International Forum for Genetic Engineering

Genetic Engineering and the Intrinsic Value and Integrity of Animals and Plants

Wednesday 18th to Saturday 21st September 2002
Royal Botanic Garden, Edinburgh, UK

Abstracts of Contributions

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Plenum Papers

Wednesday 18 September, 19.45

What do we mean by the intrinsic values and integrity of plants and animals?

Prof. Holmes Rolston III

Department of Philosophy, Colorado State University, Fort Collins, CO 80523, USA

There is integrity in any life that has a good of its kind and is good in its kind of place, with a biological identity sought, conserved, reproduced in species lines, and fitted into its world. Organisms are normative systems. A plant is a spontaneous life system, self-maintaining as the plant grows, reproduces, repairs its wounds, and resists death. In higher animal life, unlike vegetable life, there is somebody there behind the fur and feathers. Integrity is focussed in the embodied subject self.

The core of Darwinian theory is survival value and adapted fit. Value generated and conserved is the first fact of evolutionary natural history; and the result is the richness of biodiversity and complexity on Earth. Ecosystems are places of value capture and transformation. Individual and species integrity are integrated into the ecosystemic niche in which the individual resides. In this more inclusive picture, struggle is subsumed under a comprehensive situated fitness.

When humans appear, the only animal able critically to evaluate its options in behavior, such value capture can require justification. Humans may and must capture and transform natural values—genetic, organismic, specific, ecosystemic. This is both permissible and required, but it requires justification proportionately to the loss of integrity and value in the natural world as this is traded for value gain integrated into richness in culture.

Wednesday 18 September, 20.45

Engineering Genesis – Pioneering Genetic Engineering Ethics in Scotland

Donald Bruce

Director, Society, Religion and Technology Project, John Knox House, 45 High Street, Edinburgh, EH1 1SR, UK

The discussion of intrinsic value and the integrity of living organisms in genetic engineering had already begun in Edinburgh almost a decade ago. It was a central focus of the landmark study begun in 1993 by the Society, Religion and Technology Project of the Church of Scotland into the ethical and social issues arising from genetic modification of animals, plants and micro-organisms. This took the form of a unique 5 year multi-disciplinary engagement of leading Scottish experts in genetics, agriculture, ethics, theology and the social sciences. The resulting book *Engineering Genesis*, first published in 1998, predicted the crisis of public values which broke out over GM food. The paper traces the process of dialogue and ethical discourse which developed among a group holding very disparate views, and assesses the relative roles played by both intrinsic and consequential ethical considerations. It reviews the role of basic ethical values on both sides of the present polarised UK GM food debate and assesses whether a better public discourse is possible.

Thursday 19 September, 09.00

Seeing the intrinsic value of plants and animals: Developing appreciative modes of perception

Craig Holdrege

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Whether we recognize the integrity or intrinsic value of an organism depends upon our way of knowing – the conceptual background that informs our approach and our actions. In this talk I will begin by discussing conceptual frameworks within which the concept of intrinsic value can have no meaning:

1. considering laboratory animals as models;
2. the Neodarwinian view of organisms as bundles of survival strategies;
3. gene-based consideration of animals.

I will discuss the implications and limitations of these perspectives and contrast them with an integrative approach to understanding organisms. Taking examples from mammals I will show how the parts and functions of an organism are dynamically integrated and expressive of the organism as a whole. We emerge with an understanding of the animal as a creature with its own integrity that warrants recognition in all our interactions with it.

Thursday 19 September, 09.50

Does genetic engineering impact the intrinsic value and integrity of plants?

Prof. Howard Davies

Theme Co-ordinator: "Genes to Products", Scottish Crop Research Institute, Invergowrie, Dundee DD2 5DA, UK

Plant breeding, a man-made occupation, has for centuries sought to deliver variation that can be harnessed by man for the benefit of man. Thus the natural "integrity" present in the wild progenitors of cultivated crop species has been challenged either directly through "intervention genetics" or indirectly via an impact on natural habitats aided by industrialisation and historical/evolving crop and environment management practices. The impact that genetic engineering has, or may have, on the intrinsic value and integrity of plants must be considered against the backdrop of appropriate benchmarks and comparators. Plant population genetic structure has been widely changed by breeding practices, a fact that indicates the deep influence of breeding practices on the genetic make-up of crop plants.

Where a plant variety has many positive attributes but lacks one or two traits that make it a commercial winner, breeders have several options to deliver the end product. The use of molecular markers can speed up the introgression of key genes e.g. for pest and disease resistance which can result, depending on the species in question, in genetically homozygous lines with the newly incorporated phenotype. If the introgressed gene is involved in cellular metabolism or a developmental process then it is distinctly possible that there are unintended effects on cellular processes following the introgression of that gene due, for example, to pleiotropic and epistatic influences. There is good evidence that metabolism and development are interconnected due to the special role that cell metabolites play in signalling processes. For example, the concentration within the cell of even relatively simple molecules such as sugars can have a significant impact on gene expression with ensuing consequences. The complexities of such mechanisms will continue to evolve if a selective advantage accrues. In the breeding of major crop species, it is more than possible that the unintended effects of gene introgression would most likely go un-noticed since the assessment of "performance" is concentrated on key commercial attributes such as yield, resistance to pests and pathogens and the specific quality traits e.g. starch, protein or oil content and composition which are key to the end users. Similarly, where mutation breeding has been employed e.g. in the breeding of the successful barley malting cultivar Golden Promise, no attempt has been made to characterise the mutations and any secondary, unintended impact on sub cellular processes. With the possible exception of novel (non GM) foods, the products of conventional and mutation breeding are not subject to the level of scrutiny of "integrity" that GM crops must be exposed to.

The potential for "unintended effects" which might impact on the integrity and value of crop plants is one of the concerns raised over the application of recombinant DNA techniques in the production of foods. As a basis for the discussion one can broadly define intended effects and unintended effects as follows:

a) "Intended effects" of genetic engineering are those which are targeted to occur from the introduction of the gene(s) in question and which fulfil the original objectives of the genetic transformation process.

b) "Unintended effects" represent a statistically significant difference in the phenotype, response, or composition of the GM plant compared with the parent from which it is derived, but taking the expected effect of the target gene into account. Such comparisons should be made when GM and non-GM counterparts are grown under the same regimes and environments.

c) “Predictable unintended effects” are those unintended changes which go beyond the primary expected effect(s) of introducing the target gene(s) but which may be explicable in terms of our current knowledge of plant biology and metabolic pathway integration and interconnections.

d) “Unpredictable unintended effects” are those changes falling outside our present level of understanding.

Predictable and unpredictable unintended effects may, or may not prove to have relevance in terms of product safety and intrinsic value but must be taken into account when assessing risk.

The presentation will consider the process of transgene insertion into plant DNA and compare this with the process of recombination which generates “natural” and “man made” variation. In addition, developments in genomics, proteomics and metabolomics and their potential and limitations in terms of “adding value” when applying the concept of “substantial equivalence” to GM plants/crops will be discussed. The concept of substantial equivalence has been used as a component of the GM risk assessment process. The term substantially equivalent implies that, with the exception of the newly introduced trait, the GM plant/crop is equivalent to its “parent” in all characteristics that are of importance to the safety of the consumer and the environment. In terms of the integrity and value of plants the concept is an important component of the discussion platform.

Thursday 19 September, 10.15

Phenomenological studies on transgenic potatoes: genetic modification adds more than intended traits

Ruth Richter

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Morphological inspection of transgenic potatoes harbouring different transgenic constructs revealed unintended multiple modifications. Developmental dynamics and leaf shape-patterns show that genetic transformation affects integral reactions of the plant, as does alteration of the environmental conditions. These results challenge the concept of substantial equivalence.

Thursday 19 September, 11.30

Does genetic engineering of animals impact the intrinsic value and integrity of animals?

Dr. Henk Verhoog

Bioethicist, Louis Bolk Instituut, Hoofdstraat 24, NL-3972 LA Driebergen, The Netherlands

In several reports about ethics and transgenic organisms a distinction is made between extrinsic concerns, related to the consequences of making transgenic organisms, and intrinsic concerns, related to the act of making the organisms transgenic. Examples of such intrinsic concerns are: playing God, the argument that it is unnatural, and the argument that it violates the intrinsic value or integrity of the organisms concerned. In a consequentialist approach such as utilitarianism there is no room for such moral arguments. Utilitarians think that there is only a moral issue, when the organism suffers as a consequence of the genetic modification. This means that only in the case of higher, sentient animals (including man) may the creation of transgenic animals be morally problematic. When the organism does not suffer from the transgenesis it may be an aesthetic issue but not a moral issue.

A common element of all the intrinsic concerns is that the biotechnologist does not show (enough) moral respect for the self-organizing capacity, the independence, the otherness, the characteristic nature of living organisms. Contrary to utilitarians, those with intrinsic concerns refer to the human attitude towards animals or nature, to the human-animal relationship. For a utilitarian it is not important whether the human being has an empathic relation with the animal, or perceives it in a particular way. Only the consequences for the animal count. This explains why (natural) science, ethology for instance, is usually called upon to establish whether the animals suffer or not. Experimental natural science also has the tendency to sever itself from human experience. Examples of this will be given. In ethology the ‘pure science model’ of animal welfare is an example.

The alliance between utilitarianism and science is at the root of most policy with respect to transgenic organisms. As a consequence of this alliance, intrinsic concerns are seen as subjective, personal concerns (matters of taste, as in aesthetics), contrary to the objective, publicly relevant extrinsic concerns. Understanding the way in which experimental natural science distances itself from direct human experience is essential in order to understand public objection to gene technology. To become really pluralistic, the public debate about gene technology should also make room for moral approaches other than utilitarianism. Otherwise the gap between the supporters of biotechnology and the opponents may become greater and greater.

Thursday 19 September, 11.55

Does genetic engineering impact the intrinsic value and integrity of animals?

Dr. Harry Griffin

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Man has been altering the genetic composition of animals for at least 5000 years and the modern breeds of cattle, pets or racehorses bear little physical resemblance to their progenitors. They often also exhibit very different behaviours and sometimes their welfare is compromised. Given that man has modified the genomes of domesticated species so radically over the years, it seems perverse to this contributor to argue that the simple introduction of one gene by genetic manipulation represents an attack on the intrinsic value and integrity of an animal. It is possible to imagine genetic modifications that negatively impact on an animal's basic qualities (see the Agricultural and Environment Commission's Report published on 4 September on www.aebc.gov.uk) but similar changes can be achieved (and importantly have been) by conventional selection. So why the focus on GM?

Thursday 19 September, 19.30

Why is it in the farmer's interest to pay attention to the intrinsic value and integrity of plants and animals?

Timothy Brink

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The concepts of integrity and integral value of plants and animals will be considered in the light of many years of practical experience in organic and biodynamic farming. Society is engaged in a re-evaluation of agriculture and the countryside that includes questions about the role of the farmer and grower. Agricultural subsidies are moving away from production support to payments for environmental management. Modern agriculture is often described as an industry therefore implying a focus on inputs, outputs, and profitability. Organic/biodynamic agriculture and horticulture can be considered as a polarity to the industrial approach. The focus of organic and biodynamic agriculture and horticulture is on creating a natural and sustainable method of food production. Profitability is of course essential, but is achieved with higher prices to the consumer that are justified by environmental, food quality, rural economy and other benefits. The traditional family farm that occupied the middle ground between these polarities is all but dead in the modern western world. Do the concepts of integrity and integral value of plants and animals help to shape a vision of what our society wants from the countryside? What about the farmers and growers? These people are often criticised for degrading the natural environment. Many feel marginalized and misunderstood in our modern and increasingly urban society. What will motivate a new generation of young people to take up a career as a farmer or grower? Can concepts of integrity and intrinsic value help to shape a more dignified and valued role for the farmer and grower?

Thursday 19 September, 20.20

New Rules for a New Situation? Protecting animals' interests in the era of genetic engineering

Mike Radford

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Legal protection of non-human species of animals has traditionally focused on their subjective experiences, most particularly the prevention of pain. Indeed, it was the acceptance, first by moral philosophers and subsequently by legislators, that domesticated animals, especially those used in agriculture, were capable of feeling pain which provided the justification for the state initially to intervene to regulate the way in which they were treated. Thus, it has long been the case that cruelty towards animals – broadly interpreted to mean causing them unnecessary suffering – has been prohibited.

While the offence of cruelty remains the cornerstone of animal protection legislation, it is no longer in itself sufficient. The development of a distinctive discipline of animal welfare science has provided us with an increasingly sophisticated and informed insight into the physical and behavioural needs of other species, together with a greater understanding of the effects which different forms of treatment have on them. In response, there is a growing recognition that the moral duty we owe to at least some species of animals may extend beyond simply preventing them from suffering unnecessarily, and also encompasses a positive responsibility to ensure that they benefit from a high quality of life. This has been incorporated into legislation by means of increasingly detailed regulation which seeks to promote the welfare of individual animals.

While acknowledging both the practical and the symbolic importance of these two bodies of legislation, it is important to appreciate, first, that they have not changed the fundamental legal status of animals (which, broadly speaking, continues to define domestic and captive animals as property); second, the nature of the regulation laid down by both is essentially influenced by the degree of sentiency that an animal may be presumed to possess; and, third, the extent of the regulation required by policy-makers is based in the main on utilitarian principles.

It is submitted that each of these three characteristics represents a serious shortcoming against the backdrop of genetic engineering. A novel situation may require new rules: regulation must now go beyond defining how an animal should be treated, and seek also to protect the nature of the animal itself.

Friday 20 September, 09.00

Could genetic engineering be part of a sustainable breeding approach?

Christina Henatsch

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draft translation of the German original – not yet checked by the author

The idea of the cultivated plant which underlies biodynamic plant breeding will be sketched out. The formative principles in plant growth and how the latter can be influenced will be discussed from first hand experience and observations of biodynamic breeding practice. This will be used as the basis for examining the application of genetic engineering.

A cultivated food plant is distinguished by its ability to transform its capacity for reproduction into forming nutritiousness. A precondition for this is <u>compression</u> (Stauchung) of for instance the seed head or the stem. With wheat this brings about the simultaneous ripening off and firmness of the grain on the axis (rachis) of the ear (Spindelfestigkeit); with cabbage and lettuce, hearting results. A further precondition is a <u>balance</u> between vegetative development and fruit formation. Finally there is <u>formation of an inner space</u> by for instance the swelling of roots, hearts, fruit and seed. The life forces flowing straight out of the plant are diverted into forming sugars, starch, colours and aroma. The fruit arises as a plant organ in its own right.

One of the formative principles is the <u>metamorphosis</u> of the leaves up to the blossom which takes place according to particular laws. For example, with wheat it is clear that ignoring these laws has repercussions for the health of the plant and its nutritive qualities. In a cycle of lectures on agriculture, Rudolf Steiner indicated how planetary influences affect plant development and my own experiments on this have shown that both morphology and quality are affected. It is well established that the terrestrial environment (climate, soil conditions, light etc) have an influence on plant growth. Plants/varieties adapt themselves to different environmental conditions and undergo qualitative changes. So for instance successive growing of beetroot for several years on a sandy soil results in reduced nitrate content; improving the health of wheat by growing it on for several years from its own seed is worthwhile. Furthermore, an experiment with runner beans has shown that the use of the biodynamic preparations significantly increases the vitality of the plants and fruit in the succeeding generation. And in my own experiments the influence of the individual compost preparations can be seen in the growth habit and quality. Contact experiments with dill brought about an increase in the content of etheric oils; playing musical intervals to lettuce resulted in differences in growth patterns. The attitude and actions of the human being have a clear influence on plants and this is later expressed in the quality of the varieties.

The challenge for biodynamic breeding is to research into these kinds of influences on plants and to intervene in a purposeful way based on the species-typical growth principles. In order to be able qualitatively to evaluate the result of one's interventions, apart from studying the principles it is necessary to improve methods for assessing quality and to develop one's powers of observation for formative forces.

Questions which arise relating to genetic modification are as follows:

- Nutritiousness arises from what is typical of the species. This means a *composition* of the characteristics, not a *combination*. Genetic engineering clearly reaches what is typical of the species and reduces it to a sum of arbitrarily combined characteristics/traits. What influence does this have on the subtle qualities of foods?
- Beings are connected with all activity and existence. This applies to plants just as much as to technology. Different kinds of beings are connected with the usage of different kinds of technologies, which in relation to plants then cling to them, often not to the benefit of humans.
- Breeding intentions and motives likewise play a determining role in the quality of products – what do they reveal in the case of genetic engineering? If we look at the alternative possibilities indicated above, which show only a modest beginning, and then consider that genetic engineering in its agricultural context has so far not yet produced anything really useful and beneficial, then the question arises as to which technology or methodology is really the one for the future.

Intervention by genetic modification takes the plant out of its environment and its context. Thus it is all the more important to develop one's individual faculties of observation so that it will be possible to reach a qualitative judgement of the changes made and the products which result. These faculties are lacking so far and are not even being developed by the users of genetic modification. In all probability the contexts, levels and human-relatedness that are lacking will have to be compensated for through individual devotion and spirituality. But when we are in a position to do this, the human being will also understand the living world and be able to control its formative forces. In which case genetic engineering will anyway be superfluous.

Friday 20 September, 10.00

What concept of naturalness is behind the genetic engineering of animals?

Ton Baars

Senior Scientist, Animal Husbandry, Louis Bolk Instituut, Hoofdstraat 24, NL-3972 LA Driebergen, The Netherlands

In the EU standards for organic agriculture (EU 2092/91) the use of genetic modification is not permitted. But why? Breeding is an important tool in organic farming to change plants and animals for human purposes. Species can be adapted for specific a-biotic circumstances and for the needs of people. Why is there a principle difference between old fashioned breeding techniques and a direct transformation of the genome itself? The key for understanding lies in the concept of ‘integrity’, the value of its own which is respected and which act as a limitation for our interventions: what is natural and what is unnatural? This concept is related to a specific bio-ethical approach or theory about life and the relationship of man to nature, which we have identified as being ‘holocentric’, and which integrates other bio-ethical approaches.

In a project about the concept of naturalness in organic farming an attempt was made to distinguish how people defined nature and naturalness and how they acted in practice. After the analysis of the interviews we came to three interpretations of the concept of nature and naturalness. Organic farmers and traders talked about nature in three different ways and to explain the relationship to the world, which surrounded them. In the farmers view of nature a distinction is made within the universe between inorganic and organic nature (read as dead and alive nature). Agriculture is primarily related to organic or living nature, and therefore called *organic* agriculture (in the Netherlands: *biological* agriculture), clearly indicating that it deals with the realm of living nature.

This leads us to the first interpretation of the distinction between what is natural and what is unnatural: the natural is related to the realm of living nature. However, in organic agriculture this emphasis on the autonomy of life-processes can be approached negatively and positively. The negative approach we have called the ‘no chemicals approach’ (where ‘chemical’ stands for all synthetic inorganic substances), and the positive approach the agro-ecological approach. In the ‘*no-chemical approach*’ farmers have to replace (bio)chemical-synthetic substances by more natural substances. Instead of chemical sprays against diseases farmers use ‘natural’ sprays or biological control, synthetic manure has to be replaced by organic manure, and instead of herbicides mechanical weed control is used.

It is characteristic of the *agro-ecological approach* that the farmer learns from nature. In practice this means that nature is defined as an ecological system, and the ecological farmer wants to model the agricultural practice as an agro-ecosystem. Conventional farming shows a tendency to become totally independent of nature, fully controlled by technology in an artificial environment, whereas organic farming shows the opposite tendency, namely to integrate agricultural activities into nature.

The third interpretation of naturalness is based on how nature is thought of as the cultural product of the human creative mind and is called the *integrity approach*. In organic farming the term ‘natural’ refers to taking into account the characteristic nature of plants, animals, man and ecosystems because nature has an intrinsic value. Respect for the integrity of the farm ecological system, the living soil, the plant and animal species used is the result of an inner process of involvement with the way of being of natural entities.

The three approaches show a different orientation on life and nature, which can be shortly explained as an orientation on the origin of material or substances as natural versus artificial or chemical substances; an orientation on life processes as the self-regulation of natural systems versus technologically control; and an orientation on the values present in organisms themselves as respect for the intrinsic value instead of instrumental value.

The rejection of GMOs in organic farming is argued from all three orientations on nature: GMOs can only be made with the help of chemicals under laboratory conditions. Artificially created chemicals are not allowed in any part of organic farming and therefore we have to refuse GMOs like all artificial substances. Secondly, GMOs are too much thought out of the symptom orientation instead of the context orientation and do not support the self regulation of the farming system. In the process of breeding there is no longer a relationship of genotype and environment. Furthermore, are we not aware of the risk of GMOs in an agro-ecosystem and therefore should not use these artificial organisms? Thirdly, the technique does not respect the organism itself. It is a ‘cruel’ technique, which imposes on the organism the will of the human being and which cannot be refused by the organism. In this view breeding should *elicit* change from an ‘inner understanding’ of the organism's ‘otherness’, not impose on the other without any respect for its own identity.

Organic standards have to control what people do in practice. Therefore standards talk about measurable and controllable elements like the use of artificial chemicals and the origin of manure and seeds. It is much harder to create standards which relate to ‘respect of life’ or ‘integrity’. However, these elements are found in the intentions of organic farming and are expressed in the standards as the rejection of the use of GMOs.

Friday 20 September, 11.30

The socio-economic implications of biotechnology in agriculture: Exploring the issues.[a]

Dr. Ben Davies[1], Dr. Caspian Richards[1] and Prof. Clive L. Spash[1,2]

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2. School of Environment and Society, University of Aberdeen.

There are a number of socio-economic issues concerning developments in biotechnology as applied to agricultural production which suggest alternative frameworks for analysis and alternative rationales for the implementation of the technology. These reflect differing conceptions of which underlying issues are of fundamental importance from the perspective of different social actors. A fundamental issue is the discussion regarding whether the technology itself represents something radically new, or simply an extension of traditional techniques. The answer to this question tends to inform opinions as to how implementation and regulation should proceed.

Several features of biotechnology as intended for application in agriculture are then drawn out on the basis of their political and economic relevance. Some of these features can be considered as 'framing' characteristics of the technology, which relate to the assumptions and expectations within which it is developed and introduced. These include aspects such as the design both of agricultural systems and of the food marketing chain, the legislative procedures which regulate the development and commercialisation of technology and the safety of food products, and the extent to which uncertainty is acknowledged and incorporated by scientists and regulators into decision-making procedures. Other features can be described as 'embedded' characteristics, insofar as they are to a greater or lesser extent inseparable from the technology itself. Examples of these include the viability of mixed GM and non-GM cropping systems, where the very possibility of producing non-GM crops is directly bound to the extent of production of GM crops; and the impact on agricultural funding that arises from the development of biotechnology as a research agenda.

Some of the likely distributive impacts of GM-technology, in the context of current proposals for implementation, are explored with particular reference to developing countries. A distinction is drawn between the potential outcomes of implementation as distinct from issues regarding the inherent ethical status of biotechnology as a process. Ultimately society must develop a shared view both on ethically acceptable processes and on ethically acceptable outcomes, including the balancing of human and environmental risks and uncertainties. A package of institutional measures that reflects these twin concerns will then be required. This will involve answering how, what and where biotechnology applications are considered acceptable, as a pre-determinate of research into how, what and where applications might be profitable.

a) This research is funded by in part the Scottish Executive Environment and Rural Affairs Department (SEERAD) and in part by the European Commission under the CIVICS project http://www.macaulay.ac.uk/serp/research/Civics.html.

Saturday 21 September, 09.00

Progress towards a science of organisms – GM animals.

Dr. Bruce Whitelaw

Department of Gene Expression and Development, Roslin Institute, Roslin BioCentre, Midlothian, EH25 9PS, UK

There is a need to increase knowledge of biological events. It follows that we need to investigate gene function, since without genes organisms would not exist. When investigating gene function, the scientist asks two simple questions; what can the gene do and what does the gene do. Both can be informative. The first is a reductionist's approach but it is also often the focus of technological applications. The second gives real knowledge of biological events: I maintain that investigation of gene function requires animals, including genetically modified (GM) animals – in most cases the mouse. I will describe the powerful research tools currently available to the geneticist with which to investigate activity of a gene either in a cell or tissue where it is not usually produced or at a different time from when it is usually produced. Alternatively genetic modification allows removal (knock-out) of a gene to discover how the animal compensates for this loss. I will give examples of where studies using GM animals has been informative and others with more limited progress. I will discuss how these studies have lead to a growing awareness of how genes can be activated or silenced in a non-Mendelian manner (epigenetic effects) and how one gene is affected by other genes (modifier effects). In turn this re-emphasises why we need to use animals to understand the gene and to understand biology. I will conclude by describing what would be the ideal animal research system.

Saturday 21 September, 10.00

Towards a science of organisms: lessons to learn from organismic approaches

Dr. Johannes Wirz

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A brief history of genetics reveals major transitions. The era of the "genetic programme", which heralded genes as the basic units of life, was followed by the "developmental programme", which recognised the cell as the basic unit. Recent years have brought yet another shift towards the "organismic programme", which acknowledges the living being itself as the basic unit – in developmental biology, as well as with respect to evolutionary processes.

This programme may pave the way for the insight that organisms not only exert and fulfil biological functions, but also create and exhibit essential meaningfulness. This may give rise to a "whole organism biology". It will be shown that this concept requires contextualisation of all observable traits of organisms and their related properties, including for instance the conditions of animal or plant husbandry.

Examples of contextualisation will reveal that whole organism biology is more than a philosophical, aesthetic or artistic discipline and results in unexpected solutions for agronomic problems.

In addition, whole organism biology provides the basis to explore the concepts of integrity and intrinsic value and therefore allows for the development of criteria to evaluate possible infringements by genetic modification.

Breakout Discussions

Thursday 19 September & Friday 20 September, 16.30

Making a Social Contract for Biotechnology

Donald Bruce

Director, Society, Religion and Technology Project, John Knox House, 45 High Street, Edinburgh, EH1 1SR, UK

(Friday 20 September only)

The GM food crisis revealed that profound value questions had been largely ignored by the Government, the industry and the scientific research community. Agricultural biotechnology had lost touch with its public, with disastrous results. Can it find a way back to a position of social accountability, or is the gulf now unbridgeable? This session will examine the notion that biotechnology is a social contract with implicit conditions which must be satisfied for any future technology to find general acceptance, with reference to several practical applications.

Substantial equivalence and ethical equivalence: contrasting approaches

Dr. Sylvie Pouteau

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Ethos INRA

(continuing discussion theme over two afternoons subject to participants' wishes)

The objective of this breakout discussion group is to use the concept of substantial equivalence (SE): 1) to clarify the values implicitly incorporated in genetically modified organisms (GMOs), and 2) to explore the possible introduction of complementary equivalence concepts, i.e. qualitative equivalence (QE) and ethical equivalence (EE), to integrate the wider social demand. Subject to participants' wishes, these two questions will be addressed separately in the two breakout sessions.

SE was introduced to provide a 'dynamic, analytical exercise' in the safety assessment of novel foods derived from modern biotechnology, i.e. GMOs, by means of comparison with traditional food (OECD, 1993).

In the first session, we will clarify the definition and purpose of SE and consider the scientific objections raised by this concept. We will then examine why the controversy about SE is eventually not scientific but cultural. By analysing the normative levels implied by SE, we will question the values that are introduced by GMOs and validated by SE. We will then consider the objections other than scientific, i.e. the other 'legitimate factors' and values at stake in society.

In the second session, we will investigate possible ways to integrate values in the normative approach and evaluation of GMOs. An equivalence scale based on three normative levels, i.e. substance, quality, and values or ethics, (corresponding respectively to SE, QE, and EE) will be presented. Three ethical principles, i.e. sustainability, solidarity, and autonomy or freedom, will be used to introduce an ethical framework for EE. We will also examine how quality and values reveal, further to physico-chemical properties, wider intrinsic properties of organic substance. Finally, equality will be presented as a fourth principle and transverse task for public institutions to guarantee fairness of political decisions based on public deliberation of the cultural values at stake, and not to decide what the common good should be for society.

The intrinsic value of micro-organisms

Dr. Judyth Sassoon

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(continuing discussion theme over two afternoons, but new participants may join the discussion on the second afternoon)

Just over three centuries have passed since the discovery of micro-organisms by the Dutch microscopist Antony van Leeuwenhoek. Until that time, human beings lived in ignorance of the essential roles that these "little animalcules" play in the subsistence of life on our planet and it took a further 150 years for this realisation to emerge, thanks to the penetrating studies of men like Ehrenberg and Pasteur. Nowadays most people are vaguely aware that something would go very wrong if the microbial world were to be suddenly exterminated. Some people even realise that our greenest pastures and tropical forests would quickly turn into barren wastelands if bacteria and fungi were not present to perform their biochemical transformations. It is therefore clear that all living creatures are indebted to microbes for the maintenance of our earthly ecosystem.

But what of their intrinsic value? Are we able to regard micro-organisms (bacteria, fungi, protozoa and viruses) in a way that is independent of their impact on us and on our environment? A biocentric viewpoint bestows an intrinsic value on all living entities and if we define micro-organisms as "living" it would be interesting to see if we can identify their essential natures and define their intrinsic value.

These breakout sessions will touch on a number of fascinating and important microbial topics, from ecological importance to pathogenicity, but there will be a particular emphasis on their genetic manipulation and the surrounding ethical questions. We will explore the utilitarian properties of microbes, many of which effectively laid the foundations of all biotechnology, alongside their intrinsic value as biological entities. It is hoped that this approach will allow us to proceed more deeply into the moral considerations surrounding genetic engineering in general.

Genetic Engineering and Intrinsic Value: The New Zealand Experience

Prof. Alastair S. Gunn and Kelly A. Tudhope

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(schedule to be announced)

New Zealand is in the middle of a debate about genetic engineering prompted by the release of a very comprehensive and consultative report by a Royal Commission in late 2001: the only inquiry of this nature in the world at this time. Although the Report, and subsequent debate (it was for a while a major issue in the July 2002 election) often focus on risks and benefits, there is also much discussion about what the Report refers to as ethical, cultural and spiritual values. These turn out to be mostly intrinsic value. Intrinsic value is recognized in several NZ statutes including the Conservation Act 1987 and the Resource Management Act 1991, in respect of what are called “natural and historic resources”, including “ecosystems and their components”. These statutes also recognize the obligation to respect Maori concerns and rights under the Treaty of Waitangi Act 1940 between Maori and the Crown. A number of submissions to the Royal Commission referred explicitly or implicitly to intrinsic value, including submissions from various religious groups and also Maori, who make up about 15% of the population. The Maori environmental ethic of kaitiakitanga or guardianship, which emphasizes that everyone is responsible for environmental protection and restoration, has also influenced many Pakeha (European) New Zealanders. “Traditional” Maori believe that all land plants and animals (including human beings) have intrinsic value because they are descendants of the god Tane and thus we are all “environmental kin”. Transgenics is seen as polluting or destroying the “mauri” (life-force, roughly) of natural kinds and thus destroying intrinsic value. Several submissions likened transgenics to violation of the incest taboo and the consumption of food and pharmaceutical products that contain human genes to cannibalism. Many more “secular” Maori who do not take the “descendants of Tane” story literally also believe that GE release would ignore or insult Maori concerns. Government policy is to have a moratorium on “field release” of GMOs until November 2003, after which applications will be considered. In effect, this policy sidelines Maori values, and intrinsic values in general. The fact that it is so controversial indicates a rise in ecological consciousness. Thus, the New Zealand debate on GE is a microcosm of global ecological concern.

The Dutch no-unless policy with respect to transgenic animals and how one can have the public participate in ethical discussions about gene technology.

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(schedule to be announced)

The Dutch Committee on Ethics and Transgenic Animals has the function of both advising about particular research projects, and of fostering the public discussion. Can the two go together successfully? What has to be done to involve the public?

The relation between ethics and aesthetics in connection with moral judgements about gene technology

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(schedule to be announced)

Some ethicists say that when the making of transgenic animals has no effect on animal welfare it is no moral problem. When the animal as a result of genetic engineering has an abnormal shape or abnormal functions, but does not suffer from it, it is said to be an aesthetic problem. This raises the question of the relation between aesthetics and ethics in coming to a moral judgement about gene technology – not only in animals but also in plants.

Observation Sessions

Thursday 19 September & Friday 20 September, 16.30

Dr. Margaret Colquhoun

Director, The Life Science Trust, Pedlar's Way, Gifford, E. Lothian, EH41 4JD, Edinburgh, UK

Goethe's Archetypal Plant' – what is it, how does it manifest in the Botanic Gardens and what is its relevance to the integrity and intrinsic value of living organisms?

The group will work outdoors if the weather is fine and in the glasshouses. Observation will be facilitated by charcoal drawing. Drawing materials will be provided.

Christina Henatsch

Plant Breeder, Kultursaat, Trantenrother Hof, Trantenrother Weg 25, D- 58455 Witten, Germany

Plant observation – details awaited.

Lynda Hepburn

Consultant Ecologist, 7 Shandon Street, Edinburgh, EH11 1QH, UK

These observation sessions will look at two trees, the Scots pine and the silver birch (one per day). Exercises indoors on twigs will help to sharpen powers of observation and to distinguish what is seen with the senses from what is apprehended or 'seen' with the imagination, or what is in fact associations or prior knowledge. We will then look at whole trees outside, including different ages of trees (in order to become aware of the life history aspect of a tree). Using one of the areas in the Garden where both species grow together in fairly natural surroundings, the aim will be to reach an appreciation of the distinct qualities of these contrasting species and address questions as to what is intrinsic to each, how do they complement one another, what kind of environment do they create together?

Craig Holdrege

Director, The Nature Institute, 169 Route 21C, Ghent, New York, 12075, USA

We will observe the skeletal morphology of different mammal species. The aim is to begin to discover how each part conforms with and expresses the animal as a whole. In this way we approach the integrity and inner coherence of the animal.

Richard Swann

Editor ‘Star & Furrow’ (journal of biodynamic agriculture), Orchard Leigh Camphill Community, Bath Road, Eastington, Stonehouse, Gloucestershire, GL10 3AY, UK

Observation group over two sessions, introducing participants to some fundamental principles of the Goethean approach to observing the natural world. This will be done using plant specimens at hand in the botanical gardens. The sessions will likely involve some simple drawing activity (materials will be provided).

Dr. Francoise Wemelsfelder, Scottish Agriculture College, Edinburgh

Animal Biology Division, Scottish Agriculture College, Bush Estate, Penicuik, Midlothian, EH26 0PH, UK

Seeing animals whole: In this seminar video material of farm animals (mostly pigs) will provide the basis for an exercise in ‘whole animal’ observation. We will place these observations in the context of animal welfare, and the ability of animals to suffer under intensive farming conditions. Traditionally science regards animal emotions as internal mental states that cannot be directly observed. However from a ‘whole animal’ perspective, an animal’s experience is an integral part of its behaviour and becomes accessible for observation as an expressive ‘body language’. The question is: can people agree on how they interpret animal expressions, and what is it they see? We will look at this together while watching video clips of farm animals in various situations. As an animal welfare scientist I have in recent years developed a formal methodology for assessing animal expressions. If time permits, I will discuss some of this work. This may lead to a wider discussion of the relevance of ‘whole animal’ observation for recognizing the intrinsic value of animals.

Dr. Johannes Wirz

Geneticist, Naturwissenschaftliche Sektion am Goetheanum, CH-4143 Dornach, Switzerland

From the part to the whole (a two-hour exercise): During the observation session, participants will group bones from different animals. In a next step, we will try to figure out to what part of the animal they belong to and to determine concisely their positions in the animal's body. After successful arrangement we will hypothesise, what the animals look like, how they move and what kind of behaviour we would attribute to them.

We will discuss what these experiences can teach us about the integrity of animals and the coherence of the correlation between "Gestalt" and activity. Finally, we will explore possible implications of our findings with respect to genetic modification of animals.