Contrasting the use of genetic engineering in medicine and agriculture

Genes, the inherited blueprints of life, are naturally found and work in groups as an integrated whole within a given organism. For example, genes for a particular characteristic are normally associated with other genes that control their expression. Breeding between closely related forms of life exchanges variations of the same genes in their natural groupings, bringing out new combinations of traits that already exist in the gene pool of the species. The best or most desired traits are then selected by natural or human selection. The genes in each grouping have been finely tuned to work together harmoniously over millions of years of evolution.

Therefore, by working within the boundaries set up by nature, there is a minimum risk of things going wrong. Direct human experience over thousands of years has taught us what is safe for us to eat. The use of genetic engineering (GE) in agriculture, however, introduces a level of unpredictability that is far greater than the intended change.

Genetic Engineering

- At present we have only mapped a small percentage of the genes of complex organisms such as plants and animals. We know even less about how all these genes work as an integrated whole.
- GE allows the isolation and transfer of selected genes between totally unrelated organisms. GE scientists often describe the transfer of one or a few genes between organisms as precise, as they can control which gene is transferred. However the adjective 'precise' can not describe either the positioning or how the inserted gene is controlled.
- GE plants and animals start life in the laboratory where artificial units of foreign genetic material are randomly inserted into the host. To a lesser or greater degree, this always disrupts the natural genetic order and function. Because the new location of the gene is random, GE brings about combinations of genes that would never occur naturally - furthermore, the gene is transferred without the normal accompanying genes that would regulate its expression.

The artificial nature of GE does not automatically make it dangerous. It is the imprecise and uncontrolled way in which genes are combined that results in uncertainty about the safety of the outcome. For example, abnormalities in genetic functioning can lead to disruptions in the biochemistry of an organism. This in turn can result in the production of new toxins and allergies.

GE in medicine

- GE in medicine tries to correct a genetic defect that is either inherited (as in, for example, muscular dystrophy or cystic fibrosis), or acquired (as in cancer).
- Strict regulations ensure that the use of GE medicine does not result in the intentional

release of viable GE organisms into the environment. Drugs are produced under contained industrial conditions. GE organisms for potential gene therapy are intentionally crippled so that they cannot reproduce should they accidentally escape.

- A new drug or therapy produced using GE must undergo extensive pre-clinical and, more importantly, clinical trials to assess not only efficacy but also to detect any unexpected, undesirable side effects.
- Once approved, the use of a GE drug is clearly labelled and carefully monitored.

Despite these precautions things can go unexpectedly wrong. Many diabetics have reacted badly when switching from pig insulin to the 'human' form of insulin produced by genetically engineered bacteria.

GE in agriculture

In contrast, the use of GE in agriculture tries to 'repair' something which has nothing inherently wrong with it.

- GE organisms are produced specifically for the intentional release into the environment. They are rarely crippled to prevent reproduction.
- Health risks of GE derived foods are only assessed biochemically and in short-term feeding trials with animals. No tests with human volunteers are required. The Food Standards Agency commissioned the world's first known trial of GM food on humans. For more information please see the briefing sheet "GM research: A gut feeling" avaible in the library section of our website.
- Post-release monitoring is nonexistent.

Despite the fact that GE technology as applied in medicine and agriculture is largely the same, different sets of rules seem to apply in these two areas. It would appear that while the inherent, unpredictable component to GE is largely appreciated and addressed in medical applications this is not the case in food production. The Soil Association believes that this situation is unacceptable.

Conclusion

Our knowledge of the process of gene transfer is still far too rudimentary and GE technology far too crude for us to be qualified to release GE organisms into the environment and for their entry into the food chain. The only current 'safe' use is under completely contained conditions for medical applications where alternatives are either far from ideal or totally lacking.

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Further Reading

Please see the Soil Association website http://www.soilassociation.org/gm for more information

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