

**The Animal Defenders**  
**The National Anti-Vivisection Society**  
**Joint Response to**  
**Consultation on Animal Welfare Bill**  
**for the**  
**Department of the Environment, Food, and Rural Affairs (DEFRA)**

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**Proposal to consolidate and modernise the following legislation:-**

Protection of Animals Act 1911  
Performing Animals (Regulation) Act 1925  
Pet Animals Act 1951  
Cockfighting Act 1952  
Abandonment of Animals Act 1960  
Animal Boarding Establishments Act 1963  
Riding Establishments Acts 1964 and 1970  
Breeding of Dogs Acts 1973 and 1991  
Protection Against Cruel Tethering Act 1988  
Breeding and Sale of Dogs (Welfare) Act 1999

**Issues Raised in the Consultation Document**

**Animals in circuses**

*Should there be a licensing system for circus winter quarters? What provision should be made for animals performing in circuses?*

**The Animal Defenders** conducted a study of the use of animals in circuses involving academic research, and observations, during 1996 to 1998.

Observations and recordings were taken by our Field Officers working in 13 UK travelling circuses and performing animal training/holding centres (winter quarters), and 5 foreign circuses displaying UK animals. This amounted to 7,000 hours of observations, backed up by 800 hours of videotape.

We studied daily routines, husbandry, animal health, accommodation, exercise, training, psychological and physical effects, circus animal supply, and international regulations.

We found circus animals to be confined in very small spaces, chained, tethered, and restricted in every aspect of their lives. These severe restrictions on movement and ability to perform normal behavioural repertoire appeared in permanent training/holding centres, as well as on the road.

## **Winter Quarters:**

Animals can be literally warehoused in circus winter quarters (performing animal training and keeping centres) over the winter, remaining in the cages in which they travelled in the summer. Some animals are additionally sent out for advertising, films and television, for public appearances, or for circus work abroad, or stabled in a zoo.

Thus, a circus winter facility is as much a fully operating business as the travelling collection of tents and wagons that is normally defined as a circus. It is this definition of what is, and what is not, a circus which has further reduced protection for performing animals. Local authorities cannot inspect and licence a circus permanent holding centre/winter quarters as they can other collections of animals.**XXXXGET WORDING OF JUDGEMENTXXXX**

Animals in these facilities were found to be stored in their cages for excessive periods of time.

We found that Lions, tigers, and other cats remained in their cages from between 72% and 99% of the time. A hippo and two tapirs were kept in a dark barn throughout a six month period. Hyenas, black bears, and others remained in their cages; there were no facilities to allow them to leave their cages for exercise. Chimpanzees had minimal exercise areas, and were sometimes kept in altogether because of the cold. A giraffe remained in a stall in a barn from October to December 1997. Elephants were kept in a barn in small pens with a concrete floor, which they did not leave for months. In addition, they were chained inside their stalls for 67% of the time.**XXXXXXGT TABLE**

There are no regulations which satisfactorily cover the protection of animals in circus winter quarters. The Dangerous Wild Animals Act 1976 contains no standards of welfare or environmental enrichment, and furthermore, the people conducting checks are often unqualified for the task.

Although there are specific regulations on the welfare and environment of exotic animals in zoos, combined with a formal inspection and licensing system, animals of the same species kept in a circus have fallen through the net of legal protection.

To all intents and purposes, except for opening to the public, performing animal training and holding centres are a private zoo. The needs of the animals are the same and there is no justification for downgrading protection for a lion in a performing environment as compared to a lion in a zoo.

The Animal Defenders recommend that the 1981 Zoo Licensing Act is amended to include animals kept in performing animal training and holding centres. Such a move would also reflect the reality that circuses and zoos trade their animals, and circus animals are frequently rented out to zoos.

## **Animals Performing in Circuses:**

The Animal Defenders' study of the use of animals in travelling circuses concluded that with the best will in the world and given the circumstances, circuses do not have the facilities, the trained staff, or the money to adequately care for their animals.

The practical realities of living permanent on the back of a lorry, taking whatever space is available as the circus moves from town to town, makes it impossible to give these animals anything close to acceptable in terms of welfare and environment.

We found that severe confinement is not limited to any particular species, it was across the board –

- horses and ponies spent up to 96% (23 hours) of their day, tightly tethered, limiting movement;
- the large cats spent between 75%-99% of their time in small cages, on the backs of lorries.
- elephants spent between 70-98% of their time chained to the ground.

Unbearably long hours were spent with animals shut inside transporters, for example a pony spent 23 hours in a transporter, and a bear 39 hours, for just a 5-hour journey.

Often, the reason for this is the packing and moving routine. The animals are packed up Sunday afternoon after their performance. They remain shut in the transporter whilst the circus moves off. On arrival at the new venue, they will not be unloaded until the tenting and other facilities are erected. Thus, the staff drive to the new venue, leave the animals in their lorries, and go out and socialise, or have meals, and go to bed with the animals still in their transporters. The staff then may get up late the morning (or even afternoon).

On other occasions, it was not that the staff got up late, but that they spent a long time putting the tents and enclosures up, before moving the animals out of their lorries. With the horses and ponies, this sometimes led to fights because of the intolerable cramped conditions.

Such severe confinement means that these animals are unable to express their normal behaviour patterns, and so they become disturbed, and start to exhibit abnormal behaviours including repetitive swaying, bobbing, and pointless movements.

Physical abuse is part of daily life for circus animals. Whether it is a kick, a punch, a whipping, a club, or a full-blown beating, violence is endemic. When the abuse is not physical, it is verbal, and just as intimidating – the animals cower, and can urinate in fear. A full-grown tigress was observed urinating in fear when shouted at by her trainer.

Much of this abuse was caused by the pressure to be on time for the performance – getting animals in and out of the ring quickly; pressure to get feeding over, etc. Much of it was also ignorance on the part of the workers; often, an animal is hit or punished when a worker misunderstands its behaviour or expression.

Circus workers are not animal experts (pay was approximately £10 per day), and they did not understand the animals they were required to care for. There was an extensive level of ignorance about normal behaviours on the part of the trainers as well.

Circuses do not contribute to conservation, ex-circus animals are not suitable for conservation projects. Neither do circuses teach anything about other species, how they live in their environment, or their forms of communication. In fact, making animals perform in a circus teaches children the opposite of what they need to know about other species.

Our study also identified public hygiene and safety issues associated with travelling circuses. We observed examples of animal waste being spread over neighbouring fields and disguised under straw and grass; we observed many escapes of sometimes dangerous animals; sometimes highly-stressed and disturbed animals had to be kept a distance from the public. The presence of the circuses also caused traffic and noise nuisance to local residents.

## **Pet fairs**

*Should there be greater regulatory control over public and private pet fairs?*

The same animal welfare considerations apply for pet fairs as for pet shops, pet superstores, animal markets, and other sales outlets for living animals.

There should be the strictest possible regulatory control over all venues selling living animals.

Proper checks must be made by sellers of live animals that the purchaser is a suitable person, and can provide suitable facilities. See our remarks below, in regard to pet shops.

## **Pet shops**

*Should the minimum age at which children can buy pets be raised?*

Children should not be allowed to purchase pets, unless in the company of an adult. The minimum age for purchasing a living animal should be 18.

The seller should question the suitability of the person and the facilities they can offer the animal.

When people start to drive, their suitability is assessed; when they become of age to purchase alcohol or lottery tickets, the vendor is obliged to check their age.

Ownership of an animal carries just as much, if not more responsibility than some of these areas. The new owner is responsible for a life. Just as much care must go into assessing suitability for animal ownership as in these other areas.

Many responsible sanctuaries inspect homes prior to re-homing an animal. When someone purchases an animal, a home check could be organised, with the assistance of local welfare volunteers.

## **The welfare of captive pheasants that are being bred for sport shooting**

*Does the existing law provide adequate protection?*

The Animal Defenders support the position and the campaign of Animal Aid in this respect. We understand that Animal Aid is supplying detailed evidence. The study by Animal Aid has found that—

Every year in Britain some 35 million pheasants are reared inside sheds, further conditioned in outdoor pens, before being released to be shot down for pleasure. In fact, about half of those released die from exposure, starvation, disease, predation, or under the wheels of motor vehicles.

Of the roughly 16 million birds who are actually gunned down, only about 8 million are eaten. Millions are left to rot where they fall or they are buried in specially dug holes.

Annually thousands of tonnes of leadshot are dumped.

Around five million wild birds and mammals are killed with snares, poison and body-crushing traps in predator control programmes. Gamekeepers deliberately target foxes, stoats and weasels, because they are attracted to the unnaturally large number of 'tame'

pheasants. But species ranging from badgers to cats – even protected birds of prey like owls and kestrels – are caught and killed.

Even before they become target practice, the shed-reared birds suffer serious privations. In an attempt to eliminate aggression caused by the crowded conditions in the rearing sheds, pens and enclosures, the birds are subjected to painful restraints and mutilations, including:-

- beaks being partially amputated with a red-hot blade;
- blinker-like ‘spectacles’ fixed in place - sometimes by pins driven through the nasal septum;
- the fitting of plastic or metal ‘bits’ to prevent closure of the beak;
- the tying of one wing to prevent escape.

Despite the industrialised scale of pheasant production, the law recognises the practice not as ‘agricultural’ (the equivalent of broiler production) but as primarily ‘sporting’.

This means that the birds lack the basic protection afforded by legislation such as the 1968 Agriculture (Miscellaneous Provisions) Act, and the various Orders governing transport and handling made under the Animal Health Act. Nor do the relevant Welfare Codes apply.

One conspicuous consequence of this anomalous situation is the following: It is illegal to use ‘specs’ (the anti-aggression) on shed-reared poultry where the specs are attached, as described above, by driving a pin through the nasal septum. But such cruel devices can be used legally on pheasants because, as indicated, their rearing is ‘primarily sporting’ rather than agricultural.

In fact, pheasants are left unprotected – except for an inconsistently applied voluntary industry code – from the hatchery stage, through transportation to the rearing sheds, on to the release enclosures, and beyond to the cover crops.

Even after the birds are set loose, a few weeks before the start of the shooting season on October 1, they are encouraged, by the deployment of feed bins and purpose-sown cover crops, to remain within the vicinity of the rearing pens, and thus within range of the guns. They remain, therefore, as much ‘units of production’ as genuinely wild bird. In many parts of the country, pheasants are so thick on the ground, large numbers are routinely crushed under the wheels of vehicles.

The shoot itself is replete with major welfare problems. Because of the nature of the spread-shot cartridge, birds are rarely cleanly killed. Many are brought down away from the guns and die a slow and painful death.

What makes matters worse, as indicated above, is that only about one quarter of these intensively reared birds are actually eaten.

**The Animal Defenders supports Animal Aid’s call for the ‘game’ bird industry to be properly regulated under statute with regard to the welfare of the birds it rears and shoots.**

Such regulation must start at the hatchery stage and govern transportation to, and treatment of the birds within, the breeding sheds, rearing pens and release enclosures.

The regulations must cover the use of restraining devices and mutilations, such as beak trimming. It must also extend to the administration of drugs and other veterinary interventions.

The birds, who are often still being fed from hoppers, must continue to receive protection after release, because the evidence demonstrates that the industry's own shooting code, which is intended to minimise suffering, is routinely and callously flouted.

Proper protection must also extend to the millions of so-called 'vermin' species destroyed each year with traps, poison and snares.

### **Keeping exotic or dangerous animals as pets**

*In recent years there has been an increase in the number of exotic or dangerous animals kept as pets. Sometimes their owners do not understand the type of care that these animals need or that they have the potential to inflict serious injury or cause illness. Should there be greater controls over the buying and selling of exotic or dangerous animals?*

The Animal Defenders believe that individual members of the public should not be allowed to keep exotic animals.

The provisions of the Dangerous Wild Animals Act 1976 should only apply to properly regulated and registered collections.

The DWAA itself is a poor piece of legislation, but collections of such animals could also be drawn under similar provisions as the Zoo Licensing Act 1981.

**The Animal Defenders is supporting the call from The Monkey Sanctuary Trust, that it should now be illegal to keep an exotic or wild animal as a pet in Great Britain.**

### **Tail Docking**

*Should the docking of tails be banned?*

Yes, the docking of dogs' tails should be banned. **The Animal Defenders support the position and the campaign of the Anti-Docking Alliance for a ban on the docking of dogs' tails.**

We understand that the Alliance is sending in separately veterinary opinion.

### **Addition: Lay People Removing Dogs' Dew Claws**

In addition to a ban on the docking of dogs' tails, we support the call of the Anti-Docking Alliance, that lay people should be banned from removing dogs' dew claws. This procedure should only be carried out by a veterinary surgeon, and currently we understand, the legislation does not provide for this.

### **The Protection of Animals Acts**

Animal protection needs to be taken more seriously, and the law more pro-actively enforced. Each police force should have specific animal welfare officers; local authorities should have a duty to investigate and prosecute.

A more serious approach to animal welfare is sure to bring benefits to society generally, in that police and local authority involvement adds weight to teaching young that abuse and cruelty is wrong, whatever the species.

## **The creation of a new offence of 'likely to cause unnecessary suffering'**

*Does the requirement in the 1911 Act to show that an animal has suffered before an offence is committed meet present day needs?*

The current offences do not meet the need. In order to truly protect animals, the law has to allow for an offence of 'likely to cause unnecessary suffering', so that cases where the situation for the individual animals is deteriorating can be dealt with before serious harm is caused.

It should certainly not be necessary to show that an animal has already suffered serious harm before action can be taken.

In attempts to protect child abuse, children can be put on the 'at risk' register. Similarly, the existence of an offence of 'likely to cause' will put out the signal that animal abuse and neglect is taken seriously and will not be tolerated.

A conviction for 'likely to cause' could be considered as a first/second strike towards a prison sentence for subsequent offences.

## **Increasing the powers available to the police when investigating allegations**

*Should the powers of entry, search and seizure in the 1911 Act be extended or changed?*

Only the police should have powers of entry, search and seizure.

These powers should be extended for the police, in that where there is a case of cruelty, other animals on the premises (not necessarily involved in the specific cruelty charge) may be removed, for their own protection.

This is especially important in commercial premises, where the illogical situation exists that someone convicted of cruelty to one animal may continue to have control over other animals before and during a trial, and after conviction.

In the Animal Defenders case against Mary Chipperfield Cawley, Roger Cawley, and Stephen Gills, there appeared to be no legal means to protect other animals on the premises, despite that evidence of systematic abuse (a culture of abuse) was on tape.

## **Powers of arrest**

*Should the power of arrest in the 1911 Act be extended to include a person who, without reasonable excuse, is present when animals are placed together for the purpose of fighting each other?*

Yes, certainly, those present during any act of deliberate cruelty should be liable to arrest.

## **Increased sentences**

*Are the maximum sentences provided for in the 1911 Act adequate?*

Too often, fines are given for instances of cruelty when imprisonment, or perhaps community service combined with an obligation to attend classes about the needs of other people and other species, would be more appropriate.

The 'Standard Scale of fines as outlined in the 2001 edition of Stone's Justice Manual (and detailed in the 1982 Criminal Justice Act) is completely inadequate both as a deterrent, and as a message that abuse and cruelty will not be tolerated. Current level of fine are:-

Level on the scale:	Amount of fine:
Level 1	£200
Level 2	£500
Level 3	£1000
Level 4	£2,500
Level 5	£5,000

In the case of individuals, these levels should each be raised by 100%, or at the very minimum, brought into line with current-day earning levels.

More importantly, a new scale of fines is essential for companies and directors of companies or owners of businesses who, ultimately, must be made to take responsibility for the welfare of animals in their care.

In the case that the Animal Defenders initiated against The Chipperfield Organisation, Mary Chipperfield Promotions Limited, Mary Chipperfield Cawley, Roger Cawley, and their elephant keeper Michael Steve Gills, the law in relation to the responsibility of the directors of the company for the welfare of their animals was extremely weak.

Persistent cruelty, repeated offences and deliberate neglect of responsibilities to animals should all carry automatic prison sentences.

All convictions for deliberate acts of cruelty or neglect should carry an automatic life ban on the keeping of animals.

### **Increasing the time allowed for proceedings to be brought before a court**

*Should the time allowed in the 1911 Act for proceedings to be brought before a court be increased from six months to two years?*

Yes, this is an essential feature of any modern anti-cruelty legislation.

### **Providing the Secretary of State with the power to make Codes of Recommendation to promote animal welfare**

*Should the Secretary of State be empowered to make Codes of Recommendation to cover issues such as the tethering of horses or the care of exotic animals?*

Yes, the Secretary of State should certainly be empowered to make Codes of Recommendation, but these should be Codes of Practice, not just recommendation, and they need to be rigorously enforced.

Such Codes could be attached to the legislation so that a serious breach of a Code can be prosecuted as an offence.

### **Animal sanctuaries**

*Should animal sanctuaries be licensed?*

Yes, it is essential for animal sanctuaries to be licensed, but this should form part of a set of across-the-board standards of welfare, facilities and environment for animals in zoos, performing animal establishments, amusement parks, wildlife parks, boarding establishments, and sanctuaries.

The objective would be to set minimum standards which should apply to all species; any business or organisation that could not maintain these standards should not be allowed to keep animals.

Sanctuaries could be assisted with the finances to improve their facilities by local authorities – with fundraising schemes, and payment for taking stray animals.

### **Livery Stables/Yards**

*Should Livery stables/yards be licensed?*

Yes, these should be licensed and standards applied in the same way as above.

### **Licensing of Farms**

The Animal Defenders are in support of the call by Animal Aid, that farms keeping animals should also be licensed, and standards set.

### **Using electronic prods for training**

*Should electronic prods be banned?*

Yes, these should be banned immediately.

### **The mis-use of bio-technology in animal breeding**

*Science now makes it possible to produce genetically modified animals This may be necessary for scientific research or medical purposes. However, should it be an offence for breeders to produce an animal which will not be used for scientific research or medical purposes that is likely to be genetically defective in some way?*

Response from the National Anti-Vivisection Society:

Yes. DRAFT GM PAPER.....

### **GM animals**

The suffering involved in the production of GM animals is horrifying and, unfortunately, the scientific community has a tendency to present these animals to the public and media as if they suffer less than other animals.

Experience of our own studies into working practices in several UK laboratories, in animal breeding and supply companies, and academic research through available literature, has led us to the conclusion that the smaller in physical size of the animal, the less consideration given to its environment.

Prolonged distress and suffering is caused to genetically modified animals animals by the whole process of genetic engineering, including –

**The process of genetic modification** (females suffer surgery, egg collection & implantation, and repeated blood and tissue sampling for the offspring). Transgenic animals can suffer:

- longer pregnancies;
- higher birth weights (even offspring unable to stand by themselves);
- increased deaths at birth;
- foreign gene can cause mutations, resulting in premature death;
- severe health problems

**Consequences of products made by genes** (causing ill-effects in the animal):

caused by the action of the gene product, and the amount of it circulating in the blood, harming the animal. Also when the gene product appears in the wrong part of the body.

**Effects of the modification:**

The animals can suffer because of side-effects of the foreign proteins (the foreign product made by the gene) circulating in their bodies. Or, they can suffer the results of the modification (such as a disease caused by the modification). Such animals are born to suffer forms of cancer, cystic fibrosis, Alzheimer's, Huntington's, and other diseases (despite the fact that these diseases are not the same as the human version of the disease).

The NAVS considers that the harm suffered by transgenic animals can never outweigh any purported benefits. The majority of transgenic animals are used as models for human disease yet, so far, none of these 'models' has accurately or adequately replicated the condition seen in humans.

Thus, 'cures' are being tested on unreliable models, in a different species, compounding the variables to be managed. This is not good science.

**Wastage of life:**

- transgenic animals without the desired gene are killed, in vast numbers (only 1-10% of the offspring will incorporate the desired gene);
- producing transgenic animals involves multiple surgical procedures for females

**Environmental deprivation:**

these animals live in barren, sterile environments, in confined spaces, lacking in normal enrichment to provide stimulation.

- animals used for xenotransplantation are worse off, because they must be as disease-free as possible. So no bedding, or foraging, for these pigs, cattle, or sheep.

For example in order to obtain 'disease-free' piglets for organs for transplants, the animals are delivered by caesarian section, placed in isolators, and then reared in sterile environment; the offspring are also subjected to repeated procedures, blood and tissue is taken.

The same considerations apply for 'pharming' (pharmaceutical production, or proteins to make pharmaceuticals).

These animals, whose bodies are being used as 'bioreactors' or factories to make products, must be kept in sterile environments if the products they are producing are to be used in humans.

Again, these are mostly farm animals – sheep, pigs, cows, although more recently rabbit

'pharming' has been announced.

**Suffering caused by increased desensitisation of laboratory personnel:**

Overloading systems and building capacities will see more animal suffering through inhumane killing. Quantities being killed due to being surplus stock make truly humane procedures impossible; staff will either leave the industry, or become less sensitive to what they are doing.

NAVS undercover Field Officers have filmed laboratory personnel behaving inappropriately towards laboratory animals, apparently desensitised by the level of killing.

In 1999, the chairman of the Institute of Animal Technicians announced that counselling could be arranged for technicians emotionally disturbed by their role in this killing.

**The products that it is hoped can be produced from genetically modified animals:**

*Bioreactors to make products:* transgenic animals that are used as bioreactors for pharmaceutical proteins (producing medical products, in their milk, eggs, urine, blood, or semen) are being used for convenience, when there are other, non-animal methods of production available. These animals can suffer severe illness when the protein is produced in the wrong part of the body.

*Agriculture:* animals are given genetically engineered hormone products to make them produce more, or are genetically modified themselves, in order to grow faster, produce more and leaner meat, more eggs, growth hormone to produce more milk, or, more and better wool. Sometimes the aim is to try to improve their resistance to disease, like GM crops.

**Other areas of use for genetically modified animals:**

*Fundamental research:* to obtain knowledge, projects with no particular application.

*Safety-testing and other procedures,* similar to those carried out on non-GM animals, despite the fact that there are now many superior non-animal methods already available.

*Cloning experiments,* refining and developing techniques to clone organisms, to produce a flock of clones with the same genetic defect (or perhaps, although presently illegal in the UK, with the hope that ultimately, human beings can be successfully cloned). A flock of cloned sheep, for example, could be used as living factories to produce a pharmaceutical product in their milk.

**Gene therapy:**

The mapping of the human genome is unlikely to bring with it the great promises of curing all with gene therapy, provision of an understanding of disease and the development of drugs to suit the individual. Gene therapy for curing diseases with a single defective gene has a disastrous track record. Worldwide, there have been no cures, a number of deaths and at least 1000 reported serious side effects.

**Growing spare body parts for humans:**

Genetically modified animals are used to grow spare body parts for people to be used in transplants (xenotransplants).

It is important to realise that the animals are not growing a human organ. The organ simply has a human gene added. If an animal's organ is transplanted into a human, the person's immune system mounts an attack to repel the invader. These animals are given

the gene to 'trick' the human immune system into not attacking the animal's organ once it is transplanted into a person. This does not make the organ human.

All the body products generated by the cells remain non-human, and will migrate around the patient's body. The animal's organ is still designed for an animal's body, and is programmed for the lifespan of that animal, not a human lifespan.

A pig's heart and lungs were designed for a different size, horizontal animal; a pig's heart would need to be modified to pump the right volume of blood, at the right pressure. It has even been suggested that animals go through treadmill training in an attempt to ameliorate this fault.

There are fundamental physiological and metabolic differences between, say, organs of a pig and those of a human. Some researchers believe that an animal's organs, particularly liver and kidney, are metabolically incompatible with humans.

The species differences remain – the liver of a pig lacks an enzyme that regulates various functions, including the body's immune response – a pig's liver will not suddenly start producing this enzyme after it is transplanted into a human. It is unknown whether the animal's cells, once migrating around the body, will be attacked by the immune system, or cause health problems.

Transplant patients will still have to take drugs to suppress their immune-system; such drugs leave them exposed to other diseases, and can also cause cancer.

Furthermore, the risks to the human population need to be considered.

Because animal organs contain unknown animal viruses, these will be passed to the patient. A virus that is forced across the species barrier in this way can mutate, and cause a new disease, releasing an epidemic on the human population. A current idea is that patients can be asked to restrict their social contacts, and especially sexual contacts. This is not a viable plan. Human acquired immunodeficiency virus, (the AIDS virus) is an example of disease created by cross-species mutation; whilst nvCJD/BSE (caused by a prion, a rogue protein) is an example of cross-species infection.

### **Alternatives to the use of GM Animals**

In much the same way as non-GM research, methods which are based around human tissues and human data are preferable to using data gained from a different species, even if it is a genetically modified strain of animals.

Alternatives to the use of genetically modified animals in genetics research, which are already in use, include:-

#### **Population studies/genetic and biochemical data from humans/coronary artery disease:**

to evaluate the genetic disposition and dietary influence on the development of coronary artery disease. This involved analysing DNA and blood samples.

**Cell/tissue culture/lung disease:** genes can be transferred via viral vectors and the affect on cell biochemistry investigated. This method has been used to investigate gene therapy for an inflammatory lung disease.

**Human vascular tissue/diabetes/atherosclerosis:** studies have identified the mechanism behind the over-expression of a particular gene which makes diabetics susceptible to

atherosclerosis. Researchers were unable to identify this mechanism in genetically modified diabetic mice.

**Human tissue/arthritis:** studies on human tissue surrounding joints has shown that gene therapy activated by a lack of oxygen (hypoxia) could be delivered to rheumatoid arthritis patients.

***In vitro* expression system/anti-inflammatory treatment:** a human liver (hepatoma) cell line was treated with specific gene promoters. This allowed gene promoters to be investigated as a method of controlling inflammatory diseases by gene therapy.

**Cell culture from human blood/human tissue culture. A commercially available *in vitro* test kit/cancer gene therapy:** the commercially available 'Angiogenesis model' mimics the growth of blood vessels to supply blood to tumours. Using this model anti-cancer genes can be studied on human cells in hypoxic conditions, ie oxygen deprived conditions such as those found in cancer tumours.