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COGEM REPORT
CGM/141219-01

GMOS ON DISPLAY:
THE USE OF GENETICALLY MODIFIED ORGANISMS IN EXHIBITIONS

INDEPENDENT SCIENTIFIC ADVICE AND INFORMATION FOR THE DUTCH GOVERNMENT

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COGEM
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COGEM provides scientific advice to the government on the risks to human health and the environment of the production and use of GMO's and informs the government of ethical and societal issues linked to genetic modification. (Environmental Management Act §2.3).

SUMMARY

The Netherlands Commission on Genetic Modification (COGEM) was asked by the Ministry of Infrastructure and the Environment (IenM) to prepare a report on the societal or public interest aspects of exhibitions involving the use of GMOs. The Ministry of Economic Affairs (EZ) also asked the Raad voor Dieraangelegenheden (Animal Welfare Council, RDA) for advice in order to develop an approach for this topic.

The reason for this study was a permit application for an exhibition involving zebra fish embryos which would be injected with genetically-modified (GM) cyanobacteria (blue-green algae). In dealing with this request it became clear that the present assessment framework has no provision for exhibitions. There is a trend in art in which biological (living) materials are used, treated and exhibited. Government, risk assessors, artists and the general public hold differing views about the desirability and admissibility of such activities. The differences make it clear that there is a clash between the technological possibilities and how public opinion is formed. Advances in understanding and technological progress mean that, under certain conditions, genetically-modified organisms (GMOs) can be worked with safely. This has made the technology accessible to a wider group, such as artists and educational institutions. The use of GMOs for purposes other than scientific research however, could create a sense of unease in society. This friction is made all the more acute by artists mounting exhibitions in which "safe GMOs" are used. Such exhibitions encounter objections (based on considerations other than safety) from some people. These objections, however, have no formal validity in the decision-making process concerning permit applications.

BioArt typified by diversity

BioArt is typically diverse and may be practised with numerous different intents. It is difficult to ascribe just one objective to BioArt and different people may also attribute different functions and effects to individual projects. A bio-artist may have a particular goal in mind for his or her work, for example, but visitors may perceive this quite differently. Artists, exhibitors, government, financiers, scientists and the general public may all have different opinions.
BioArt can have a function of its own, but may also serve as an object of reflection (e.g. on the legitimacy and goals of science), for education (learning, inspiring and thinking about biotechnology), as a strategy (freedom of expression, creating acceptance or resistance), as inspiration (public debate, scientific innovation) or a challenge (working with new materials, fascination with new technological advances).

Public response to BioArt

Given the public debate on genetic modification, its use in exhibitions also raises questions about desirability and admissibility of such. The use of GMOs in exhibitions may be seen as a contribution to the public debate which could be both positive and negative. The combination of art and genetic modification could, on the one hand, help to broaden the public's view of biotechnology by enabling a wide range of visitors to learn more about its possibilities and applications and see how these impact on society in an accessible or even playful manner. Conversely, art can seek to shock, overstep boundaries and challenge taboos. The response of the general public to BioArt exhibitions with living genetically-modified organisms has been mixed, ranging from curiosity and interest, to objections to the use of genetic modification in organisms. The use of higher order organisms and genetic modification without a primarily scientific goal would appear to heighten the discussion. COGEM also notes that exhibitions often attract a particular target audience. In this context it should be noted that where reference is made to the public response to BioArt, in most cases this will refer to the reactions of a select group. Therefore caution is advised when extrapolating the conclusions to the general public as a whole.

No distinction between BioArt and educational exhibitions

The State Secretary of Infrastructure and the Environment asked COGEM whether a distinction could be made between exhibitions which are purely intended as an art expression or those with an educational purpose. COGEM's conclusion is that this is not possible. There is no clear boundary to be drawn between art exhibitions and educational exhibitions. It may be possible to make such a distinction on paper, but in practice this would not offer a solution to the objections which have been raised. If educational exhibitions were to be treated differently than BioArt, some artists would simply state that their exhibition serves an educational purpose. A clear distinction between education and art cannot be made.

Most uses of GMOs in exhibitions covered by existing regulatory framework

There are various legislative frameworks that apply to activities involving animals and GMOs or combinations of these. All activities, including BioArt, where genetic modification is used are subject to a permit requirement. The legislation on GMOs applies to all organisms in which genetic material has been altered in a way which would not be possible in nature through reproduction or natural recombination. This means that the GMO legislation applies to microorganisms (fungi, viruses, bacteria, parasites), plants and animals (vertebrates and invertebrates). Genetic modification in humans is prohibited.
A permit is also required under the Animals Act (WD) for physical interventions, including genetic modification, in both vertebrates and invertebrates. With the exception of

biomedical applications, such activities are subject to a mandatory ethical assessment. A permit will be issued if the activities do not have any unacceptable consequences in terms of the health and welfare of animals, and where there are no ethical objections to the activities.

Animal testing is also subject to a permit requirement. The Experiments on Animals Act (WOD) applies to all living vertebrate species. This legislation also applies to certain specific invertebrate species, such as octopodes (Cephalopoda). The reason why some animals are covered by the WOD and others are not, is that activities which fall under the heading of 'animal testing' could cause distress. It is assumed that animal testing could cause distress in these groups of animals. Distress refers to: causing pain, suffering, discomfort or lasting injury. The presence of a central nervous system plays a crucial role in this distinction, which is why many invertebrates are not covered by this legislation. The WOD does not apply to exhibitions, however, because there will almost never be any animal testing as defined in the legislation.

The use of animals in exhibitions, including GM animals or combinations of GMOs with animals is subject to Section 2.16 of the Animals Act (WD), Exhibition of animals. This lays down that no animals may be exhibited in which a prohibited intervention has been carried out, in accordance with Section 2.8. This includes interventions for which there is no veterinary necessity. The minister can make exceptions by government decree (AMvB) for exhibitions with animals in general and for interventions under Section 2.8 of the Act. The rules on showing animals, however, do not apply to embryos. These are considered by the legislature to be animal products.

Niche applications of BioArt considered to be problematic

COGEM notes that most applications of GMOs and organisms in exhibitions are covered by the existing regulatory framework. COGEM observes that certain niche applications of BioArt, specifically combinations of GMOs with embryos, however, are covered only by the GMO legislation. From a judicial point of view this can only look at the environmental risks, because ethical considerations do not form part of the decision-making process on whether or not a permit will be granted such uses. Objections or a general sense of public unease could arise in society, which would appear to be the case given the background to this advisory report. These uses have become a matter of debate due to the specific combination of **GMO + animal (embryo) + exhibition**, because:

- GMOs are controversial in society;
- certain animal species or stages of development are not deemed by law to be an experimental animal, but still instinctively viewed by some in society as warranting protection.
- opinions about relevance ('value') of exhibitions differ widely, as opposed to scientific purposes in which the relevance to society is less controversial.

The State Secretary asked COGEM to make a distinction between exhibitions with GMOs in general and exhibitions of various groups of GMOs, such as bacteria, plants, animals or animal embryos, including fish embryos. Exhibitions with GM bacteria would be unlikely to raise objections in society. Projects with GM plants would also be unlikely to generate much discussion. The involvement of animals or embryos in BioArt will encounter objections, regardless of whether or not there has been genetic modification of the animal in question. An example of this is the zebra fish embryos used in the Errorarium exhibit of the BioSolarCells project. These were not genetically modified but were nevertheless met with caution on the part of the legislature. There is also a distinct difference between animals and embryos warranting legal protection and society's perception of such. Some people in society see some animals or stages of development which the law does not consider as warranting protection, as in need of such, particularly in combination with biotechnological activities like genetic modification.

Statutory solutions have a knock-on effect on science

If statutory solutions were to be sought for assessing the foregoing niche applications in BioArt on grounds other than purely safety, these will always be generic. Such solutions will, therefore, almost always have a knock-on effect on scientific or economic applications. For what purpose genetic modification may be used and how animals or embryos should be protected are indeed important public concerns.
Policy is arrived at not just on the basis of statutory frameworks, but also through guidelines, recommendations, codes of conduct, or covenants and agreements. It may be possible to find a solution in the codes of conduct which apply in the professional museum field. The self-regulating mechanism for museums could play a part in this. The Dutch translation of the ICOM Code of Ethics for Museums states that this provides a means of *"professional self-regulation in a number of areas in which the museum has its own specific expertise and competence which is not or not sufficiently covered by national legislation"*.

Finally, COGEM would like to point out a number of considerations in relation to exhibitions involving the use of GMOs and animals. COGEM notes, first of all, that exhibitions involving the use of GMOs do not have to be problematic per se. Various positive elements which this form of BioArt brings are also discussed in this report, such as artists' fascination with experimenting with 'new' materials, enabling a wider audience to learn more about biotechnology, and inspiring scientific innovation. A second consideration which COGEM would like to point out is that the questions raised by the public about BioArt exhibitions also concern the matter of who is financing such projects and why. This also affects government if, and insofar as, such exhibitions are mounted with direct or indirect public funding. In this context COGEM wishes to point out that the government needs to be aware of how its own role in the direct or indirect funding of exhibitions could affect its image. COGEM also observes that those aspects

which have been raised in the discussion concerning GMOs, animals and exhibitions, also apply to the use of animals in general for such purposes. The use of animals is a sensitive issue in society on which the general public holds a very wide range of opinions. In this context COGEM notes that there is an ideological element to the various approaches to the protection of animals which does not always correspond with the judicial or statutory protection afforded and that cannot strictly be divided into vertebrates or invertebrates, animals or animal products.

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INTRODUCTION

The use of genetic modification in organisms in exhibitions can evoke various emotions in the general public. The subject has become a matter of public interest since a number of permit applications for art projects involving genetically modified organisms (GMOs) were submitted to the Ministry of Infrastructure and the Environment (IenM) last year. The Ministry observed during the permit authorisation procedure that the GMO legislation does not cover exhibitions. The Commission on Genetic Modification (COGEM) was therefore asked to draw up a report which looks more closely at the background to and public interest aspects involved in exhibitions with GMOs.

The immediate reason for the ministry's request for this report concerned a permit application submitted for an art project which formed part of the BioSolarCells project (see text box: **'Yes, Naturally' Exhibition**).

'YES, NATURALLY' EXHIBITION

The five year BioSolarCellsa research programme is intended to make a contribution towards more sustainable production of food, energy and sustainable (green) raw materials for industry. Among other things, the research is aimed at improving the system by which plants and cyanobacteria capture energy from sunlight. Besides a science and technology approach, the programme also included a section on 'society' in which what society thinks about these new technologies was investigated through various projects. As part of this, artist Adam Zaretsky wanted to present a mini-ecosystem (Errorarium) comprising some GM variations of known model organisms.[1]

Various mutants of the Thale Cress (*Arabidopsis thaliana*) would be grown in the Errorarium. In addition, Zaretsky was planning to inject zebra fish embryos (*Danio rerio*) with GM blue-green algae (cyanobacteria, *Synechococcus sp.*) to create a symbiosis enabling the fish embryos to live from the substances produced by the algae under the influence of light. Owing to the use of GM algae, the project was subject to the GM legislation. A permit application was made to the Ministry of Infrastructure and the Environment, entitled "Public exhibition of a mini-ecosystem consisting of modified plants, animals and microorganisms". The purpose of the art project was

a www.biosolarcells.nl >>>

described in the permit application as follows:
"To enable the public visiting the museum to become acquainted with genetically-modified organisms. The plants, animals, and microorganisms will provide an underlying impetus for the public debate surrounding the manipulation of living organisms and the Biobased Economy."

The ministry failed to handle the permit application within the applicable statutory period. During the procedure in an open letter the applicant requested clarification of the reasons for the delay in the final assessment of the permit.[2] The reason given was that the application was of "an unusual nature". The permit application was ultimately not granted because the exhibition had already ended, which meant that the activities for which the permit had been applied for could not longer be carried out within the time period specified in the application.[3]

1.1 BIOART EXHIBITIONS: THREATS AND OPPORTUNITIES

BioArt is an art movement in which biological (living) materials are used, treated and exhibited. Now that technologies, such as genetic modification, which were once the preserve of science have become more widely accessible, artists have also shown an interest in using them. Given the public debate on genetic modification, its use in exhibitions also raises questions about the desirability and admissibility of this. The use of GMOs in exhibitions may be seen as an involvement in the public debate which could be both positive and negative.
As many people see it, art is first and foremost, art, without a preconceived goal.[4,5] But at the same time, art is also an expression of originality, creativity and emotion which can be used to convey a message or elicit a discussion. Some artists deliberately seek out the legal and ethical limits in order to draw attention to controversial matters. This might be a reason for engaging with biotechnology. The combination of art and genetic modification in exhibitions could, on the one hand, help to broaden the public's view of biotechnology, by enabling a wide range of visitors to learn about its possibilities, applications and its relevance to society in an accessible or even playful manner. Conversely, art can seek to shock, challenge boundaries and expose taboos. Genetic modification is seen as controversial by various groups in society and in combination with art therefore touches upon the ethical and ideological objections associated with this technology.[6]

1.2 EXHIBITIONS WITH GMOS IN THE NETHERLANDS

COGEM has issued advice in the past on the environmental risks of exhibitions with GMOs. An overview:

Biotechnology exhibit in Leiden

In 2001 COGEM gave advice concerning an application to exhibit a GM bovine ('Herman the Bull') in the Naturalis museum.[7] The bull had been genetically modified with the human lactoferrin gene, as a result of which female offspring would produce the anti-inflammatory human protein lactoferrin in the milk glands. The bull would be kept on the Naturalis site in largely closed animal housing. The housing was fenced on one side from behind which the public could see the bull during the opening hours of the museum. COGEM concluded that the exhibiting of the GM bull would involve no risks to humans or the environment.

Cloning of a synthetic DNA sequence in *Escherichia coli*

In 2012 COGEM advised on a project entitled '*Blighted by Kenning*'.[6] The artist wanted to send apples to various laboratories all over the world into which a purified DNA fragment had been introduced in which the amino-acid sequence had been encoded with Article One of the English language version of the 'Universal Declaration of Human rights'. The laboratories taking part were asked to sequence the DNA and decode the message and return this, together with copies of lab journals, prints of sequences, etc. to the artist.[8] COGEM recommended that the laboratory work could be carried out at the lowest safety level (ML-I level). Together with this advice, COGEM also published a report in which it pointed out the ethical and public interest aspects of the application.

Exhibition with GM magnetotactic bacteria

In 2013 COGEM was asked to advise on a permit application for the use of GM bacteria in an artwork entitled '*Living Mirror*'.[9] The applicant wanted to use these bacteria for artistic visualisation purposes in which portraits of the public could be made using a camera, a computer system and electromagnets. The bacteria *Magnetospirillum gryphiswaldense* would be used for this. This bacteria occurs naturally in river and pond mud. Because of its magnetotactical properties the bacteria can orient itself relative to the earth's magnetic field. By introducing a fluorescent protein, the bacteria could be made visible while moving in the electromagnetic fields that formed a portrait of a member of the public. The bacteria would be contained during the exhibition in a sealed container. COGEM concluded that the risks to humans and the environment from the proposed installation with GM bacteria during the exhibition would be negligibly small.

1.3 MINISTRY REQUEST

Permits for exhibitions with GMOs raise questions which cannot easily be answered within the existing statutory frameworks. The Ministry of Infrastructure and the Environment therefore asked COGEM to draw up a report on this subject. COGEM was asked to consider the possible ethical and public interest aspects associated with exhibitions of GMOs. COGEM was also asked to include the following elements in its report:

- The existing legislation on animal health and welfare, test animals, animal by-products and biotechnology in animals requiring a permit procedure which also includes an ethical assessment related to the acceptability of the goal in society.
- Make a distinction between exhibitions with GMOs in general and exhibitions with various groups of GMOs, such as bacteria, plants, animals or animal embryos, including fish.
- Make a distinction between the various goals of exhibitions. This could include exhibitions which are purely intended as an art expression, or those which serve an informative or educational purpose.
- The positioning of the advice relative to previous advisory reports published by COGEM that touch upon this subject.

It was also indicated in the request that the Ministry of Economic Affairs (EZ) had approached the Raad voor Dieraangelegenheden (Animal Welfare Council) (RDA) to draw up an opinion on the same topic and we were requested, to coordinate the reports where necessary.

1.4 ANALYSIS OF THE REQUEST

In the Netherlands activities involving GMOs and animals, including laboratory animals, are subject to various statutory regulations. Chapter 4 four of this report will look at the statutory frameworks in more detail. For the purposes of this analysis of the request made by the ministry, a brief overview of some important points in this legislation is provided in the following box (see text box: **Overview of legislation on GMOs and animals**).

OVERVIEW OF LEGISLATION ON GMOS AND ANIMALS

GMOs – to undertake activities with GMOs – whether microorganisms, plants or animals – a permit is required under the Chemical Substances Act (Genetically Modified Organisms (Environmental Management) Decree) (WMS- BGGO). Before this permit can be issued the application is assessed in terms of the possible risks to humans, animals and the environment. Where the risks are negligibly small, the permit is generally issued. This is issued by the Minister for Infrastructure and the Environment.

Biotechnology in animals – For biotechnological activities with animals – both vertebrates and invertebrates – for non-biomedical applications, apart from the GMO legislation, a mandatory ethical assessment must be carried out, on the basis of which the Minister of Economic Affairs may issue a permit (Section 2.23 Animals Act, Biotechnology permit). A permit will be issued if the activities do not have any unacceptable consequences in terms of the health and welfare of animals, and where there are no ethical objections to the activities.

Animals Act – the Animals Act (WD) is a framework act covering a wide range of legislation on animal health and welfare. The Act also contains rules on veterinary medicines and animal products. The Animals Act applies to animals in captivity[b], unless otherwise specified. The act is based on a recognition of the intrinsic value of animals, as animals capable of feeling, and that violation of the integrity or welfare of animals other than is reasonably necessary, should be prevented.

Animal testing – for animal testing both an institutional licence as well as a project permit are required. Institutions must hold a licence to be able to carry out animal testing. A permit for projects will be issued by the Central Authority for Scientific Procedures on Animals (CCD) further to a recommendation by the Animal Ethics Committee (DEC). The Experiments on Animals Act (WOD) applies to all living vertebrate animals, as well as living invertebrate species as designated by government decree (AMvB). A permit will generally be issued if the provisions of the legislation have been met. It is prohibited to undertake animal testing for a purpose that can also be achieved by alternative means or where the interest does not weigh sufficiently against the distress that would be caused to the animal.

The application for the 'Errorarium' of the artist Adam Zaretsky did not infringe the statutory framework in force. It was to have consisted of mutants of Thale cress (*Arabidopsis thaliana*), zebra fish embryos (*Danio rerio*) and GM bacteria (cyanobacteria*, Synechococcus sp.*). The Thale cress was genetically modified by introducing two constructs which ensure that the gene expression in the plant cells is either activated or suppressed. There was no biotechnology in animals, because the zebra fish

b Animals living in the wild are governed by the Flora and Fauna Act.

embryos would not have been genetically modified. There was also no animal testing involved as described in the Experiments on Animals Act. Owing to the use of GM bacteria, however, the application was subject to the statutory framework for GMOs and a permit was required. This application was submitted to the GMO Office. The applicant wanted to work with model organisms for which there are no indications that they have pathogenic properties and he had taken various physical measures to prevent the GMOs ending up in the environment. It is reasonable to assume that the environmental risks posed by this application would thus fall in the category of negligibly small. As a rule, establishing a negligibly small risk with GMOs is sufficient to arrive at a risk assessment and final assessment to be able to issue a permit. A decision on the permit for this application could not be made in the statutory periods which applied. The application for the permit was ultimately not granted because the exhibition had already finished.
A reticence was observed on the part of the legislature in issuing a permit for an exhibition with GMOs and zebra fish embryos, despite the fact that the statutory conditions had been met. This could mean that: 1) there are also implicit value judgments about usefulness and risk which play a part in environmental permits for GMOs, or that 2) there is resistance to the use of GMOs for other purposes than scientific purposes.

COGEM interprets the question from the State Secretary as a request to identify and set out the ethical and public interest aspects surrounding the use of GMOs in exhibitions. COGEM will respond to the request to examine these aspects in light of the existing statutory framework and make a distinction between various types of organisms and types of exhibitions by analysing and describing the situation that arose surrounding the Errorarium. In the context of its statutory task, COGEM can in this way support the policy in seeking a suitable solution for similar situations in the future.

COGEM's reporting task is to inform the government of the ethical and public interest aspects of genetic modification. For this purpose it makes as wide an overview as possible of the elements which play a part in discussions about GMOs and the force behind them. Whether and what changes or amendments to the policy may be required is a political matter. In this report COGEM makes no statements about the value of art or exhibitions, or about what should or should not be permitted in relation to the use of genetic modification for such purposes.

1.5 ABOUT THIS REPORT

This report is about the use of genetic modification in BioArt: the altering of genetic material in microorganisms, plants and animals or combinations of these in exhibitions. COGEM notes that largely the same aspects and objections may also be raised when genetically unmodified organisms are used in exhibitions.

Although COGEM did not give advice on the specific permit application for the 'Erro-rarium', she was aware of the discussion. COGEM previously provided advice and published a short report on an art project ('*Blighted by Kenning*') and therefore investigated whether other elements had possibly arisen in the new case. COGEM had therefore already been involved with the topic when the ministry made its request with a particular focus on policy options in light of the legislation in force. Given the course of this process the first part of this report is mainly a description of the background and context of BioArt while the second part is mainly concerned with the problematisation of the specific case and the scope of the statutory framework in force.

This reports sets out the various elements involved in the use of GMOs in exhibitions. **Chapter 2** looks at the development of BioArt as a movement and the role of genetic modification. Based on an overview of examples of BioArt, **Chapter 3** examines where the controversies lie and the relevant themes. **Chapter 4** sets out the present legislative framework that applies to exhibitions in which GMOs or animals are used. Among other things, an evaluation is made of which uses are assessed for environmental risks and which also require an ethical assessment. At the end of this chapter some uses are identified where no ethical evaluation is required but which could encounter objections from society. **Chapter 5** looks at whether there are policy options for dealing with future permit applications for exhibitions in which GMOs are used and what these might be.

Besides COGEM, the RDA (Animal Welfare Council) was also asked to examine this subject. While preparing this report COGEM contacted the RDA to coordinate the requests and to be able to answer the questions from both ministries as fully as possible. RDA and COGEM share the opinion that the ministries will be best served with two separate reports in which both organisations respond to the requests on the basis of their own expertise and remit. However, it was specifically the elements of GMOs, animals and exhibitions in combination which led to the request from the ministry. There is therefore an unavoidable and intentional overlap between both reports.

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CONTEXT: BIOART, EXHIBITIONS AND GENETIC MODIFICATION

The first art expressions in which biological (living) materials were adapted and used (BioArt) go back quite some time. In 1933 Alexander Fleming, better known as the man who discovered penicillin, painted pictures of bacterial cultures which he exhibited in a hospital. In 1936, artist and photographer Edward Steichen presented mutated delphinium flowers (*Delphinium*) in the Museum of Modern Art in New York, USA. He had immersed seeds of the flowers in a chemical bath with colchicine thereby inducing polyploidy.[10,11] In plant breeding colchicine was generally used to artificially double the number of chromosomes. The "beautiful" flowers were exhibited while the misformed blooms were excluded to illustrate the role of selection.

2.1 BIOART AND EXHIBITIONS

Modern BioArt can be seen as a form of contemporary art which is typically diverse. Other than in other art periods it is difficult to break down contemporary art into clearly defined movements. Contemporary artists work both figuratively and abstractly, and use a wide range of materials and media. Painting and sculpture have become less prevalent; in exhibitions of contemporary art a mix of installation, performance and various types of media art will be displayed: photography, video art and even digital or electronic art and internet art. Cartoons and animation can also be seen as forms of contemporary art. BioArt too is typically diverse. In general terms the various forms of BioArt can be classified as follows:

- Conceptual BioArt
- Visualisation (photo, film, scans, blots) of cells or cell components (DNA)
- Body art (bodily adaptations, often of the artist him or herself)
- The use of animal or human cells (blood, tissue, bone, hair)
- The use of living or dead organisms (bacteria, plants, animals)
- Changes to the properties of bacteria, plants and animals due to genetic modification

BioArt projects may be exhibited in museums or galleries. Besides this, there are exhibitions which devote attention to GMOs in a more general sense. For example, exhibiting GM plants or food products that have been brought onto the market.

2.2 EXAMPLES

BioArt is a worldwide phenomenon and in recent years there have been various national and international projects involving the use of biological elements. With the arrival of new biological and biotechnological techniques in the natural sciences, BioArt began to take an interest in their application. Some BioArt projects are closely linked to Do-It-Yourself biology (DIYbio). DIYbio can be seen as an international network of amateur researchers, artists, and students, working with professional and semi-professional scientists. These DIY-biologists carry out biological experiments using simple and affordable resources. There are also activist and ideologically-driven proponents who mainly attach value to the democratisation of knowledge and technology.[12] There are very few BioArt projects involving the use of living GM organisms. The diversity of the movement may perhaps best be illustrated with examples of BioArt and artists from various countries (see text box: **Examples of exhibitions, projects and artists**). A few examples of exhibitions with GMOs have also been included in the list.

EXAMPLES OF EXHIBITIONS, PROJECTS AND ARTISTS

Gene Genies Worldwide (USA): a conceptual art project by artists Karl Mihail and Tran T. Kim-Trang. They opened a shop in Pasadena, USA where the public could 'buy' transgenic properties, such as the loyalty of a dog or the slyness of the fox.[13,14]

Rayfish Footwear (NL): a film project by artists Koert van Mensvoort, Ton Meijdam and Floris Kaayk of Next Nature, an international art foundation.15 The film is about a fictional company that offered personalised sneakers made of GM stingray leather that could be customised with the buyer's choice of colour and pattern.[16]

'Pigeon D'Or' (NL): a conceptual project exhibited by Tuur van Balen which aimed to modify bacteria in the digestive tract of pigeons so that they would defecate soap and become flying cleaners.[17]

C-lab (UK): an interdisciplinary art platform in Great Britain that generates and participates in discussions on the intersections between art and science.18 The founders are Howard Boland and Laura Cinti, also the creators of the 'Living Mirror' project with magnetotactic bacteria (see §1.2).

Harlequin Coat (AUS): the French artist Mireille Suzanne Francette Porte (artist's name Orlan) made a 'biotechnological costume' from her own skin cells cultured with the 'WS1 type dermal fibroblasts' of a 12-week-old female foetus and the smooth muscle cells of an Australian marsupial. The project is entitled 'The Harlequin's Coat'.[19]

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Scale Ear (AUS): performance artist Stelios Arcadiou (artist's name Stelarc) made a replica of his own ear from human cells and had it implanted in his arm. He worked on this together with Oron Catts and Ionat Zurr (see SymbioticA, this text box).[20]

Art Orienté Objet (FR): The French duo Marion Laval-Jeantet and Benoît Mangin attempted to blur the boundary between man and animal. In one of their projects they grafted a fusion of their own skin cells onto the skin of pigs. These '*transspecies*' tissues were to be offered for sale so that art collectors could become one with both the pig and the art/artists through xenotransplantation. In another project, Laval-Jeantet had herself 'immunized' with horse cells horse in order to become one with the animal ('*Que le cheval vive en moi*' – May the Horse Live in Me).[21]

Ergo Sum (NL): Charlotte Jarvis (see § 1.2) had a self-portrait made from her own stem cells. In a live performance various cell types were harvested for this that were then transformed through tissue culture into different sorts of cells.[22]

SymbioticA (AUS): an Australian project in the field of tissue engineering in which artist Oron Catts worked with various scientists. Among other things, they made a miniature coat.[23] Oron Catts also worked with Ionat Zurr on a project about the production of 'victimless leather': leather from human and animal cells that would be cultured *in vitro* so that killing 'real' animals would become unnecessary.[24] Another project by this duo is called 'Semi-living worry dolls'; consisting of bundles of tissue in the form of Guatemalan worry dolls which will 'listen' to our concerns about biotechnology.[25]

Synthetic Aesthetics (USA): a project by the University of Edinburgh and Stanford University in which scientists, designers, artists and social scientists work together in teams to develop art projects with a social significance. Under the project various products have been developed such as cheese made from body bacteria and a coffee mug produced by bacteria.[26]

Helena (DEN): artist Marco Evaristti exhibited living goldfish in blenders in a Danish museum and gave visitors the option of switching on the device or not. Two fish were destroyed by visitors.[27]

Idiots (NL): the Dutch duo 'Idiots' comprises Afke Golsteijn and Floris Bakker. They make creations from animal materials. Examples include a blanket made from a cowhide from which a stuffed calf is emerging, squirrels in fancy dress for on the wall and half a lion with jewellery rolling out of it.[28]

Orvillecopter (NL): Dutch artist Bart Jansen made a helicopter from his dead cat and called it '*Orvillecopter*'. He later repeated this project with a rodent and an ostrich.[29]

Les Deux Garçons (NL): a Dutch duo making artworks from stuffed animals by combining them with each other or with everyday objects such as dolls, tableware or coat hangers.[30] >>>

Tinkebell (NL): artist Katinka Simonse (artist's name Tinkebell) made a handbag from her cat, threatened to put 61 day-old chicks in the shredder if her public did not buy them, shut hamsters up in plastic hamster wheels and turned dead cats and dogs into soft toys.[31]

Malus Ecclesia (USA): Joe Davis is a bio-artist who became known for various projects including '*Malus Ecclesia*', in which he decoded parts of Wikipedia and introduced this into the genome of an apple tree, thus literally creating a 'tree of knowledge'.[32]

Project Autoinducer PH-1 (UK): a project by Andy Gracie and Brian Lee Yung Rowe consisting of a semi-synthetic ecosystem made up of three organisms (rice, fern and cyanobacteria).[33]

Alba (USA): Eduardo Kac is an artist who created controversy with the creation of a GM fluorescent rabbit (GFP Bunny) called '*Alba*'. He also created a GM Petunia (plant) containing his own DNA.[34,35] Kac also works with conceptual BioArt. His installation 'Genesis' visualized a translation of a sentence from the biblical text of Genesis into DNA base pairs.[36]

Postnatural organisms of the European Union (EU): this exhibition was organised in several European countries. At the Waag Society in Amsterdam, 11 examples of (prepared) animals species were on view to the public which had been modified through domestication, selective breeding programmes or genetic modification.[37]

Ichtys & Pisces (USA): artist David Kremer made 'sculptures' of GM zebra fish which he exhibited alongside the 'non-manipulated' species.[38]

Genetic Engineering Room (JP): a permanent exhibit at the Nagoya City Science Museum in Japan where GM *medaka* (Japanese Rice Fish) are displayed in a small room. The room has been set up as a laboratory and there are various tools on show which are used in genetic modification. It states on the website that live experiments will also be carried out.[39]

Transgenic organisms of New York State (USA): an exhibition in which organisms can be seen that have been changed by humankind. RoundUp Ready Maize of Monsanto was among the exhibits on show.[40]

The Cactus Project (UK): artist and scientist Laura Cinti created GM cacti which grew human hair instead of spines. By introducing a human keratin gene into the DNA of cactus cells she created hybrid beings which are neither human nor plant.[41]

Transgenic mosquitos of Southern California (USA): a transgenic mosquito (Anopheles stephensi) was exhibited as part of the ZERO1 festival.[42]

Artifact walls – the birth of biotech (USA): the National Museum of American History in Washington has a display case showing the laboratory material that was used to make the first recombinant insulin in GM bacteria.[43]

2.6g 329m/s (NL): artist Jalila Essaïdi worked with scientist Randy Lewis on developing a bullet-proof skin by combining human skin cells with transgenic spider silk produced in goats. Through her work she seeks to explore the social, political, ethical and cultural issues surrounding safety in a world full of new biotechnological possibilities. The title of the project was derived from the performance standard for bulletproof vests.[44]

Apart from individual art projects there are various international joint activities in the field of BioArt, festivals are organised and prizes awarded to bio-artists. An example of the latter is the BioArt & Design Award which is presented every year in the Netherlands.45 Examples of festivals include the Discovery Festival and Bio Fiction.[46,47]

Some conclusions

- BioArt is a form of contemporary art typified by diversity;
- Biological materials (living or otherwise) are modified and used;
- These materials come from bacteria, plants, animals or the artists themselves;
- BioArt touches directly upon life and its opportunities and limitations;
- BioArt makes use of a wide range of techniques, including genetic modification;
- Genetic modification adds another dimension to the treatment of materials (living or otherwise) for exhibitions, not least because of the controversy surrounding this technology;
- BioArt therefore has both the potential to make biotechnology more accessible to a broader audience as well as heighten the current debate on GMOs.

3

PUBLIC INTEREST ASPECTS OF BIOART

This chapter looks at a number of public interest aspects involved in the combination of BioArt exhibitions and GMOs. Among other things, the various functions which BioArt may have will be examined. Additionally, some themes will be identified that have been brought to the fore by various stakeholders in the debate on BioArt using GMOs (e.g. artists, scientists, visitors to exhibitions, government authorities, risk assessors and the general public). Finally, it will be considered whether there are specific indicators for controversy surrounding BioArt and GMOs.

3.1 FUNCTIONS

As many people see it, art is first and foremost, art, without a preconceived goal.[4,5] But at the same time, art is also an expression of originality, creativity and emotion which can be used to convey a message or elicit a discussion. Some artists deliberately seek out the legal and ethical boundaries in order to draw attention to controversial topics. But art may also be used functionally in order to confront controversies or to surprise visitors through creativity and get them thinking about important issues in society.
BioArt is typified by pluralism and may be practised with all kinds of different intents.[48] It is difficult to ascribe just one objective to BioArt, besides which different people and groups may attribute different functions and effects to art. A bioartist, for example, may have a particular goal in mind for his or her work, but visitors may perceive this quite differently. Artists, exhibitors, government, financiers, scientists and the general public may all take a different perspective. Table 1 provides an overview (non-exhaustive) of some of the functions which may be attributed to BioArt (see **Table 1**).

TABLE 1:
A LIST OF SOME OF THE FUNCTIONS OF BIOART AND EXHIBITIONS WITH GMOS

Aesthetic: • 'the beauty' • 'the exalted' • 'the sublime'	**Educational:** • educational, provocative and reflective • making abstract problems more concrete • informing visitors about biotech
Evocative: • image of biotechnology/GMOs • social implications of biotech • revealing differences in context	**Reflective:** • reflecting on the limits and intersections between art and science • opportunities and limitations of science and technology • legitimacy and goals of science and technology • reflection on ethical implications of technological developments
Strategic: • vrijheid van meningsuiting • acceptatie of weerstand creëren	
Challenging: • working with new materials • fascination with new technology	**Inspiring:** • debate in society • scientific innovation

3.2 PUBLIC RESPONSE

At a number of art projects involving GMOs a survey of the public was conducted among the visitors to the exhibition. In 2011, 109 visitors to the '*Synth-ethic*' BioArt exhibition in Vienna, Austria were interviewed about what they had seen.[49] This exhibition included works[c] by ten artists in which they gave their perspective on human intervention in biotechnology and the responsibilities that this brings.
The public survey was mainly concerned with the question of how visitors felt about the use of living organisms and to what extent boundaries and overstepping these boundaries played a part in their opinion of the BioArt exhibition. They were also asked for their views about the combination of various disciplines such as science and art. The researchers concluded that the visitors strongly felt that boundaries were needed in relation to technological progress and its ethical implications. The visitors felt uncomfortable with a lack of clear boundaries and definitions. According to the researchers, this need for boundaries implies a desire to be able to under-

c The projects 'Que le cheval vive en moi', 'Pigeon D'Or', 'Autoinducer PH-1' and the 'semi-living worry dolls' were also part of this exhibition (see § 2.2).

stand and control new developments. The 'out-of-the-box' nature of the exhibition, however, was also seen as an opportunity to gain new ideas and inspiration. The visitors did not consider the use of living organisms to be problematic provided that this remained limited to 'simple' life forms. Organisms with consciousness (or self-awareness) were considered to be problematic morally. The study investigators noted as a limitation of their study that these types of exhibitions often draw a specific target group of well-educated people. This makes it difficult to extrapolate the conclusions to the public at large. At the same time, they stated that art and science are often inherently linked to a particular segment of the public. From this it may be derived that a small proportion of the population is actually acquainted with BioArt. Another part of the population may well have only heard or read about it and there could well be a large part of the population that may never have even heard of it. In this context COGEM would like to point out that where reference is made to the public response to BioArt, in most cases this will refer to the reactions of a select (target) group.

In the Netherlands too, the public's experience of BioArt has to some extent also been looked at. In 2012, in the context of the BioSolarCells projects, visitors to the Dutch Lowlands Festival could inject zebra fish embryos with cyanobacteria. These bacteria were not genetically modified. Visitors were asked for their responses to this experiment.[50] A selection of their reactions can be found in the text box: **Llowlab 2012 visitor responses**.

LLOWLAB 2012 VISITOR RESPONSES

"Great that a wider audience gets to learn more about this in such a simple way with an experiment like this. Good luck, this is the way to go :)"

"Interesting, but I have my reservations. To what extent may humankind pretend to be ' God'?"

"Good idea, nice opportunity to offer solutions. It's a pity that humans destroy their environment only for profit. So that the rich can get even richer. Research to protect or conserve something is fine. Modifying something (against the laws of nature) in order to solve a human problem is bad. It would be better to change human behaviour. That's what should be 'modified'."

"Heavy, to have control over 'life'. 'Mixed feelings'"

"What you are working with here is a living/viable life form. You have no idea how much they suffer as a result. Apart from the fact that they will be killed anyway. This is quite wrong! I am horrified to hear this!"

>>>

"In my opinion this is going too far. I see this as a living being. And what kind of ecosystem does it have? Could disturb the balance of nature."

"Starts out like fun and games, But if you can't predict the consequences (to the fullest extent) what and how will you know what you'll be doing to any type of organism? (like say…humans or..poultry.. Same diff.really) [sic].

"It was kinda weird."

Source: Louwrier D (2012). Appendix 3 field notes. Public response to LLowlab 2012, following the opportunity to inject zebra fish embryos. In: Zaretsky A. BioSolarCells: Making a Field for Interpretation Two Year Report and Proposal for Future Research.

Several of the elements among these reactions are recognizable due to the broader themes included in the discussion on genetic modification, such as playing God – whether something is natural or unnatural – living organisms warranting protection and the consequences of biotechnological interventions. Besides this, there are other elements involved such as the accessibility of technology and the prospects it offers for the future.

3.3 ARGUMENTS IN THE DISCUSSION

The discussion about BioArt, with or without the use of GMOs, is the same as the general debate about biotechnology in general, and can be divided into arguments which are related to GMOs, the use of animals or about exhibitions. There are also a number of aspects which are typical to the combination of these elements. In this order, but without making a strict separation between them, a number of the themes that play a part in the debate will be enlarged upon here.

3.3.1 RISK

There is comprehensive legislation in place governing the development and activities involving the use of GMOs. This applies to microorganisms, plants and animals and to applications inside and outside the laboratory. Arguments about the risks, unforeseen consequences, and long-term consequences are recurring themes in the debate.[51] This applies to almost all applications involving the use of genetic modification, including the use of GMOs in BioArt exhibitions. The added dimension which BioArt may bring is the fact that the general public is brought into more direct contact with genetic modification (unlike the research carried out in laboratories). BioArt involving the use of GMOs is also subject to a permit requirement and is assessed in terms of its safety. In

practice it appears that organisms are used for these projects which are not vectors for pathogens. BioArt projects in the Netherlands involving the use of genetic modification have not led to exposure of either third parties or the environment to hazardous effects.

3.3.2 BENEFIT

In assessing risks there are roughly three categories which can be applied to determine whether to allow an activity, not to allow it, or to allow it under certain conditions. Firstly, there is the lower limit of a negligible (very small) risk. Secondly, there is an upper limit of a risk which is too great, which will lead to an activity not being permitted. Thirdly, there is everything else in between to which a benefit/risk consideration applies: an activity will only be permitted if its benefit outweighs the risk. For some activities, e.g. with animals, even with a negligible risk there will also be a supplementary assessment of the value or importance of the activity.
For GMOs, however, negligibly small risks will essentially always be the minimum requirement: activities involving GMOs will only be permitted provided that the risks are negligible. Genetic modification in animals is also covered by the legislation on animals where an additional assessment is required besides a risk assessment: the activities may not have any unacceptable consequences in terms of the health and welfare of animals, and there may be no ethical objections to the activities. Biotechnology activities in animals for biomedical applications are an exception to this. It has been concluded that these can generally be considered as having value and are therefore exempt from the ethical assessment (more about legislation in chapter 4). Other applications must be assessed, in which biotechnological activities in animals for sport, games or entertainment will never be permitted. If an exhibition includes activities subject to a permit requirement, then in some cases the authorities must say something about the purpose because proportionality plays a role in the assessment (e.g. GM animals). This may be considered problematic because of the varied nature of BioArt and the responses to it.
Questions about the value or usefulness are mainly raised specifically when living organisms are used which may suffer adverse effects as a result of an experiment or activity. Most people take the view that a balance has to be found at that moment between the value and benefit of the activity when weighed against the damage to the physical integrity of an organism.
Some take the view that the use or modification of animals for BioArt or exhibitions is unnecessary and even undesirable. Others state that art serves a purpose in society and that the discomfort that one or a few animals experience can help to address the wrongs in society regarding animal welfare. This argument is used not only in the debate on biotechnology activities in animals, but also in relation to the use of animals in general for art projects or exhibitions. The use of GMOs in exhibitions combined with animals or embryos calls into question the value/risk, even where the lowest level

of negligibly small risk is involved. The problem here may partly be in the difference between the legal definition of organisms warranting protection and what the general public would like to see in terms of organisms warranting protection.

3.3.3 ORGANISMS WARRANTING PROTECTION

The Dutch legislation makes a distinction between genetic modification of microorganisms, plants and animals. An environmental risk analysis must be carried out for GM microorganisms, plants and animals. For GM animals the Animals Act also contains provisions on biotechnology under which the ethical aspects of applications must also be assessed[d]. This classification gives a general indication about the extent to which our society considers that living organisms should be protected (i.e. protection is warranted). Higher order[e] animals especially, are seen as warranting protection. Visitors to the 'Synth-ethic' BioArt Exhibition in Vienna indicated that they did not have a problem with the use of living organisms provided that this remained limited to 'simple' life forms. This aspect is also reflected in the discussions on BioArt projects where genetic modification was used. There appear to be almost no (new) ethical or public objections to applications with bacteria or plants. A recent American project in which light-emitting plants would be produced through crowd-funding, was even able to garner considerable public support.[f] The involvement of living animals in BioArt however does encounter objections, even without genetic modification of the animal itself.
There are differences in the degree to which people see organisms as warranting protection and this can lead to discussion. The statutory protection for laboratory animals is linked to the degree to which it can be scientifically demonstrated that the animal can experience distress. At the moment this aspect is closely linked to the presence of a central nervous system. This is why vertebrate animals are covered by the Experiments on Animals Act (WOD) and most invertebrates are not. This means that snails, jellyfish, starfish, butterflies, spiders or crustaceans are not statutorily considered to be test animals. For biotechnology activities in animals the statutory protection is wider: both vertebrates and invertebrates are covered by the provision on biotechnology in the Animals Act. A distinct difference can be observed between animals warranting protection in the legislature and society's perception of such. Some people in society instinctively see some animals which the law does not consider worthy of protection

d COGEM notes that in the scientific literature on ethics risks are also considered to be ethical aspects.

e In the taxonomy or classification system used in biology, orders is the term used to distinguish between different species of organisms. There is no clear-cut definition of 'higher order organisms' and interpretations of this differ. Often what is meant is animals that can be seen with the naked eye (unlike microorganisms, for example) and that can be recognized as conscious beings.

f www.glowingplant.com

as warranting such, particularly when combined with biotechnology activities like genetic modification.

3.3.4 FREEDOM OF CHOICE

Freedom of choice plays an important part in the discussion on genetic modification, particularly when it comes to food. In 2011 COGEM published a report on the development and role of freedom of choice surrounding GMOs in Europe.[52] The report identified three main arguments in favour of freedom of choice: 1) the importance of autonomy in itself, 2) religious, cultural and fundamental beliefs, and 3) concerns about technological developments, ranging from safety and natural integrity to socio-economic aspects. The interests in relation to freedom of choice can be subdivided into collective interests or individual interests, some of which are controversial. Collective interests are of concern to everyone and therefore often arranged at public administration level (e.g. safety). Individual interests are linked to personal beliefs about 'the good life'. Controversial consumer interests can be grouped under interests which are seen by an individual or a group as collective interests but on which no collective decisions have (yet) been made. People may believe, for example, that the use of genetic modification should be banned, or prohibited in certain applications (such as BioArt).

Freedom of choice also has a role in BioArt exhibitions. In this context artists, exhibition organizers, government, financiers, scientists and visitors too, are dealing with freedom of choice in some way. Artists may be limited in their freedom of choice or free speech when a project (or part of a project) is subject to a permit requirement or even prohibited. Some artists are known to seek out the limits and will consider the imposition of rules or restrictions on their projects as a form of censorship. Visitors to exhibitions essentially have freedom of choice in that they can decide whether or not they wish to visit the exhibition (provided that it has been indicated that genetic modification has been used). Scientific projects now often include a 'society' component or some scientific communication in which attention is focused in a creative manner on scientific advances. This can lead to dilemmas in situations where people accept the impact on animal welfare for scientific purposes but not when it comes to artistic applications (see §3.3.2). The BioSolarCells project referred to in the introduction is an example of this. Scientific research is funded by government or private institutions and organisations. These could also be civic organisations which in turn are sponsored by private individuals. In this context, in an open letter the Gentechvrije Burgers (The European GMO-free Citizens) asked whether all the parties funding the BioSolarCells project were aware of the use of genetic modification for the 'society' component.[53] Direct or indirect funding of BioArt projects may be seen as giving implicit consent for such applications. Some people consider this to be problematic, because it conflicts with their personal convictions. In this context government funding of projects can also elicit public controversy.

In a letter the artist [Zaretsky] wondered whether the project backers might have been the reason for the stagnation in the permit application process thus restricting his freedom of choice.[2] This discrepancy underlines a controversial matter in relation to freedom of choice. There are different ideas with regard to BioArt in the context of genetic modification. The most extreme positions can be termed 'integration' and 'propaganda', respectively. These two approaches are illustrated in the text box: **Integration versus Propaganda** based on two quotations.

INTEGRATION VERSUS PROPAGANDA

The quotations given below illustrate the divergent ideas and interpretation of the purpose of BioArt projects using GMOs.

"The purpose of the exhibition is to inspire the public and make a real contribution to ecological and social justice. The mini ecosystem forms part of this and offers visitors an opportunity to see GMOs and learn about modern research outside the laboratory context."
(Source: Permit application by Zaretsky)

"What they want to do therefore is, through an exhibition in which the unwitting public can influence zebra fish embryos that have already been injected with GM bacteria from algae and GM Thale cress plants, with light and sound, and thus cast GMOs in a different light. This reveals the true purpose of the exhibition: the exhibition organisers want to promote genetic modification."
(Source: opinion of the Gentechvrije Burgers [The European GMO-free citizens]

On the one hand, it is stated that the project contributes to 'integrating' biotechnology into society by making this technology more visible and accessible to a wider audience. The introduction of creativity provided by the art can also be seen as an impetus for innovation and out-of-the-box thinking which science can benefit from. Conversely, there are those who consider the art project to be propaganda on the part of the biotechnology sector.[54]
It is open to question however, whether the science and biotechnology sectors would also consider BioArt projects to be a way of promoting their cause. Rather it is quite possible that they would see a risk of damage to the image of technology or a particular product used in the art project. From the point of view of science, art projects which have a tendency to seek out the extremes and to shock could put the whole field and the opportunities offered by technology in a bad light. Moreover, scientists who view their work as a very serious business will not always appreciate something which enables a wider public to become acquainted with biotechnology in a playful and accessible manner. With the complexity of life being reduced to no more than a DNA code or a 'simple art project'.

There is yet another view of the relationship between BioArt and genetic modification. This view holds that art is an excellent means by which to make the complex moral issues surrounding biotechnology more explicit and thus contribute to a more thoughtful critical debate in society about the ethical desirability of various forms of biotechnology and possibly help to clarify the boundaries between what is acceptable, specifically by challenging taboos or by throwing light on the implications of such. Art can make abstract problems more concrete and thus play an important role in society without, by definition, being 'for' or 'against' science and technology.

3.3.5 PLAYING GOD AND 'UNNATURALNESS'

As with genetic modification, the arguments of 'playing God' and 'not natural' also recur in the debate on BioArt. As shown by the visitor responses to the Llowlab 2012, for example, about injecting zebra fish embryos (see text box: **Llowlab 2012 visitor responses**, §3.3). These arguments surface when physical interventions or genetic modification is performed in animals. Some, based on a religious belief, take the view that GMOs are unnatural and that genetic modification is equivalent to 'playing God'. When organisms are considered to be unnatural this can bring other associations, such as lack of safety or risks.

In the report "The Gentech Debate Analysed" (Het gentechdebat ontleed) COGEM identified this argument as one of the key themes in the discussion on genetic modification.[55] The interpretation of what is 'natural', differs. The concept of what is natural is mainly used to express concern and dissatisfaction with human intervention in natural processes. People often have an intuitive sense of what is natural (or unnatural) about food or organisms, in which something which is unnatural is implicitly associated with something which is not as good or even unsafe. Protecting life, nature, and biodiversity against potential threats is considered by many to be a goal worth fighting for. This is partly laid down in the regulatory framework. But for some people this is not enough, because they consider genetic modification, by definition, to be a violation of the integrity of microorganisms, plants, animals and human beings, and of life itself. To them the word 'natural' is antagonistic to 'man made'. According to others, all technological activities in which scientific knowledge is used are either natural or artificial.[56] In this sense 'natural' means: "in accordance with the laws of nature" and therefore all human and non-human activities are natural. There are also relative versions of this in which what is 'natural' is consistent with human stewardship and human intervention. In this case 'natural' is no longer an absolute but more relative and gradually interpreted: some interventions are more natural and others less natural. This will be determined by whether the view held about cultural heritage and what is natural is static or more dynamic and the degree to which human intervention in nature is considered permissible.

3.3.6 DOUBLE STANDARDS?

BioArt can reveal or magnify contextual differences. Differences between individual behaviour or the same behaviour in the context of an art project, for example (such as modifying the human body).
Artistic exploitation of the human body is seen as controversial while, as some bioartists would argue, experimental or commercial exploitation of the body or body parts by science and the commercial sector is accepted by society.[43] For the purposes of this report this is about the difference between 'real' science and the 'staging' of science in a metaphorical sense.[57] Where there is a metaphorical staging of science, a great deal is permitted under the heading of 'artistic licence' (e.g. the conceptual BioArt projects described in chapter 2). When actual processes are carried out, the context changes and at the same time its effect in terms of its perception and acceptance in society. And where there are also processes involved which even for scientists are subject to strict controls (as with genetic modification) this creates added tension.[51]

The BioSolarCells case in which GM algae were to be injected into zebra fish embryos, illustrates this difference in context. Zebra fish embryos are already used on a large scale as a model organism in science (see **Chapter 4**).[58] The same project was also carried out with non-genetically modified algae at the Lowlands Festival. It is the use of GM algae in zebra fish embryos for an art project which then makes the discussion acute.
A related argument which surfaces in both art and science is the image of the 'nutty professor' in the lab or the 'crazy artist' in the studio. This theme appears to refer to various feelings: the potential for making ingenious inventions set against the danger of overstepping the limits due to a lack of ethics or regard for the values of society and what is considered important.[59] Books and films can sometimes strongly reinforce such images.[60]

3.4 THE PURPOSE OF EXHIBITIONS: MAKING A DISTINCTION

The State Secretary asked COGEM whether a distinction could be made between exhibitions which are purely intended as an art expression and those with an educational purpose. Such a distinction can only be made on paper, and would not, in practice, help find a way to deal with the objections that have been identified. Different parties can also ascribe different functions and effects to the same exhibition. A bioartist, for example, may have a particular purpose in mind for his or her work, but visitors may perceive this quite differently. If educational exhibitions were to be treated differently than BioArt, some artists would simply state that their exhibition serves an educational purpose. COGEM concludes that it is not possible to make a distinction because a clear line between education and art cannot be drawn. Although it is possible to think of

examples of typical art projects or specific educational projects, in practice for many applications this will be less clear. This raises the question of whether and why the one would be more 'useful' or 'desirable' than another.

3.5 SOME CONCLUSIONS

- BioArt is typified by diversity and may have numerous purposes, including aesthetic, reflective, inspiring or challenging;
- It is not possible to make a clear distinction between exhibitions which are intended as art and exhibitions with an educational purpose, because there is no objective dividing line which can be drawn between art and education;
- If an exhibition includes activities subject to a permit requirement, then in some cases the authorities must say something about the purpose because proportionality plays a part in the assessment (e.g. GM animals); This can be seen as problematic because of the varied nature of BioArt and the responses to it;
- Insofar as there is a public response to BioArt exhibitions with living organisms, the reactions are mixed, varying from interest and curiosity to objections to the use or genetic modification of organisms;
- Arguments originating from the debate on GMOs, the discussion on animals as well as on exhibitions and art in general are all brought into the debate on BioArt;
- The arguments in the discussion, for example, relate to risk, value or usefulness, that organisms warrant protection, freedom of choice, playing God and whether something is natural or unnatural;
- Besides which, is the discussion concerned with the relevance of BioArt to the field of biotechnology (integration or propaganda) and the different contexts of artists and scientists;
- There appear to be few objections to genetic modification of plants or microorganisms for BioArt, as long as safety is guaranteed;
- Objections mainly arise when higher order living organisms are to be used;
- The same aspects and objections may arise when animals which have not been genetically modified are used in exhibitions.

4

GMOS IN THE REGULATORY FRAMEWORK: IMPLICATIONS FOR EXHIBITIONS

As the previous chapter shows, the views and attitudes towards exhibitions involving the use of GMOs or animals differ widely. This chapter looks at which of these aspects are covered or assessed in the context of the statutory framework in force. The legislation on GMOs (Genetically Modified Organisms (Environmental Management) Decree and the legislation on animals (Animals Act (WD) and the Experiments of Animals Act (WOD)) are most relevant in the context of this COGEM report. Besides the aforementioned legislation, companies, institutes and organisations working with GMOs must, of course, where applicable, meet the rules which apply to other activities (e.g. the Pesticides Act, the Commodities Act, the Working Conditions Act, etc.).

4.1 GMOS IN THE REGULATORY FRAMEWORK

A permit requirement applies for applications involving the use of genetic modification, in which applications are assessed in terms of the environmental risks. The legislation on GMOs applies to all organisms (with the exception of human beings) in which genetic material has been altered in a way which would not be possible in nature through reproduction or natural recombination. This means that the GMO legislation applies to microorganisms (fungi, viruses, bacteria, parasites), plants and animals (vertebrates and invertebrates).[g]

4.1.1 EUROPEAN LEGISLATION ON GMOS

A distinction is made in both European and national legislation between Contained Use (IG), Release into the Environment (IM) and Market Applications (MA):

Contained use (IG): All activities with GMOs which are conducted in a classified space, such as a laboratory. Activities refers to: the genetic modification of organisms,

g Genetic modification in humans is prohibited.

the multiplication, storage, making available to another person, the use, holding, transport and disposal or destruction of GMOs.

Release into the Environment (IM): All activities with a GMO which are not covered by contained used. This category covers field experiments, cultivation and the admittance of products to the market. Gene therapy falls under IM in the Netherlands, but in some other European countries it is classified under contained use (IG).

Market application (MA): a permit application for the introduction onto the market of GM products, such as crops, foodstuffs or medicines.

The European directives and regulations concerning GMOs are based on these categories. In Europe, directives and regulations apply to the contained use of GMOs (Directive 2009/41/EU) and deliberate release into the environment (Directive 2001/18/EU). Regulation 1829/2003/EU also applies to GM foodstuffs and GM animal feeds, while Regulation 1830/2003/EU applies to the traceability and labelling of GMOs and the traceability of foodstuffs and animal feeds produced with GMOs. These European regulations and directives are not relevant to this report and will not be further discussed here.

4.1.2 DUTCH REGULATORY FRAMEWORK ON GMOS

The production of and activities involving the use of GMOs in the Netherlands are also assessed in terms of environmental risks. This applies to microorganisms (fungi, viruses, bacteria, parasites) plants and animals (vertebrates and invertebrates). In the Netherlands the Animals Act (WD) also includes provisions on biotechnology for applications involving GM animals, both vertebrates and invertebrates. An ethical assessment is required in this context. This will be covered in more depth in **§4.2**. **Figure 1** provides an overview of the scope of the GMO legislation for various organisms.

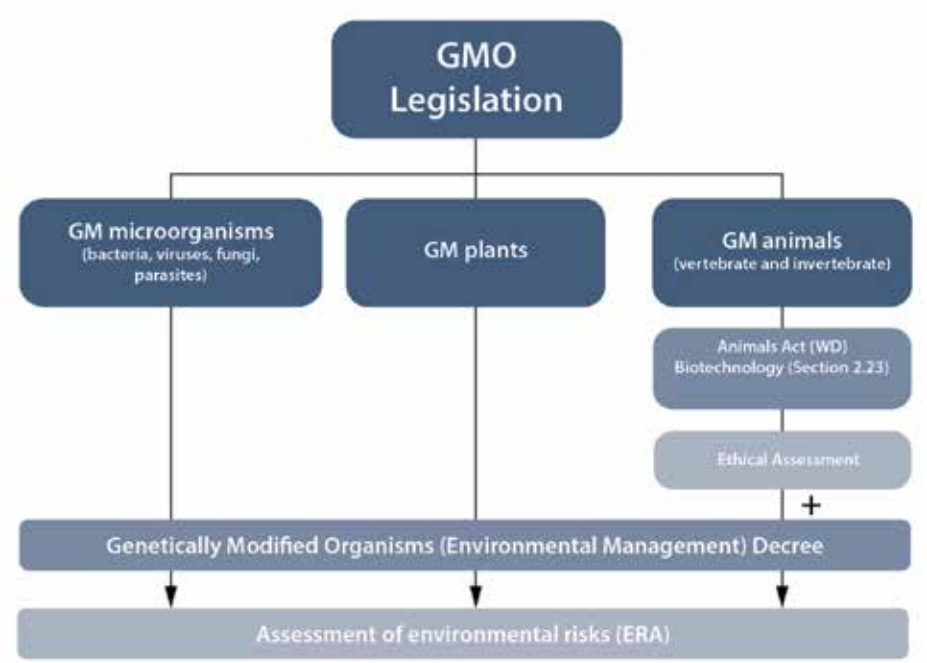

Figure 1: Overview of the GMO legislation for various organisms and the associated permit requirement.

Where work is carried out involving the use GMOs in the Netherlands both the applicant and the institution must hold a permit to do so. The permit for the activities is issued by the Ministry of Infrastructure and the Environment (IenM). The legislation on genetic modification in the Netherlands is based on the European directives and regulations. European Directive 2009/41/EU on contained use has been implemented in Dutch legislation in:

- Genetically Modified Organisms Regulation (Regeling GGO)
- Genetically Modified Organisms (Environmental Management) Decree (Besluit GGO)
- The Environmental Management Act (WM)

The Genetically Modified Organisms Regulation forms part of the Genetically Modified Organisms (Environmental Management) Decree. This contains further rules, general safety standards as well as housing guidelines and operational procedures. A permit may be issued after an environmental risk assessment (ERA) has been carried out, which looks at any potential risks to humans and the environment. The permit may also provide for measures to limit the risks. For activities with organisms under contained use, measures to limit the risks are generally taken at two levels: physical containment and biological containment.

Physical containment

Physical containment of the organisms that will be worked with is based on reducing the chances of the organism coming into contact with other organisms. In the Netherlands and Europe, for example, activities using microorganisms in laboratories are subdivided into four levels of increasing physical containment: from ML-I (lowest), ML-II, ML-III to ML-IV (highest). At each level higher standards are imposed on the design of the laboratory accommodation. The more dangerous a particular microorganism is, the stricter the standards which apply to the space in which these organisms may be worked with. Before GMOs can be worked, with, a permit must be issued for the 'classified space' under the Environmental Permit (General Provisions) Act (WABO). This legislation lays down the requirements to be met in the building where the work is to be carried out. These permits are issued by the municipality or provincial authority of the area in which the building is situated.

Biological containment

In research organisms are often used which have been weakened or which are dependent on specific conditions for their development which can only be created in the laboratory. As a result, these organisms will not or are unlikely to survive outside the laboratory. This is known as biological containment. Both the physical and biological containment is taken into account in issuing a permit. A permit will generally only be issued where the risks are negligibly small. A permit may also include supplementary requirements (such as specific operational procedures) thereby making the risks negligibly small.

Release into the environment

Where activities with GMOs take place outside classified spaces, release into the environment (IM) is involved. If GMOs are released into the environment only for research purposes and not introduced onto the market, a permit requirement applies under the Genetically Modified Organisms (Environmental Management) Decree. This applies, for example, to field trials with GM crops and clinical studies for the purpose of vaccine or therapy development. Outside the laboratory there are fewer avenues for containment, which means that from the point of view of containment, the possible the environmental effects must be fewer or absent.

Permits for exhibitions with GMOs are currently applied for under the Release into the Environment (IM) category. For the containment category a permit must be issued under the Environmental Permit (General Provisions) Act (WABO) for the design of the space in which GMOs will be worked with. Meeting the requirements to obtain a permit for a classified space can involve considerable time and cost. This can constitute a barrier for organisations which only occasionally wish to undertake activities involving

the use of GMOs, such as schools (see textbox: **GMOs for educational purposes**). Another difficulty is that one of the requirements applying to an ML-I space is that it may not be open or accessible to the public. However, one of the typical features of exhibitions is that they are open to the public.
COGEM notes that it is not unusual for art also to be sold. In this context COGEM notes that market admittance will be required where there is commercial trade in a GMO.

GMOS FOR EDUCATIONAL PURPOSES

In 2012 a secondary school was reprimanded by the Human Environment and Transport Inspectorate because it had performed activities with GMOs without a permit under the Environmental Management Act (WMO).[61] This related to GM bacteria which were safe enough to work with at the lowest containment level. These bacteria formed part of a demonstration kit from Bio-Rad Laboratories B.V. and produced a fluorescent protein (GFP), which made the bacteria glow green. To work with these bacteria a containment category permit is necessary together with a permit under the Environmental Management Act (WABO) for a ML-I (lowest level) laboratory or work area. Furthermore a biological safety officer must be appointed who is responsible for the supervision, internal management and administration of the activities.[62]
The manufacturer, Bio-Rad Laboratories B.V. hoped to be able to bring GMOs for educational purposes onto the market with a containment category permit exemption. For this it is necessary to be placed on Annex IIC of Directive 90/219/EEC. In a recommendation made in 2009 COGEM stated that safety to humans and the environment would be guaranteed if these GMOs were to be placed on Annex IIC.[63] This opinion is based on a technical and scientific consideration of the environmental risks and the conditions laid down in Annex IIB to the Directive. COGEM also published a report which considered the public interest aspects of such an exemption.[64] This discussed the contribution which such an exemption could make in increasing familiarisation with GMOs, as well as the chance of undesirable contact with GMOs. This exemption has still to be put in place. The new Genetically Modified Organisms Regulation, however, does include an exception which would make it possible for schools to work with GMOs at the lowest containment level without obtaining an Environmental Management permit.[65]

4.2 THE LEGISLATION ON ANIMALS

Biotechnology activities involving animals are covered by a number of statutory rules and regulations for activities with and the use of animals and animal products, such as the Animals Act (WD), and the Experiments on Animals Act (WOD). The collecting and exhibiting of living animals is subject to various rules to protect animal welfare and prevent the spread of infectious diseases (Section 2.16 Exhibition of animals, WD).[66] The Dutch legislation prohibits animal abuse (cruelty) and neglect (Sections 2.1 and 2.2 Activities with animals, WD). The legislation on animals is largely based on the European legislation.

4.2.1 EUROPEAN LEGISLATION ON ANIMALS

The European rules on caring for the health of animals are laid down in numerous directives and regulations which further elaborate on keeping animals, animal housing, breeding, transport and the killing of animals, identification and registration of animals, preventing and treating animal diseases and zoonoses (infectious diseases of animals which can be transmitted to humans). These will not be discussed in any detail in this report. Some relevant examples, however, will be mentioned. Regulation 882/2004/EU provides an overall framework for government inspection of the observance of rules on food safety, as well as animal health and welfare. Besides animal health and welfare, Directive 2010/63/EU is also important. This concerns the protection of animals which are used for scientific purposes. This Directive was implemented in the Dutch Experiments on Animals Act (WOD) on 18 December 2014.[67,68]

4.2.2 DUTCH LEGISLATION ON BIOTECHNOLOGY IN ANIMALS

For genetic modification in animals – whether vertebrate or invertebrate – a "no, unless" policy applies in the Netherlands.[69] This means that a mandatory ethical assessment must take place, on the basis of which a permit will or will not be issued by the Minister of Economic Affairs (Section 2.23 Biotechnology permit, WD). The Animals Act (WD) and thus the provision on biotechnology, applies to all animals kept in captivity, whether vertebrate or invertebrate. A committee of independent experts advises the State Secretary on this matter.[70]

A permit will be issued if the activities do not have any unacceptable consequences in terms of the health or welfare of animals, and where there are no ethical objections to the activities. It is also important that no realistic alternative to the study is available. This applies both to conducting the study as well as its practical applications.[71] The legislation states that performing biotechnological activities on animals for the benefit of sports performance or entertainment is prohibited. Since 1 January 2010 there has been an exemption in force for biotechnological activities involving animals for biomedical research. This type of research is still subject to the Experiments on Animals Act (WOD) and must be assessed by Animal Ethics Committees (DECs).[72]

4.2.3 DUTCH LEGISLATION ON ANIMAL TESTING

A permit is required for animal testing under the Experiments on Animals Act (WOD). Both an institutional licence as well as a project permit are required. Institutions must hold a licence to be able to carry out animal testing. A permit for projects will be issued by the Central Authority for Scientific Procedures on Animals (CCD) further to a recommendation by the Animal Ethics Committee (DEC). A permit will generally be

issued if the provisions of the legislation have been met. It is prohibited to undertake animal testing for a purpose that can also be achieved by alternative means or where the benefit does not weigh sufficiently against the distress that would be caused to the animal. The Minister of of Health, Welfare and Sport (VWS) issues the licence or permit and the Animal Ethics Committees (DECs) undertake the initial assessment. In the event that they advise against the application, it may then be submitted to the Central Authority for Scientific Procedures on Animals (CCD).
The Experiments on Animals Act (WOD) applies to all living vertebrate animals, as well as living invertebrate species designated by government decree (AMvB). An amendment to Directive 2010/63/EU was made in 2010 such that this now also applies to octopodes, i.e. Cephalopoda.[73,74,60] This amendment has been implemented in the WOD. Whether or not certain animal species are included has to do with the degree to which it may be assumed that activities in the context of animal experiments could cause distress, or where the intended or possible consequences affect the birth of an animal subjected to distress. Distress refers to: causing pain, suffering, discomfort or lasting injury. The presence of a central nervous system plays a pivotal role in this distinction. The propagation/breeding or use of most invertebrates is, therefore, not subject to a permit requirement under the Experiments on Animals Act (WOD).[75] This means that the following phyla or classes in the animal kingdom are not subject to the WOD legislation:

- *Porifera* (Sponges)
- *Cnidaria* (Sea nettles)
- *Ctenophora* (Comb jellies)
- *Platyhelminthes* (Flat worms)
- *Rotifera* (Wheel animals)
- *Nemertea* (Ribbon worms)
- *Mollusca* (Molluscs, apart from *Octopodes*)
- *Annelida* (Ring worms)
- *Nematoda* (Round worms)
- *Arthropoda* (Arthropods)
- *Echinodermata* (Echinoderms)
- *Chordata* (Chordates, apart from certain vertebrate species)

The amendment to Directive 2010/63/EU also states that this also applies to independently feeding larval stages and foetal stages in mammals from the last (trimester) part of their normal development.[66] Non-independently feeding larval stages of vertebrate animals falls outside the scope of the WOD. Zebra fish embryos (*Danio rerio*) less than 5 days old are a known example. This amendment was recently implemented in the Dutch legislation. These have an important role in scientific research (see textbox: **Zebra fish embryo as animal testing model**).

ZEBRA FISH EMBRYO AS ANIMAL TESTING MODEL

The zebra fish (*Danio rerio*) has become very important in scientific research. Besides testing the effect of chemical substances (e.g. pesticides, medicines, plastics, cosmetics and various other chemicals), the zebra fish is also widely used for biomedical research. This is because the fish has genes and mutations linked to specific clinical disorders which correspond to those of humans. This fish has, in that respect, attained the same status as the mouse as a laboratory animal. This little fish has also been studied since the 1970s as a genetic model for organ development, not least because of its transparent embryonic stage. The developing organs show many similarities with those of humankind, as well as the development of the pituitary, hypothalamus, thyroid, adrenal gland, pancreas and gonads. This makes it an ideal model for endocrine disorders.76

The embryonic development is rapid and many processes can already be studied in the first five days after fertilization. Twenty-four hours after fertilization a beating heart can be observed. The embryos leave their transparent eggshell, known as the chorion, 2 to 3 days after fertilization and after 5 days the most important organs have been formed. Already from the first day the embryos have an inherent immune response. This makes the zebra fish interesting for immunological and biomedical research.

A test animal is viewed as an organism that must be provided with food in a laboratory setting. For animals which have larval stages, this means that the rules only apply to them once they reach an independent feeding stage. Only after the fish starts feeding independently and producing faeces, will it be necessary for the researchers to present a research protocol to an Animal Ethics Committee. The zebra fish has a relatively large yolk sack on birth and can survive for the first five days without external food. This means that provided the life of the fish is ended within 5 days, animal tests can be conducted without the necessity of having to apply for a permit.[52]

The question is whether the Experiments on Animals Act (WOD) applies to exhibitions with GMOs, animals or combinations thereof. In the Dutch legislation animal testing refers to: the entirety of activities that with regard to a living vertebrate animal, or a living invertebrate animal of a species designated by government decree, are carried out:

a. to produce or check or undertake biological benchmarking of sera, vaccines, diagnostics or other medical, veterinary or biological substances,
b. to undertake toxicological or pharmacological research,
c. to identify or investigate pregnancy, disease or other physical conditions or bodily characteristics of people or animals or similar situations or characteristics of plants, other than in the practise of veterinary medicine on the animal in question,
d. to obtain or develop an understanding of the human or animal body, or skill in undertaking interventions on such, or
e. to obtain an answer to a scientific question.

In view of this summary and the examples of BioArt with living organisms as described in this report, it appears that the Experiments on Animals Act (WOD) does not apply to most exhibitions with animals, GM animals or combinations of animals with GMOs.

4.2.4 DUTCH LEGISLATION ON ANIMALS

The use of animals or animal products is governed by the framework Animals Act (WD) which contains legislation covering a wide area of animal health and welfare. The Animals Act includes provisions on animal heath and welfare, as well as on veterinary medicines and animal products. The Act applies to all animals kept in captivity, unless otherwise laid down. The act is based on the stated principle that "the intrinsic value of animals, as beings capable of feeling is recognized, and that violation of the integrity or welfare of animals other than is reasonably necessary, should be prevented". The Animals Act does not further specify how the intrinsic value of animals should be interpreted or what interventions may be deemed as reasonably necessary.

Exhibitions with GM animals are subject to a permit requirement in which an ethical assessment is mandatory under the Animals Act (see **§4.2.2**). Exhibitions with only animals are also subject to general rules as laid down in Section 2.16 Exhibition of animals, Animals Act (WD). This also states that it is prohibited to exhibit or present for examination animals in which a banned physical intervention has been carried out (Section 2.8, Veterinary activities, Animals Act). This includes physical interventions for which there is no veterinary necessity or the use of veterinary medicines which have not been admitted. The injection of a GM microorganism into an animal for an exhibition is not a physical intervention for which there is a veterinary need. This application would therefore appear to be prohibited.
The question is, however, whether the rules on exhibiting animals and the physical interventions which may or may not be permitted also apply to animal embryos. Under this legislation embryos would be classified as animal products, for which - by or pursuant to government decree (AMvB) - rules may be drawn up with regard to the extraction, processing, mixing, storage and commercial exploitation of these products (Section 3.1, Animal products, Animals Act). In view of the fact that the ministry did not prohibit the exhibition of the Errorarium with the zebra fish injected with GM algae on the basis of Sections 2.16 and 2.8 of the Animals Act, it would appear that this legislation does not apply to exhibitions with embryos.

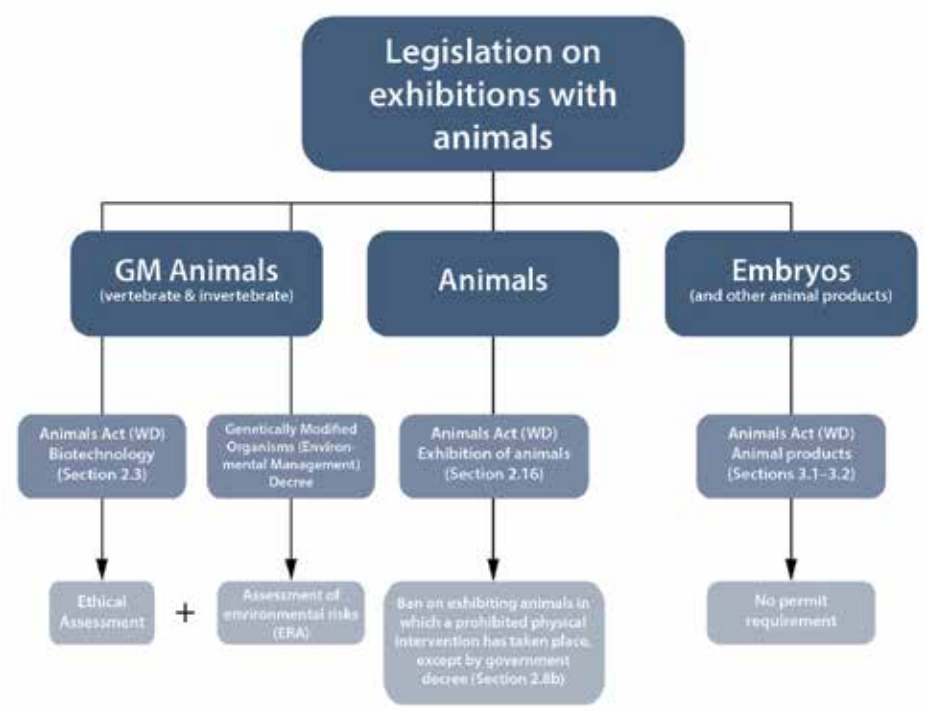

Figure 2: Overview of the legislation applying to exhibitions with animals, GM animals and embryos (as well as other animal products). Where applicable general rules also apply concerning hygiene and preventing the spread of infectious diseases.

Figure 2 provides an overview of the legislation on animals in the context of exhibitions. To summarize: biotechnological activities with all animals are subject to a permit requirement and, apart from an environmental risk assessment, must also undergo an ethical assessment. Institutions that wish to conduct animal testing need a licence under the Experiments on Animals Act (WOD). The WOD does not apply to exhibitions with animals, GM animals, or animal products because animal testing as defined in the regulations will not generally be involved. Section 2.16 of the Animals Act on exhibition of animals and Section 2.8 which prohibits exhibiting animals in which a banned physical intervention has taken place, do apply however. These two provisions however do not apply to animal products, which includes embryos.

4.3 THE LEGISLATION ON GMOS COMBINED WITH ANIMALS

COGEM notes that most applications of GMOs in exhibitions are covered by the existing regulatory framework in force. On the basis of **§4.1** and **§4.2**, however, COGEM wishes to point out that specific niche applications of BioArt, i.e. GMOs in combination with embryos, are governed only by the GMO legislation (see Figure 3). Some people consider this to be problematic because these applications could raise ethical objections or create a sense of unease in society.

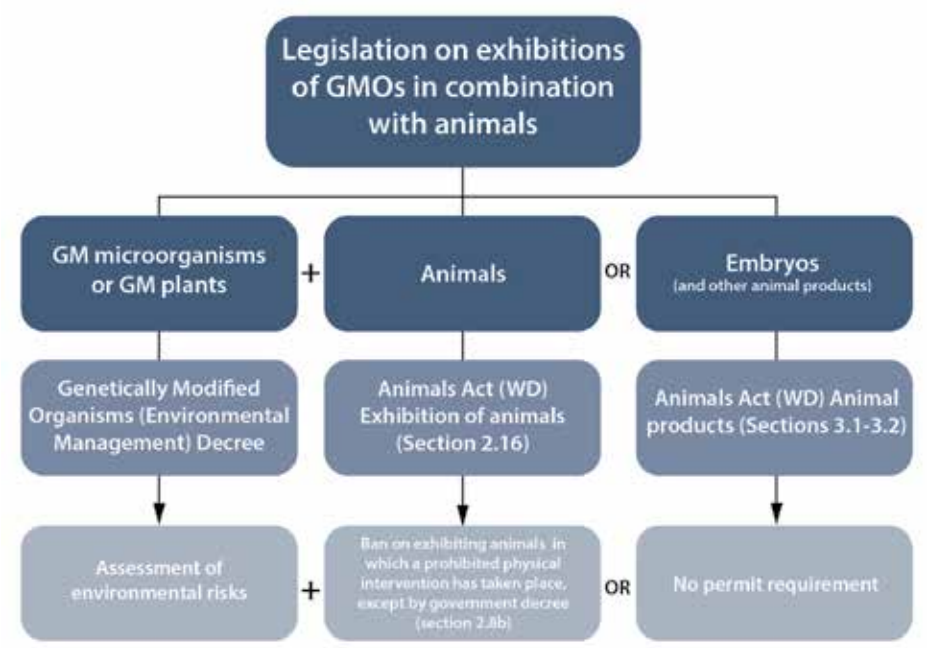

Figure 3: Overview of the legislation which applies to specific niche applications like exhibitions, i.e. GMOs in combination with animals or embryos (and other animal products). Where applicable general rules also apply concerning hygiene and preventing the spread of infectious diseases. Animals which have themselves been genetically modified will be assessed both in terms of the environmental risks and the ethical aspects (see **Figures 1 and 2**).

4.4 LEGISLATION APPLYING TO EXHIBITIONS AND MUSEUMS

Policy is arrived at not just on the basis of statutory frameworks, but also through guidelines, recommendations, codes of conduct or covenants and agreements. These exist for art, museums and exhibitions too. Exhibitions and art projects must, of course, observe the national and international legislation in force. Besides this, national and international codes of conduct have been drawn up for museums that wish to organise exhibitions in association with artists.

4.4.1 CONVENTION ON INTERNATIONAL EXHIBITIONS

The Convention on international exhibitions was drawn up early in the 20th century and signed in Paris on 22 November 1928. The treaty has been amended a number of times, specifically in 1948, 1966 and 1972. This convention applies to all international exhibitions with the exception of exhibitions lasting less than three weeks, Fine Art exhibitionsh and exhibitions which are mainly of a commercial nature.[77] An exhibition is international when more than one country takes part. The purpose of the treaty was to provide supervision of the content, quality and frequency of exhibitions (primarily the World Expos). The Bureau International des Expositions (BIE) was set up for this purpose. The BIE has 168 member nations.[78] Although not directly relevant to BioArt exhibitions, the treaty provides one of the few definitions of an exhibition (see text-box: **Definition of an exhibition**).

DEFINITION OF AN EXHIBITION

An exhibition is a manifestation which, irrespective of its title, has as its primary purpose to educate the public by providing an overview of the means which mankind has at its disposal to meet the needs of civilization or to demonstrate the progress made or future prospects in one or more branches of human endeavour.

Source: Convention on International Exhibitions.

h The term 'fine art' refers to any art form which serves only to evoke aesthetic pleasure or express an art appreciation idea. The fine arts do not serve a practical purpose or have an intrinsic economic value. The term fine arts mainly relates to the visual arts and the performing arts, such as painting, sculpture, architecture, photography and certain printing techniques as well as theatre, dance, and music.

4.4.2 CODE OF ETHICS FOR MUSEUMS

In addition to this, there is an International code of conduct for museums: the International Code of Ethics for Museums (ICOM). A revised International Code of Ethics for Museums was adopted in 2004 at the ICOM General Conference in Seoul (Republic of Korea). The Dutch translation of this was drawn up by a working group and discussed in the Netherlands Ethics Committee for Museums. This translation of the Code of Ethics for Museums now provides the basis for the professional ethics of the museum sector in the Netherlands.[79,72] It states in the membership conditions of the Museum Association that members are expected to abide by the Code of Ethics for Museums in all their activities. The Netherlands Register of Museums also stipulates the same condition for registered member museums.

The Dutch translation of the Code of Ethics for Museums states that this provides a means of "professional self-regulation in a number of areas where the museum has its own specific expertise and competence which is not or not sufficiently covered by national legislation". The Code sets minimum standards of professional conduct and performance for museums and members of the museum profession. The Code also lays down what the public may reasonably expect from the museum profession."

The Code contains several passages about exhibiting living organisms (see textbox: **Code of Ethics for Museums: exhibiting living organisms**).

CODE OF ETHICS FOR MUSEUMS: EXHIBITING LIVING ORGANISMS

The following passages from the Code of Ethics for Museums relate to living organisms:

- **Museums should not acquire biological or geological specimens that have been collected, sold, or otherwise transferred in contravention of local, national, regional or international law or treaty relating to wildlife protection and natural history conservation (2.6 Protected Biological or Geological Specimens).**
- **Where collections include live botanical or zoological specimens, special consideration should be given to the natural and social environment from which they are derived, as well as any local, national, regional, or international law or treaty relating to wildlife protection or natural history conservation (2.7 Living Collections).**
- **A museum that keeps living animals must assume full responsibility for their health and well-being. It should prepare and implement a safety protocol for the protection of its personnel and visitors, as well as of the animals, that has been approved by an expert in the veterinary field. Genetic modification should be clearly identifiable (2.24 Welfare of Live Animals).**

Source: Code of Ethics for Museums: Chapter 2: Museums that maintain collections hold them in trust for the benefit of society and its development.

On request the Ethics Committee for Museums can advise the Netherlands Museum Association, the Dutch ICOM Committee, the National Forum for Museum Curators, the Museum Annual Season Ticket organisation and the Dutch Federation of Museum Friends. Requests for advice may be submitted in writing to one of these organisations. In the past, for example, the committee advised on the exhibition related to the GM bovine ('Herman the Bull') and on a project 'painting goldfish'. A brief summary is provided below.

Herman the Bull: The Ethics Committee for Museums also expressed an opinion about exhibiting Herman the Bull.[80] Its opinion was that displaying the bull was in line with the code of conduct concerning the welfare of living animals that are exhibited. It further added that the value of exhibiting the animal was clear: Herman the Bull has a symbolic role in the public debate on biotechnology and is the first large mammal to have been modified with an experimental permit. However, the following was also stated: *In the context of the policy freedom of museums it is not up to the Committee to give an opinion about whether exhibiting animals actually contributes to a better understanding of biotechnology. This is a matter for the exhibition organizers.*

Painting goldfish: In 2003 the Fish Protection Society made a complaint about the exhibition policy of the Stadsmuseum Woerden. In the complainant's view, the work "Painting goldfish" in which a living goldfish was painted and filmed in its death throes on a piece of paper was animal cruelty and in breach of the law.[81,82] The artist's aim with the work was to provoke a public debate about the fate of animals in general and fish in particular. By using an individual fish he wanted to make the public think about the suffocation death of fish. In his view this was a reasonable goal. One fish was being sacrificed in order to save other fish, as is the case when preventive culling of livestock is carried out.[74] The Ethics Committee for Museums (ECM) ruled that it was not a matter for the Committee or the museum to pass judgement on the actions of the artist. It did state that the museum had underestimated the public response and should have provided a clear explanation of the artist's intentions. In its report the Ethics Committee for Museums described the role of museums as follows: the museum should protect the public from unethical and criminal behaviour, while at the same time respecting and safeguarding the authenticity of artists and artworks. The degree of protection will also depend on the museum's target group, was the recommendation made.

4.5 SOME CONCLUSIONS

- For the production of and activities with GMOs – whether microorganisms, plants or animals – a permit is required under the Chemical Substances Act (Genetically Modified Organisms (Environmental Management) Decree;
- Before this permit can be issued the application will be assessed in terms of the possible risks to humans, animals and the environment;

- Genetic modification of animals – vertebrates and invertebrates – for non-biomedical purposes is subject to a mandatory ethical assessment;
- A permit will be issued if the activities do not have any unacceptable consequences in terms of the health or welfare of animals, and where there are no ethical objections to the activities;
- For animal testing both an institutional licence as well as a project permit are required. The Experiments on Animals Act (WOD) applies to all living vertebrate animals, as well as living invertebrate species designated by government decree (AMvB);
- This legislation however does not apply to exhibitions unless one of the statutory objectives for animal testing applies;
- The use of animals in exhibitions, including GM animals or combinations of GMOs with animals is subject to Section 2.16 of the Animals Act (WD), Exhibition of animals. This states that no animals may be exhibited in which a prohibited intervention has been carried out (Section 2.8.). This concerns, among other things, interventions for which there is no veterinary need. By government decree (AMvB) the minister can make exceptions or stipulate additional rules for exhibitions with animals and interventions as referred to in Section 2.8;
- Sections 2.16 and 2.8 do not apply to embryos. These come under animal products;
- The statutory framework for GMOs and animals are mainly concerned with scientific research and animal testing;
- COGEM notes that specific niche applications of BioArt, specifically combinations of GMOs with embryos, are covered only by the GMO legislation (see Figure 3);
- This means that when deciding on whether or not to issue a permit for these applications, only environmental risk considerations can be taken into account;
- Some people consider this to be problematic, as shown by the background to this COGEM report, because these applications could raise objections or create a sense of unease in society;
- Besides the statutory framework for GMOs and animals, there are a few national and international treaties on exhibitions, such as the Convention on which ICOM Code of Ethics for Museums was based;
- The Dutch translation of the ICOM Code of Ethics for Museums states that this provides a means of "professional self-regulation in a number of areas in which the museum has its own specific expertise and competence which is not or not sufficiently covered by national legislation".

5

DEALING WITH GMOS IN EXHIBITIONS: POLICY OPTIONS

From the analysis in this report it seems that there are differing views on exhibitions in which organic materials and living organisms, in particular, are used. It appears from the previous chapter that the legislation in force takes into account most, although not all, exhibitions involving the use of GMOs, animals or embryos. Based on the statutory framework in force and assuming that there is a desire to change the present situation, this chapter describes a number of possible policy options for dealing with the use of GMOs in the context of BioArt or exhibitions, possibly in combination with animals. First of all, the main conclusions from the previous chapters will be set out and the problem analysis more narrowly defined.

5.1 OVERVIEW OF CONCLUSIONS AND PROBLEM ANALYSIS

BioArt is a form of contemporary art which is typically diverse. Living biological materials are used and processed or handled, derived from bacteria, plants, animals or the artist him or herself. As techniques which in the past were reserved for science have become more accessible, through the use of genetic modification BioArt has entered a new application field. Partly because of the controversial nature of these technologies, genetic modification brings an added dimension to working with living materials for the purpose of art. At the same time, BioArt has the potential to make biotechnology more accessible to a wider audience and to focus the existing discussion on GMOs. The reactions of the general public to BioArt exhibitions with living organisms has been mixed, ranging from interest and curiosity to objections to the use of genetic modification of organisms.

The State Secretary asked COGEM whether a distinction could be made between various purposes of exhibitions, such as art or education. COGEM has concluded that such a distinction can only be made on paper, and would not, in practice, help to find a way to deal with the objections that have been identified. If educational exhibitions were to be treated differently than BioArt, some artists would simply state that their exhibition serves an educational purpose. Besides which, different functions and effects could be attributed to projects by different parties. A bioartist may, for example, have

a particular purpose in mind for his or her work, but visitors may perceive this quite differently. It is therefore not possible to make an objective assessment of whether something is art or education in this context. COGEM notes that in Dutch society there is also a strong tradition that in a democratic society there should be no censorship of art. Although it should be stated that artists must in any event observe the legislation and other rules in force.

COGEM notes that most applications of GMOs in exhibitions are covered by the existing legislation and regulations in force. If genetic modification is to be used in animals to be exhibited then a permit must be applied for in which an ethical assessment will be carried out. There are also rules which apply to the exhibiting of animals without genetic modification, such that it is prohibited to exhibit animals in which a banned physical intervention has been carried out.

COGEM notes that specific niche applications of BioArt, specifically combinations of GMOs with embryos, are covered only by the GMO legislation. As a result only environmental risks and not ethical considerations will be included in the decision whether or not to grant a permit for such uses. Some people consider this to be problematic, as shown by the background to this COGEM report, because these applications could raise objections or create a sense of unease in society. This resistance becomes heightened where higher order organisms are used. However, this is not the only component. The specific problem lies in the combination of three elements:

PROBLEM	**GMOS + ANIMALS + EXHIBITIONS**
GMOs	**controversial topic in society**
animals	**certain species or development stages are not statutorily considered to be a test animal, but are instinctively seen as organisms warranting protection by a certain segment of society.**
exhibitions	**opinions about the relevance ('the value') of exhibitions differ greatly (as opposed to scientific purposes in which the relevance to society is less controversial).**

The State Secretary asked COGEM to make a distinction between exhibitions with GMOs in general and exhibitions of various groups of GMOs, such as bacteria, plants, animals or animal embryos, including fish. Exhibitions with GM bacteria appear to raise few objections in society. Projects with GM plants also appear to be unlikely to generate much discussion. The involvement of living animals or embryos in exhibitions, however, encounters objections, with or without genetic modification of the animal itself. The zebra fish embryos in the Errorarium of the BioSolarCells project were not genetically modified, but nevertheless led to caution on the part of the legislature.

5.2 POLICY OPTIONS

It is possible to adapt the statutory framework such that niche applications of BioArt as described in this report can be more broadly assessed than just in terms of environmental risks. Either the statutory framework for GMOs or the framework for animals would have to be amended for this. It should be noted that where statutory solutions to this problem are sought these will always be generic in nature. These solutions will, therefore, almost always have a knock-on effect on scientific or economic applications. The following sections consider three possible areas in which solutions may be found for dealing with the identified niche applications of GMOs in relation to exhibitions. The options which will be examined are:

- Maintaining the existing legislation
- Amending the statutory framework for GMOs
- Amending the statutory framework for animals

5.2.1. MAINTAINING THE EXISTING LEGISLATION

Maintaining the present legislation means that activities in which embryos are combined with GMOs can only be assessed in terms of the environmental risks. This means that any public objections to such applications will have no impact on the decision-making. Based on the conclusions of chapter 4, GMOs combined with animals will be covered by Section 2.16, Exhibition of animals of the Animals Act (WD). If the existing legislation is maintained this could create tension in that the assessment of specific niche applications of BioArt would not be considered in terms of their ethical aspects while some in society would consider that this should be the case. This tension and resistance could increase if the use of GMOs and embryos in exhibitions were to grow. Based on the principle of maintaining the present legislation, COGEM would like to point out another possibility. As indicated in **§4.3**, besides the statutory frameworks there are also treaties, conventions and codes of conduct which apply to exhibitions. If the existing legislation offers no solution and applications lead to public objections, an organisation like the Ethics Committee for Museums could play an independent role.[i]

5.2.2 AMENDING THE STATUTORY FRAMEWORK FOR GMOS

The statutory framework for GMOs could be changed to include a mandatory assessment of the public acceptability of the purpose. Given the specific nature of the niche applications of the sort addressed in this report, [this] would then only be concerned

i It should be noted that BioArt exhibitions may not always take place in the institutionalized setting of museums, but may also be held in galleries or temporary spaces without a dedicated function.

with assessing the purpose of exhibitions. On the basis of the legislation in force on GMOs it may be said that the use of GMOs for scientific purposes is accepted in society and seen as worthwhile. This is separate from market admittances for GMOs. There are regulations in force which safeguard the freedom of choice of consumers and users who hold objections to these products.
A purpose assessment could apply to GMOs for purposes other than scientific and commercial applications. The addition of a supplementary assessment would require an assessment framework. The self-regulating mechanism for museums could play a part in this. It should be noted here that applications with GM animals are already subject to ethical assessment (Section 2.23 Biotechnology permit, Animals Act) in which the genetic modification of animals for games or entertainment is prohibited. In this context it should also be noted that exhibition activities and art projects with GM plants or GM microorganisms do not appear to elicit large-scale public objections or protests.
A mandatory purpose assessment for applications other than scientific or commercial could create uncertainty and provide room for deception. As indicated, there is no clear dividing line which can be drawn between the purposes of exhibitions. An amendment of the statutory framework for GMOs further implies that the issue outlined in this report has its origins in the use of genetic modification. COGEM notes that the issue more specifically lies in the combination of the elements GMOs, animals and exhibitions (see §5.1).
Another possibility in this context is a generic ban on the use of GMOs for exhibitions. These applications however may also have a positive side, such as enabling a wider public to become acquainted with biotechnology, encouraging reflection on the benefits and drawbacks of biotechnology and inspiring scientific innovation. In the event of a general ban none of these opportunities would be given a chance. Furthermore, applications to which there is less public objection would then also be banned. In the event of a general ban there is also the matter of whether artists' freedom of expression should be curtailed in this way, which could be construed as a form of censorship.

5.2.3 AMENDING THE STATUTORY FRAMEWORK ON ANIMALS

A final option would be to change the statutory framework for activities with and the use of animals, and, in particular, animal products like embryos. It was concluded in the previous chapter that the use of animals (including GM animals or GMOs combined with animals) in exhibitions is governed by Section 2.16 Exhibition of animals of the Animals Act. Exhibitions with embryos however are not covered because these are considered to be animal products.
Changing the statutory framework for animals to be able to make a wider assessment for exhibitions with GMOs and animals than just the environmental risks, would represent either a different status for embryos or an additional assessment for the use of animal products. Such a change would also affect other applications involving embryos

besides exhibitions. This would apply to zebra fish embryos in scientific research, for example, or to the use of embryos for commercial purposes such as IVF in livestock management. For further details of what may be possible in terms of amending the statutory framework for animals, COGEM refers to the report of the Animal Welfare Council (RDA).

5.3 CONCLUSIONS

- COGEM notes that most applications of GMOs and living organisms in exhibitions and art projects are covered by the existing legislation.
- COGEM notes that highly specific niche applications of BioArt, specifically combinations of GMOs with embryos, are covered only by the GMO legislation. This means that only environmental risk considerations can be taken into account when deciding on whether or not to issue a permit for these applications. This is considered by some to be problematic;
- From the problem analysis it appears that the objections are reinforced by the particular combination of GMOs, animals and exhibitions:
  - GMOs because they are a controversial topic in society,
  - Animals because certain species or development stages are not statutorily considered to be an animal or test animal, but are instinctively seen as organisms warranting protection by a certain segment of society,
  - Exhibitions because opinions about the relevance ('the value') of exhibitions differ widely;
- If statutory solutions to this problem are sought these will always be generic in nature. These solutions will, therefore, almost always have a knock-on effect on scientific or economic applications;
- The question of what purposes genetic modification may be used for and whether and how animals should be protected are considered important in society;
- It may be possible to find a solution in the codes of conduct which apply in the professional museum arena. The Ethics Committee for Museums could play a part in this.

6

CONSIDERATIONS

Besides the policy options identified here, COGEM would like to point out the following considerations concerning permit applications in which GMOs are used for BioArt and other exhibitions, these are:

- Exhibitions in which GMOs play a part do not have to be only problematic. Various positive elements which this form of BioArt brings are also covered in this report, such as artists' fascination for experimenting with 'new' materials, enabling a wider public to become acquainted with biotechnology and inspiring scientific innovation. BioArt with genetic modification can highlight complex moral issues surrounding biotechnology and in this way make a contribution to a more thoughtful and critical debate in society by clarifying the possible boundaries of what is acceptable, specifically by challenging taboos or revealing the implications of such.

- Questions from the public on BioArt exhibitions are also concerned with who is financing projects and why. In this context COGEM wishes to point out that the government needs to be aware of the image that may be created in relation to its own role in the direct or indirect funding of BioArt exhibitions.

- The aspects that have been come to the fore in the discussion about GMOs, animals and exhibitions are also relevant to the use of animals in general for exhibitions or art projects.

- The differing views about whether animals warrant (or are worthy of) protection has an instinctive element which is not always consistent with the statutory definition of such. This sensitivity is not as such linked to the difference between vertebrate or invertebrate animals. The broader concept of warranting protection perceived by some people could point to additional, moral considerations which (at the moment) are not covered by the legislation.

- The public responses to the use of GMOs in BioArt have so far come from a small section of the public. It is unclear whether and to what extent these responses are common throughout society.

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