratorium on the marketing of B.S.T. in Europe.

Here I must divert for a moment. All my life I have campaigned as vigorously as I knew how for the consumer's right to choose. Now I find that in the debate about intensive agriculture, freedom of choice is used in a way which I believe to be misleading.

Not long ago I was discussing B.S.T. with a Minister of Agriculture of a European Government. His response was - print it on the label and let the public choose freely. That sounded like a good free-market sentiment but, in fact, it is deeply flawed. How can a consumer know the truth about B.S.T. or about other genetically engineered new products or indeed about most of the marvels of modern science? Sometimes the true facts are not disclosed. Much more often the true facts are just not known.

It can take generations to learn the long-term effects of some new products.

I started my business career by founding a pharmaceutical company which today is a good-sized European company. I went on to form a food manufacturing and retailing company which ranked among Europe's largest. Of course I am not a scientist, but I have employed many. I have listened to them and participated with them in the excitement of developing new products. We can all get caught up in the thrill. I can assure you of one thing. None of us can know for sure the full extent of the long-term effects of a completely new drug. The scientists who developed Thalidomide were not men of evil intent. They just did not know the truth. Only the other day pregnant women were suddenly warned that they should report to medical centres specialising in genital tract abnormalities if their mothers, the grandmothers of the child they were expecting, had taken a hormone called Diethyl-stilboestrol (D.E.S.) up to fifty years earlier. The pathological side effects of a drug taken

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[31] Letter from Congressman John Conyers, Chairman of the Congressional Committee on Government Operations, to The Hon. Richard P. Kusserow, Inspector General, U.S. Department of Health & Human Services, 8 May, 1990.

[32] Memorandum from Richard P. Kusserow to Dr. James O. Mason, Assistant Secretary for Health, 3 May, 1991.

[33] Samuel Epstein, 'Questions and Answers on Synthetic Growth Hormones', International Journal of Health Services, Vol. 20, No.4, 1990, p. 575.

two generations earlier were suddenly reconsidered and thought to be a danger to the granddaughter of the original user.[34]

I can state categorically that the idea that the consumer on his own, by referring to a label, can assess all the possible after-effects of a new chemical, pharmaceutical or biotechnological product, is nonsense and must be rejected.

Biotechnology encompasses a wide array of techniques involving the manipulation of living organisms. Genetic engineering is part of it. The other principal forms are tissue or cell culture; cloning; cell fusion and embryo transfer. Some of the early results are spectacular.

Tissue or cell culture technology is based on growing isolated cells or very small pieces of tissue from plants and animals including humans. A single cell in plants possesses all the genetic material needed to grow a complete plant. To achieve this, the cell is treated with a series of hormones and nutrients until leaves and roots are formed. The process makes it possible to mass-produce thousands of plants, virtually identical genetically, from a tiny amount of raw material, and is known as cloning.

Cell fusion consists of fusing two different types of cells to create hybrids with the properties of both parents. Usually this is achieved through the use of chemicals and electrical inputs.

Embryo transfer is well known. In cows, embryos are transferred from the reproductive tracts of the biological mother to those of the surrogate. Thus a highly prized cow can be the biological mother of a multitude of calves without ever giving birth. Usually this process is accompanied by injecting the biological mother with hormones which stimulate the production of an abnormally high number of eggs per ovulation. About five days later, the cows are ready to be artificially inseminated. Six to eight days after that, the embryos are removed and before being implanted into the surrogate mother, can be further manipulated - such as by splitting the embryos so as to multiply the offspring and artificially create extensive twinning. Further mutations are being developed. For example, by fusing embryo cells from different species of animals, researchers are creating entirely new kinds of animals. Recently a hybrid of sheep and goats was produced by cell fusion and named a geep.[35]

But the most extraordinary of the biotechnologies is undoubtedly genetic engineering which is also known as recombinant D.N.A. technology. D.N.A. is the carrier of the genetic information of all living things. Genes are segments of D.N.A. and carry specific, as opposed to general, information. The basis of genetic engineering is to transfer genes from one cell to another and thereby be able to create new life forms. Skills are now available to manipulate and transfer genes from one species to another. For example researchers at the University of Kentucky have transferred genes from a fish to a soya bean plant.[36] Other researchers have introduced a gene for the human growth hormone into a pig. The pigs grow faster but get arthritis.[37]

In agriculture genetic engineering is applied to plants, animals, and bacteria and viruses. The consequences of genetically altering the plant realm are far reaching. Supporters of biotechnology claim that genetically engineered seeds will produce crops which are tolerant to herbicides and more resistant to drought, frosts, disease and pests. Also it is

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[34] Daily Telegraph, 24 June, 1991.

[35] From a speech by Dr. Rovert of the University of Calgary during the Christian Farmers of Alberta Annual Meeting in Edmonton, Canada, autumn 1986.

[36] Cary Fowler, Eva Lachkovics, Pat Mooney & Hope Shand, 'The Laws of Life. Another Development and the New Biotechnologies', Development Dialogue, 1988: 1-2.

[37] Ibid.

claimed that they will reduce agrochemical input including chemical fertilisers and insecticides.

The biotechnology industry is lobbying for a legal system which would allow all living organisms altered by genetic engineering to be patented. New life forms would become patented monopolies. A draft European Community directive is currently under discussion in the European Parliament.

Of course, there are those who consider that the disadvantages of using biotechnological processes in agriculture outweigh the advantages.

Such a debate is to be encouraged as we are playing with the fundamental elements of all life on earth.

The principal arguments against genetically engineered seeds are:

1) This is a replay of the Green Revolution but dimensionally more perilous. In the 1950s, '60s, and '70s, there was great enthusiasm for synthetic organic chemicals, produced by petrochemical and agrochemical companies. Their purpose was to replace natural raw materials and to increase yields by applying them to genetically selected high-yielding strains of seeds which became known as 'Miracle strains'. This led to the development of monocultures, greater mechanisation and ever increasing inputs of chemicals and energy. As Fowler and Mooney put it: " ... achieving high yield required fertiliser and irrigation. Fertiliser and irrigation nourished weeds as well as crops, creating the need for herbicides. And pests found the uniformity of new varieties appetizing which necessitated the use of insecticides as well ., . The fertilisers made the new varieties possible. The new varieties made the fertiliser necessary.'[38] So it became clear that, inter alia, the degradation and erosion of the soil, the chemical pollution of ground water, water depletion, the destruction of genetic diversity, and damage to the environment in general were too great to sustain.

2) Contrary to industry claims, the use of herbicide-tolerant seeds is likely to result in a need for more and stronger herbicides.

Recent studies at the University of California have demonstrated that 'gene flow by pollen occurs readily among populations that are separated by 1000 meters and even greater distances.' Thus, in the words of Dr. David Ehrenfeld of Rutgers University: 'It would only be a few growing seasons before we could expect to see this engineered herbicide resistance be transferred naturally, in the field, to weeds themselves.[39]

3) The way of the world is constant change, evolution and adaptation. Insects develop resistance to insecticides just as weeds develop resistance to herbicides. In the U.S. despite a tenfold increase in the use of insecticides, annual crop losses to insects over the years have nearly doubled. [40]

Similarly, diseases evolve and can adapt to new circumstances. In a relatively short time, there will be mutations of the diseases which will enable them to break through the defences of the genetically engineered varieties.

And scientists cannot predict reliably how the new altered organisms themselves will evolve and behave once released.

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[38] Cary Fowler and Pat Mooney, The Threatened Gene, Cambridge, Lutterworth Press, 1991, pp. 58 and 60.

[39] Ibid, pp. 143.

[40] Richard Hindmarsh, 'The Flawed "Sustainable" Promise of Genetic Engineering', The Ecologist, September/October 1991, pp. 198-9.

4) It will never be possible to control the releases into the environment of untried and unauthorised organisms. Since 1986, numerous examples of such behaviour have come to light.[41]

5) And finally, the development of genetically engineered monocultures will cause further devastation of the world's genetic resources. Genetic diversity is one of nature's greatest treasures. Many years ago, the plant pathologist Martin Wolfe, working with the geneticist John Barrett, had already confirmed that polycultures are healthier than monocultures.[42] They demonstrated that a blend of three common varieties of spring barley was stronger than the three when grown separately. As each stem is surrounded by other varieties, should an infection attack one particular variety, it is shielded by its resistant neighbours which themselves might not be affected. They concluded that whereas a monoculture might produce higher yields in a given year, the polyculture blend produces more over the longer term.

We throwaway diversity at our peril. History supplies many well-publicised warnings. For example, there are still 5000 varieties of potato grown around the world.[43] But in Ireland, in the 19th century, potatoes descended from only two introductions[44] and the genetic limitations resulted in a lack of resistance which allowed the blight to reach epidemic proportions and cause the great famine.

After the southern corn leaf blight of the 1960s, the U.S. National Academy of Science confirmed that the principal cause of the epidemic was corn crop uniformity. The crop was based on a hybrid. The Academy concluded: 'When one genetic component became susceptible to the new blight, the whole American crop became vulnerable.'[45]

The same is true of the Russian wheat epidemic of the 1970s. Forty million hectares had been sown with a single variety of a so-called 'miracle strain'. Unexpectedly and despite scientific experimentation, the strain sometimes was incapable of surviving the harsh winter. Because of genetic uniformity, the consequence was a general crop failure. Intensive agriculture destroys genetic diversity not only in seeds, but also, of course, in all forms of animal and vegetable life affected by cloning, embryo transfer, gene selection, creation of monocultures, tissue culture, genetic engineering and the other processes of intensive agriculture. The granting of patents for new life forms will accelerate this trend because the law requires that the new patented varieties be internally consistent, that is to say uniform.

Unfortunately, farmers will be forced to adopt all these new processes because, at least temporarily, yields will be greater. As farmers must survive in a competitive world, they will farm intensively or be driven out of business.

What is more, farmers will become tied to and dependent on the chemical suppliers. As the patented seeds and their plants will be genetically engineered to respond to particular chemicals, the suppliers of those particular chemicals will control the farmers who use the seeds.

Genetically engineered products, of course, are also used in human health care. On the whole, these seem to be better tested, monitored and regulated. They will produce some

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[41] The Mismanagement of Genetic Engineering', The Ecologist, September/October 1991, p. 200. David Burch, Dr. Kees Hulsman, Richard Hindmarsh, Arthur Brownlea, 'Biotechnology Policy and Industry Regulation: Some Ecological, Social and Legal Considerations'. Submission to the House of Representatives Standing Committee on Industry, Science and Technology Inquiry into Genetically Modified Organisms. Australia, September 1990.

[42] The Economist, 10 August, 1991.

[43] Cary Fowler and Pat Mooney, The Threatened Gene, p. 19. 44

[44] Ibid, p. 43.

[45] Ibid.

dramatic and valuable results. But the main difference to agricultural products is that they have been directed at combatting disease rather than attempting to alter the character of a species.

So far, producing human clones or hybrids with other animals or humans genetically engineered to provide particular skills or attributes remains part of science fiction. But we are approaching the day when knowledge available to us will make it possible to do the most extraordinary things. Shortly we will have established a complete human gene-map which will allow us to alter profoundly the genetic heritage of man.

So biotechnology and genetic engineering are forcing us to face enormous moral and practical problems.

The practical questions include: can we understand the longer-term effects, direct and indirect, of these wholly new and partially explored products? Can we obtain their benefits without terrible consequences? Do we really believe that new regulations will be sufficient to stop uncontrolled releases into the biosphere of these new forms of life? How can we avoid new forms of life, such as genetically engineered microbes, causing unlimited damage? Their very 'newness' means that existing life on earth, both animal and vegetable, has never been exposed to them and therefore has no immunity to protect against them. Do we understand that by creating instantaneous, unexplored new forms of life we have thrown away the vital protection of being able to learn by our own mistakes?

With thousands of researchers experimenting throughout the world and using their imagination to create instantaneous new life forms unknown to nature and therefore untested by the trials and errors of millions of years of natural evolution, is it possible to avoid mistakes and accidents which could have unimaginable consequences? We should always remember that there are no reliable shortcuts for testing new drugs. As we have seen their effects can become apparent years later.

But there are deeper questions. Man is very clever but is his wisdom commensurate with his cleverness? Has man the moral right to create new microbes, new animals, new life forms? Are we wise to transform the course of evolution artificially and to do so at unimaginable speed? Do we realise that much of the change is irreversible? Can we convert animals and fields and forests and all things living into unnatural high-performing machines whose only purpose is to serve human beings? Is changing fundamental genetic information in living things, which will remain part of their inherited characteristics, the ultimate form of pollution?

Has the hubris of mankind become dangerously inflamed?

Have we arrogated to ourselves the role of God's representatives on earth and as such come to believe that nature is there for our exclusive use? Have we concluded that we have been granted the exclusive right to use animals and water and soil and air as we wish - and to change them at our whim and to create any kind of new life that our cleverness invents? Has man assumed the role of God or, in the eyes of the less formally religious, has he usurped the role of nature?

I will return to easier questions - what should be done with the Common Agricultural Policy or C.A.P. and with the current G.A.T.T. negotiations as they affect agriculture?

The C.A.P. is flawed because through its support policy, it is designed to encourage maximum as opposed to optimum production. As all production is bought at supported prices, the C.A.P. provides a guaranteed market at guaranteed prices whatever the level of production. So quantity of production becomes all-important and this encourages every form of intensification of agriculture. Such a policy, in the short term, produces surpluses, the famous lakes and mountains, the storage and disposal of which, including export subsidies, account for about half of Europe's agricultural budget. What is more, when these heavily subsidised and discounted surpluses are dumped on other nations, their farmers are

unable to compete so there is terrible damage to the rural population and social structures of nations used as dumping grounds.

At this particular moment the surpluses could be useful to help the Republics that formed the Soviet Union move from a socialist structure to private property. But that will be transitory. These nations, prior to communism, were exporters of food.

The C.A.P. must be reformed. A fundamental shift of objectives is required. The C.A.P. should aim at bringing production into balance with demand by moving away from intensive methods and encouraging extensive farming. This would reduce surpluses, maintain a stable rural population, encourage family farmers and reverse some of the damage done by intensive methods. Also it would ensure that healthy food is available to consumers.

Over half the C.A.P. agricultural budget would be economised by eliminating surpluses and this could be redirected to facilitating the move from intensive to extensive methods. We should not seek to reduce the overall budget. It only represents 0.7% of the E.E.C.'s G.D.P. and is needed to achieve the proper objectives of the C.A.P.

The current G .A. T. T. negotiations are very dangerous as they propose prohibiting nations from limiting the volume of imported agricultural products. In other words, they seek to create what they call a free and competitive world market in agriculture.

It sounds excellent but none the less let us consider it further.

Competition is a form of controlled warfare. In the case of agriculture, on the one side you have farming based on industrialised monocultures, intensive methods, direct and indirect subsidies and an agricultural community which has already been reduced to the needs of intensive farming. On the other side, you have traditional agriculture. In such a contest, communities in which small or medium-sized farms still predominate would be washed away as if by a catastrophic flood; whole populations would be uprooted and swept into urban slums. Those who remained to try and compete against industrialised and subsidised agricultural imports, by necessity would be pressed into adopting the short-term solutions of intensive methods.

What is more, the industrialised countries want to stack the cards even further in their own favour. Not only do they wish to obtain patents on new life forms but also they want to set the standards of safety and quality which all nations would have to accept.
According to current proposals, this would be achieved by vesting the exclusive right to define world standards in the Codex Alimentarius, a Committee of the Food and Agricultural Organisation. The membership of this supranational commission, as well as of its subsidiary working parties, consists of numerous bureaucrats, representatives of the agrochemical and food industries along with their contracted scientific advisers. It must be remembered that these scientists are advocates not judges. The Codex Committee is severely biased in favour of intensive farming and its industrial and pharmaceutical suppliers.

Professor Philip James, Director of the Rowett Research Institute and a member of the World Health Organisation's Director General's advisory committee, is quoted as saying: 'Codex is dominated by the Food Industry.'[46] And drawing on all my past experience, I can assure you that Professor James is right. The Codex Alimentarius suffers from a well-documented disease - agency capture - whereby the regulators are under the influence of the regulated.

The G.A.T.T. proposals for agriculture, if adopted, would do enormous harm. Take Vietnam as an example of the many countries making the first faltering steps towards rejoining the free world. It has a population of 67 million of which 78% live on farms. Driving them from fields into urban slums would create deeper and longer-lasting

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[46] Scotland on Sunday, 4 August, 1991, p. 26.

devastation than the horrors of communism or the war. In the world as a whole, the rural population is 2.9 billion. Let us suppose that as a percentage of total population, it were to be reduced to the levels that exist in the 'new' countries like Canada or Australia. The result would be an exodus from the land to the towns of about 1.9 billion people. All in the name of efficiency and free markets.

The 'new' countries must understand that their social structures are quite different from those of traditional nations where populations were not assembled by immigration. When immigrants reached North Dakota, for example, they did not find a society with a large population based on village life. They found wide-open, relatively uninhabited space. They did not worry about social changes which would follow the creation of vast farming areas. They just went ahead.

Carla Hills, the U.S. Trade Representative handling the G.A.T.T. negotiations, testifying before a Senate Committee, said: 'I would like you to think of me as the U.S. Trade Representative with a crowbar, where we are prying open markets, keeping them open so that our private sector can take advantage of them.'[47]

Oscar Wilde described one of his acquaintances as 'a man who knows the price of everything and the value of nothing'. That is an apt description of those who for the sake of the short-term benefits of industry would destroy the cultures, traditions and stability of nations. And, in this particular case, even the price is wrongly calculated.

We must not allow G.A.T.T.'s agricultural proposals to become a vehicle for neo-colonialism. The current proposals must be rejected.

I do not suggest for one instant, that U.S., Canadian, Australian or other new world farmers should be penalised. On the contrary, I believe that they are a vital and healthy part of their own societies and that they are suffering financially. These farmers also, need a fair deal which recognises the full extent of their role: economic, social and environmental.
When I was young, it was accepted as a given, that civilisation was progressing inexorably towards better things. Yet despite our awesome cleverness, the extraordinary invention of the most unbelievable technologies, many of which individually can work wonders, the sum of human misery has risen exponentially.

Sixty years ago, the world's population was approximately 2 billion. Today it is 5.3 billion. The absolute numbers of those living in squalor has exploded. And during that same period, we have threatened the stability of the very fundament of life - water, soil, air, forests, the climate.

It is time to reassess the path that we have chosen. We must consider more profoundly the criteria which we employ to assess prosperity and contentment. We must select and use the extraordinary new tools of the technological revolution, in ways which are compatible with those criteria. And we must recognise that, at this moment, we might be riding an accelerating merry-go-round to hell.

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[47] 'Hearing of the Senate Finance Committee - Confirmation of the U.S. Trade Representative. ' Witness, Carla Hills and chaired by Senator Lloyd Bentsen. 27 January, 1989.