

**HUMANITY CANNOT
AFFORD THE RISKS OF
GENETIC ENGINEERING**

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Present state of GE food science on health

- **Many opinions but few data!**
- **Less than 30 peer-reviewed science papers published to date**
- **No agreed protocol for risk assessment**
- **Only one human clinical trial and only few animal studies have been published to date**
- **When statistically significant differences between GE- and non-GE crops/foods are found these are declared by the GM biotech industry to have no biological significance**
- **Scientists finding such differences are vilified**

**Independent science is a myth
without the legal and social
protection of scientists**

A personal account

- **In 1995 the Scottish Office commissioned a three-year multicentre research programme under my coordinatorship with the main task to:**
- **identify genes encoding antinutritional factors that would increase the resistance of plants towards insects but without harming non-target, beneficial organism, the environment and livestock and which would present health risks to humans**
- **establish credible methods for the identification of possible human/animal health and environmental hazards of genetically engineered/modified (GE or GM) foodstuffs for the use by the regulatory authorities for risk assessment**

Selection and transfer of the gene of *Galanthus nivalis* agglutinin into *Desiree* potatoes

- **Transgenic expression of GNA has increased the resistance of potatoes to aphids and nematodes**
- **Two successful lines (71 and 74), after two years' field-growth at Rothamstead and re-grown at SCRI in tents side-by-side with the parent line and harvested at the same time, were used in the work**

Compositional differences affecting nutritional value

- The protein content of GM line 74 was 20% less than that of parent or GM line 71
- The potato lectin (PL) content of GM lines was significantly higher than that of the parent. GM 74 contained twice as much as the parent
- The TI, starch and sugar contents of GM lines were significantly different from the parent line
- The glycoalkaloid content of the GM lines was significantly less than that of the parent line

Conclusions of the analytical work

- **As a result of genetic modification of the potatoes with the GNA gene, due to unpredictable changes in the genome, possible insertional mutagenesis, gene silencing, suppression and/or somaclonal variation the composition of the GM lines became substantially different from that of the parent and from each other**

Further problems with the GM potato lines

- Although the aphid resistance of the GM lines was enhanced there was no correlation between GNA expression level and protection
- GM potatoes did not only harm aphids but also beneficial, non-target insects such as ladybirds
- The nutritional value of GM potatoes was reduced compared with the parent line, and feeding rats with GM potato diets damaged their gut, other organs and immune system

Nutritional studies

- In short-term and (particularly) long-term feeding studies with young, rapidly growing rats it was shown that:
- Rat growth on GM diet was slightly reduced
- There were significant changes in the development of rat internal organs
- There were major functional and structural alterations in different compartments of the rat digestive system
- Humoral and mucosal immunity was affected

Changes in the digestive system

- **Proliferation in the gastric mucosa**
- **Hyperplastic growth, increased mitotic figures and IEL invasion in the small intestine and variable changes in the large intestine**
- **None of these changes were caused by the lectin GNA as its transgenic expression in potatoes had no affect its binding to the SI mucosal epithelium either qualitatively or quantitatively**

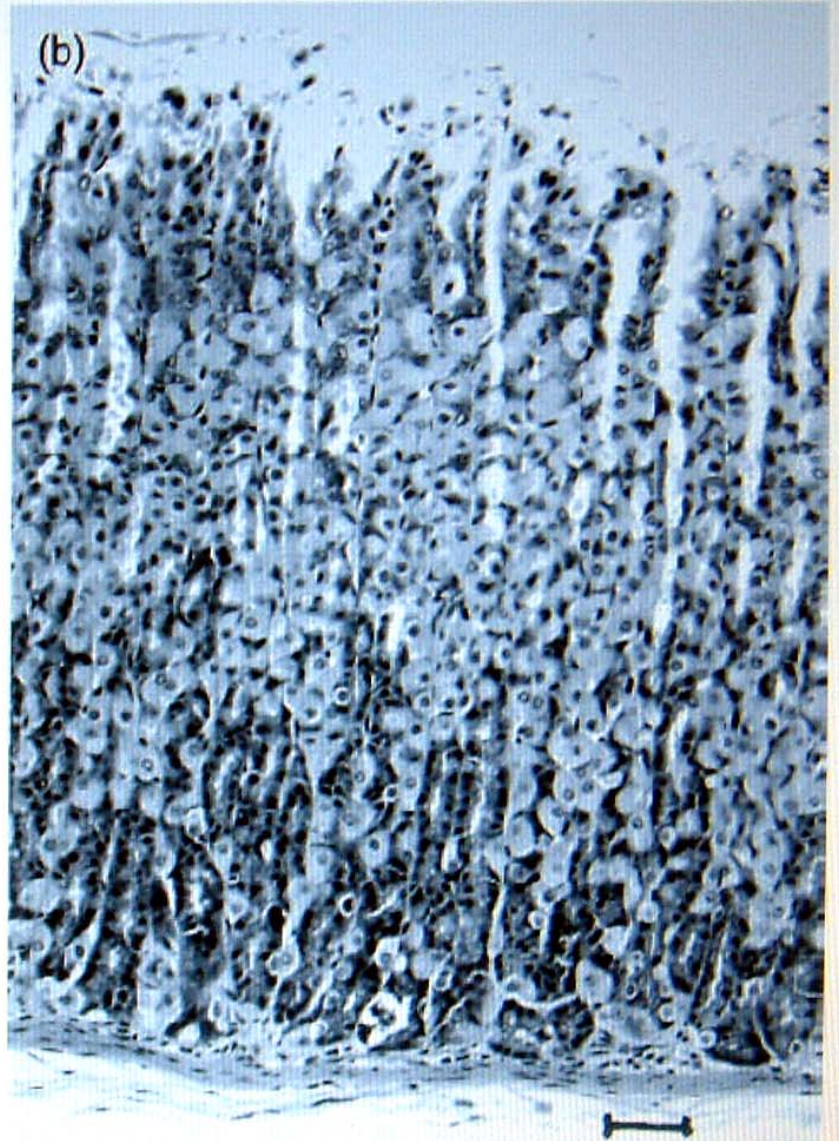
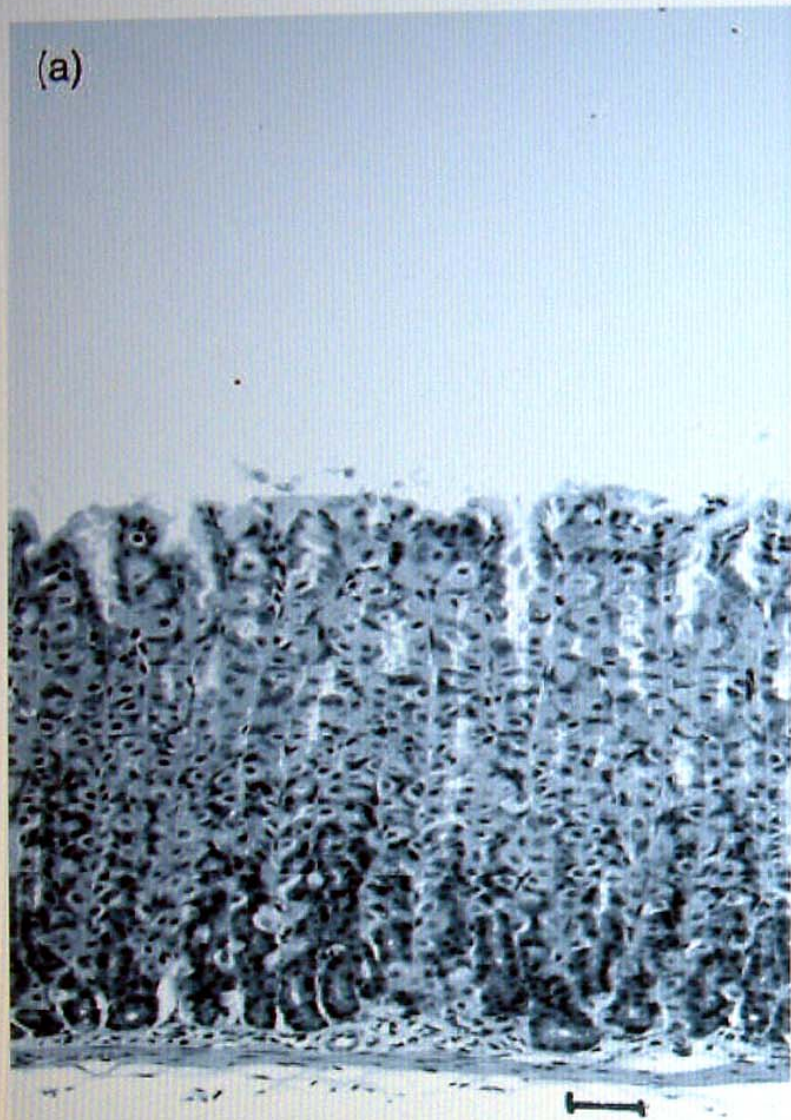


Fig. 16.1. Comparison of the stomach mucosa of rats fed with raw GM potato diet (b) shows marked thickening due to hypertrophy of mucosal cells in comparison with that of rats given the parental line (a) (bar = 100 μ m).

Conclusions of the nutritional work with GM potatoes

- The rate of digestion/absorption in the presence of GM potatoes in the diet was slightly reduced with a consequent reduction in rat growth
- The development of some vital organs (liver, pancreas, SI, immune organs) in GM-fed rats significantly differed from that of control rats
- GM potatoes in the diet depressed humoral immune function but increased that of the mucosal immune system

Final conclusions

- **The results of experiments carried out at the Rowett support the suggestion that the consumption by rats of transgenic potatoes expressing GNA has significant effects on growth, organ development, body metabolism and immune function that is fully in line with the significant compositional differences between transgenic and parent line potatoes**

Message

- **The nutritional safety testing protocol used in our work at the Rowett could have formed the basis of the health-risk assessment of any GM plant/food, particularly with further developments**
- **Why is it not used?**

**KEEPING THE PUBLIC IN
THE DARK IS THE MAIN
CENTRAL STRATEGY USED
BY INDUSTRY AND
PARTICULARLY THE GE-
BIOTECHNOLOGY
INDUSTRY!**

Lack of transparency

- **Several methods are used by industry to achieve secrecy:**
- **Declaring all research results as confidential business information (CBI)**
- **Withholding publication of unfavourable data**
- **Disinformation**
- **Falsifying research data**
- **Generating doubts about the validity of “uncomfortable” results**

The consequences of lack of transparency in research

- **With irreversible technologies such as gene-splicing dependence of research on industrial funding will lead to:**
- **Loss of accountability**
- **Harm to human/animal health**
- **Irreversible environmental damage**
- **Without exchange of data and views between scientists progress in science is impossible**
- **Increase in all forms of scientific fraud**

Some examples of major harm due to secrecy

- **Hiding data showing that smoking was a main factor in lung cancer, heart/circulatory diseases, etc prevented society to take decisive preventive action**
- **Hiding the results of BSE studies showing the possibility of the spread of the disease from cows to humans led to the death of over a hundred people**
- **Hiding the evidence that genetic engineering had a role in the death and maiming of people taking GE-tryptophan supplements (eosinophilia myalgia syndrome) and the destruction of the GE-bacteria used in the production of tryptophan the company should be held responsible for this human disaster**

Damage by the GE-biotechnology industry to our World (1)

- **Blocking research on the possible irreversible health, environmental and economic risks due to the spread of potentially hazardous GE-crops**
- **Blocking research into the increased destruction of biodiversity, soil quality and food security**
- **Growing dependence of farmers on monopolies**
- **Withholding funding from research into finding new genetic techniques**
- **Destruction of independent scientists by the financial and political power of the GE industry**

Damage by the GE-biotechnology industry to our World (2)

- **By political pressure the GE-biotech industry achieved that in the US there is effectively NO GE-regulation and that “safety assessment” is based on the poorly defined and not legally binding concept of “substantial equivalence”**
- **The results of risk assessment are “confidential business information”, and therefore not available for public or independent scrutiny**
- **Using the power of WTO the GE-biotech companies try to force other nations to accept their GE products (USA vs. EU at WTO)**

Corruption of science by industrial/political interference (1)

- **Report: Disinformation syndrome afflicts government scientists (PEER and Union of Concerned Scientist survey):**
- **One in five scientists had been directed to exclude or alter information in a scientific document**
- **More than half of the 3247 respondents said that commercial interests through political intervention directed them to reverse or withdraw research conclusions**

Corruption of science by industrial/political interference (2)

- **In a survey by Institute of Professionals, Managers and Specialists: 30% of the 500 respondents said they had been asked to tailor their research conclusions, such as:**
 - **- 17% to change the results to suit the customer's preferred outcome**
 - **- 10% to change their conclusions if they wanted a further contract**
 - **- 3% were told not to publish “unwelcome” results**

Corruption of science by industrial/political interference (3)

- In a survey of US Fish and Wildlife Service concerning the protection of endangered plants and animals the respondents reported:**
- 44% have been directed to withhold data that indicated the need for protection of species**
- 20% have been instructed to compromise their scientific integrity by excluding or altering data and opinions**
- 56% knew of cases where commercial interests induced the reversal or withdrawal of decisions or conclusions through political intervention**

Corruption of science by industrial/political interference (4)

- **In an investigation of 103 government scientists by the N.I.H it was found that:**
- **44 violated ethics rules on collaborating with pharmaceutical companies**
- **9 may have violated criminal laws**
- **Department of Health and Human Services received 274 complaints of alleged misconduct in 2004. Due to staffing shortage they could only investigate 23 of these**

FINAL CONCLUSIONS

- **All independent studies with GE crops so far described worrisome health effects; most have been ignored by the industry and politicians**
- **The general malaise of genetic engineering is that on transgene insertion the plants' own genes can be unpredictably re-shuffled in a way that may lead to the activation of genes coding for toxins, allergens and other harmful matters**
- **Humanity cannot afford to take the health and environmental risks of insertional mutagenesis!**

The way forward?

- **It is the public and not the corporations must decide whether GE-crops are needed at all**
- **Even if the public can agree that GE crops are needed the claims of corporate science must be independently verified by publicly funded scientists acting as watchdogs. The public must be helped to understand that for independent scientific advice they will have to release scientists from their “servitude” to business by funding them from the public purse so that research could be done “openly, transparently and inclusively” for the benefit of all**