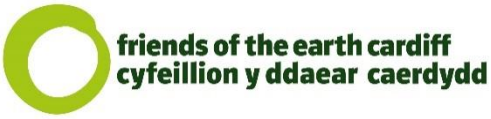

GM Team
Department for Environment, Food and Rural Affairs
2 Marsham Street
London
SW1P 4DF
Submitted by email to gm-regulation@defra.gsi.gov.uk

28 March 2018

Dear Madam/Sir

Re: Application from Rothamsted Research to release a genetically modified organism, reference 18/R8/01 as published at https://www.gov.uk/government/publications/genetically-modified-organisms-rothamsted-research-18r0801

We are writing on behalf of GM Freeze, the Soil Association, Garden Organic, the Organic Growers Alliance, OF&G, the Organic Research Centre, Shepton Farm, Future Sustainability, ACE Energy, South East Essex Organic Gardeners, the Kindling Trust, Nourish Scotland, The Biodynamic Association, Cardiff Friends of the Earth, The Corner House, The Springhead Trust, Hodmedod, Unicorn Grocery, LoopyFood.net, Banc Hadau Llambed / Lampeter Seed Library, GM Watch, GeneWatch UK, EcoNexus, Beyond GM, Mums Say No to GMOs, and GM Free Dorset to request that the above application to release genetically modified (GM) camelina is refused.

GM Freeze is the umbrella campaign for a moratorium on GM in food and farming in the UK.

The **Soil Association** is the UK's leading membership charity campaigning for healthy, humane and sustainable food, farming and land use. **Garden Organic** (formerly known as the Henry Doubleday Research Association) is the UK's leading organic growing charity with over 20,000 members throughout the UK and abroad. The **Organic Growers Alliance** supports and represents growers involved in commercial organic horticulture. **OF&G** was the first body to be approved by the government to inspect and certify organic food and farming and is now the largest certifier of organic land in the UK.

The Organic Research Centre is the UK's leading independent research centre for the development of organic/agroecological food production and land management solutions to key global issues including climate change, soil and biodiversity conservation, and food security**. Shepton Farm** in Somerset grows grass/clover, arable crops and apples. **Future Sustainability** advises on organic production, food quality and health. **ACE Energy** helps farmers to use less energy intensive methods of farming. **South East Essex Organic Gardeners** promotes the principles of organic gardening.

The **Kindling Trust** is working towards a just and ecologically sustainable society. **Nourish Scotland** is an NGO campaigning on food justice issues in Scotland. The **Biodynamic Association** is part of an inspirational international movement that promotes a uniquely holistic approach to organic agriculture, gardening, food & health. **Cardiff Friends of the Earth** works on a local level to create a just world where people and nature thrive. The **Corner House** supports democratic and community movements for environmental and social justice. The **Springhead Trust** promotes environmental education, sustainability, organic agriculture and local performing arts.

Hodmedod works with British farmers to offer a range of foods from diverse arable crops to retail, catering and manufacturing customers. **Unicorn Grocery** in Manchester has pioneered a cooperative approach to sustainable urban food supply**. LoopyFood.net** is an organic food directory promoting wholesome lifestyles. **Banc Hadau Llambed / Lampeter Seed Library** offers free locally adapted and produced open pollinated seeds to its members.

GM Watch is a news and information service that aims to keep the public up to date on issues around GM crops and foods and associated pesticides. **GeneWatch UK** monitors developments in genetic technologies from a public interest, human rights, environmental protection and animal welfare perspective. **EcoNexus** analyses developments in science and technology and their impacts on environment and society. **Beyond GM** is a creative initiative to educate and engage the public and raise the level of debate around the issues of GMOs and sustainable food production in the UK. **Mums Say No to GMOs** is a coalition of mothers and their families using consumer pressure to stop GM crops being grown and sold in the UK. **GM Free Dorset** is a grass roots campaign supported by individuals, groups, local businesses and charities that exist to promote rural sustainability.

Contact address: GM Freeze, Open Space Cooperative, 41 Old Birley Street, Hulme, Manchester M15 5RF
Tel: 0845 217 8992 **Email:** liz@gmfreeze.org **Web:** www.gmfreeze.org **Twitter:** @GMFreeze
Registered office: 50 South Yorkshire Buildings, Silkstone Common, Barnsley S75 4RJ

We do not believe that this trial should go ahead. The genetic modification and resulting novel traits represent an unacceptable risk, including to human health. The information provided by the applicant is incomplete with two GMO lines and inserts in other lines being uncharacterised. Also, significant recent evidence of possible adverse effects on non-target organisms is not considered anywhere in the application. Furthermore, should the trial proceed, and the GM camelina advance to commercial cultivation, there will be no net benefit to society. In summary, our objection covers the following points:

1. The proposed trial represents an unacceptable risk to people, non-target organisms and the wider environment
   1.1. Wax esters can induce anal oil discharge, diarrhoea and other gastro-intestinal effects in humans.
   1.2. Traits for herbicide tolerance, increased photosynthesis and changed architecture could alter the persistence of any offspring.
   1.3. There is a risk of outcrossing via seed and/or pollen dispersal and cross-hybridization.

2. The application is incomplete
   2.1. Two of the GMO lines have not been characterised.
   2.2. Molecular characterisation of the inserts is missing from the application.
   2.3. Evidence for possible adverse effects on non-target organisms is not considered.
   2.4. The applicant does not acknowledge current UK cultivation of camelina.
   2.5. The application does not appear to have been prepared with due care and attention.

3. The proposed trial is unnecessary and will be of no net benefit to society.
   3.1. No credible justification is given for this GM camelina field trial.
   3.2. The proposed trial risks turning arable land into an open-air factory for industrial compounds.
   3.3. GM pharma and industrial crops do not need to be grown outdoors.

1. THE PROPOSED TRIAL REPRESENTS AN UNACCEPTABLE RISK TO PEOPLE, NON-TARGET ORGANISMS AND THE WIDER ENVIRONMENT

1.1. Wax esters can induce anal oil discharge, diarrhoea and other gastro-intestinal effects in humans.

One of the lines of GM camelina to be field trialled produces wax esters (line 11 MaMa14-6, Part 1A, paragraph 14, pg. 12) as described in a scientific publication by the applicants[1]. The application mentions that wax esters are produced by the plant jojoba (Part IA, paragraph 13, pg. 10) but, in fact, they are more commonly associated with marine organisms[2]. In the GM camelina created for this proposed field trial, the wax esters are produced by a combination of genes from both plant and marine proteobacteria (Part AI, paragraph 12 pg. 7).

Wax esters can cause anal oil discharge, known as keriorrhea, in humans. For example, there is currently an application to the UK Advisory Committee on Novel Food Processes (ACNFP) to market as a food supplement an oil rich in wax-esters from the marine zooplankton *Calanus finmarchicus*[3]. As ACNFP[4] states: *"Mammals have a limited capacity to hydrolyse wax esters and this can result in an involuntary oil discharge from the anus (keriorrhea)*". Further, "*The [ACNFP] Committee noted that humans had a limited ability to process wax esters and questioned whether gastrointestinal side effects recorded in a clinical study were related to the composition of the oil. The applicant advised that, although adverse side effects were seen in the study in question, the number of subjects was too small to attribute these with certainty to consumption of calanus oil*".

The European Food Safety Authority (EFSA) has also commented on the adverse effects in humans produced by the ingestion of fish containing wax esters[5]. Referring to Oilfish (*Ruvettus pretiosus*) and Escolar (*Lepidocybium flavobrunneum*), EFSA[6] states "*As humans lack the ability to digest wax esters, they will pass through the gastro-intestinal system. During the passage, they may cause diarrhoea and other acute gastro-intestinal symptoms when present in sufficient amounts. The symptoms can be dramatic but are seldom long lasting.*"

It is not possible to deduce the exact level of similarity between either the wax esters in *C. finmarchicus* or those produced by Oilfish and Escolar, and those produced by the GM *camelina.* However, when referring to the Oilfish and Escloar, EFSA[7] states, "*In these wax esters, C14 - C22 fatty acids are esterified with fatty alcohols of similar chain length"*, which would give the wax esters a length in the region between C28-C44. Ruiz-Lopez et al. (2017) report a wax ester profile for GM *C. sativa* with MaMa14 (as contained in line 11 of this application, Part A1, paragraph 14, pg. 18) of between C28 and C44 length, peaking around C34. It appears, therefore, that they could be of a similar length to the wax esters in these two fish species.

It's clear that the ingestion of wax esters has the potential to cause adverse effects in humans but the applicant does not acknowledge this hazard. Indeed, they go further, stating in Part A4, pg. 10:

"*Omega-3 long chain polyunsaturated fatty acids are essential components of most vertebrates' diet, with these fatty acids widely recognised as being health-beneficial.* ***They are very widely represented in the human food chain, without any reported negative effects. This is equally true of ketocarotenoids and wax esters.*** *These compounds are present in natural food webs and do not appear to interact in a synergistic fashion.*" [bold added] and in Part 1A, paragraph 19, pg. 22 "**There are no known toxic, allergenic or harmful effects known to be associated with omega-3 long chain polyunsaturated fatty acids or astaxanthin and associated ketocarotenoids, nor wax esters**." [bold added].

It is not known whether the particular wax esters in GM camelina pose a risk to humans. Despite this, the applicant proposes growing, at field scale, a crop that, in the event of human consumption, could cause symptoms that would be distressing to anyone and potentially dangerous in vulnerable individuals. We are aware that procedures will be put in place to prevent any GM camelina grown in the proposed trial entering the human food chain. However, such measures can never be 100% guaranteed and the escape of seeds or transgene(s) is always a possibility.

Looking beyond this trial, it is also important to recognise that, even if any commercially grown GM camelina producing wax esters is intended for industrial (rather than food or feed) use, it will still have to undergo a food and feed risk assessment prior to any commercialisation. This is due to the risk of outcrossing and/or comingling with non-GM camelina intended for food or feed use and raises serious questions about the value of a field trial of a trait that may be intrinsically non-viable.

Contained experiments should be conducted to establish any food risks to humans before considering consent for these experimental GM plants to be grown in the field.

1.2. Traits for herbicide tolerance, increased photosynthesis and changed architecture could alter the persistence of any offspring.

Some of the lines (line 12, containing the GDH construct; line 13, containing GDH-PP and line 14 containing MAP22) include GM traits for enhanced plant architecture or photosynthesis. These traits may increase the competitiveness (and hence persistence) of the GM camelina in the event of an escape. The applicant assumes any change in persistence will not result in significant environmental harm, stating in Part A4:

"*In the case of the constitutively-expressed MAP and GDH genes, it is conceivable that these provide a slight metabolic advantage compared to wildtype Camelina. However, this is unlikely to be realised in the natural environment given the general performance of this crop in unmanaged systems (see (i) above*)", where (i) above states: "*C. sativa is an annual species that requires active management to out-compete more weedy plants. Left unmanaged, it does not establish well in nature and thus has a low base line of invasiveness and persistence.* ***Even if intended or unintended effects of the genetic modification resulted in major changes in invasiveness or persistence, it is considered that this would not result in significant environmental harm for agricultural or unmanaged ecosystems.*** *C. sativa is a benign plant that can be easily managed by cultivation or specific herbicides****.***" [bold added]

Any change in competitiveness, and the applicant's assumptions about potential harm, need to be validated in contained experiments before any consent to a field trial is considered.

One of the lines contains a *bar* marker gene, conferring tolerance to glufosinate herbicides. As the applicant acknowledges (Part A4), "*The bar marker gene present in three C. sativa lines described in this application provides tolerance of the broad spectrum herbicide bialaphos (also known as glufosinate). The presence of this transgene could provide a selectable advantage to the GMO.*"

No GM crops containing herbicide tolerance traits should be released into the environment. Although used as a selectable marker by the applicants, there is no guarantee that, in the event of commercial cultivation, the herbicide tolerance trait will not be utilized by farmers. This could increase the use of these herbicides and potentially lead to problems with weed resistance as has happened with glyphosate in areas where GM Roundup Ready crops are cultivated, e.g. in North America[8].

1.3. There is a risk of outcrossing via seed and/or pollen dispersal and cross-hybridization.

We wish our comments[9] regarding the risk of transgene escape made in response to the previous application for a GM camelina field trial (16/R8/01) to be taken into account. We stated "*there is a possibility for pollen and/or seed escape to the wider environment and a possibility to hybridize with camelina and capsella relatives. Such a hybridization could result in the GM trait persisting, and even introgressing into natural populations. The implications of this have not been considered or quantified but could impact on biodiversity (eg if the plant was no longer palatable to foraging animals, including insects)*".

It is not clear why nets are not being used, as in previous trials, to mitigate pollen dispersal by insects. For example, application 16/R8/01 stated "*In addition, the entire site is contained by two chain-link fences, which also serve as physical barriers to impede foraging bees. To further mitigate against pollen dispersal by insects, the GM C. sativa will be covered with netting (0.25mm fine mesh) during the flowering period to exclude any insects which could act as pollen carriers.*" Instead, for the current application, the applicants state "*Pollen dispersal be minimised through the placing of wildtype C. sativa on the external strip of the experimental plot – this will serve as a pollen-trap for pollen released from the GM C. sativa.*" Pollen dispersal could be a key route of transgene escape from the field trial.

There have now been several field trials of GM camelina, from 2014 onwards. Whilst monitoring within the trial area has taken place, the area surrounding the field trial area (both within, and outside Rothamsted Research) should be checked for any feral GM camelina that could be growing, or any hybrids with close relatives. This should be ongoing as, although the dormancy of camelina seeds is not well known, the seeds of similar brassica species such as oil seed rape are known to persist for up to 9 years in the UK[10].

It is imperative that as much precaution as possible is taken against pollen and seed escape. Camelina is already being grown in the UK (see 2.4, below), and significant expansion of this crop may be a future option for farmers. For example, in Canada, oil from non-GM camelina is finding new markets as animal feed and is advertised as a novel, profitable, crop for farmers[11]. Contamination of the UK countryside with GM camelina would destroy the viability of existing and potential future non-GM camelina cultivation in the UK. The impact of this could be particularly significant in areas that may see a reduction in rainfall as a result of climate change[12].

2. THE APPLICATION IS INCOMPLETE

2.1. Two of the GMO lines have not been characterised.

Two of the GM lines (Part A1, paragraph 34, pg. 26), 2F4-24 and A7, have been developed by the CRISPR-Cas9 genome-editing technique: "*In addition to these 17 GM lines, each block will contain a single WT control Camelina strip, and also 2 mutant alleles in which the FAD2 12-desaturase has been disrupted by CRISPR-Cas9-mediated genome editing (Morineau et al. 2017).*"

CRISPR – Cas9 has been used in this context to prevent the FAD2 12-desaturase gene from converting oleic acid to linoleic acid, allowing the oleic acid to be diverted to forming wax esters[13]. As such, it gives rise to an increase in oleic acid in vegetative parts of the plant (Part A4, pg. 8/9).

CRISPR – Cas9 is a method of direct modification of the genome, and therefore gives rise to GMOs as defined in Directive 2001/18 EC. We are aware that some of those assessing the proposed trial may be of the opinion that these lines could be exempted from the EU GMO regulations. However, the question of exemption currently lies with the European Court of Justice, which has not yet delivered a ruling on this matter. Therefore, organisms developed by techniques using the CRISPR system, in the context of this application, must be regarded as GMOs and form part of the application, i.e. with full molecular characterisation and risk assessment.

This application should be rejected and a new application presented for consideration and public consultation, including full characterisation of the two GMO lines developed using the CRISPR system and an associated risk assessment.

2.2. Molecular characterisation of the inserts is missing from the application.

There does not appear to be any molecular characterisation of the sequences actually inserted (as is required under EU law). Only a description of the intended inserts is given (Part 1A, paragraph 14, pgs 11-20). In particular, it is essential to identify the presence of any unintended fragments of the insert(s), rearrangements or deletions of the plant's DNA and whether any backbone sequences have been inadvertently transferred to the GM camelina.

This application should be rejected and a new application presented for consideration and public consultation, including full characterisation of inserts and an associated risk assessment.

2.3. Evidence for possible adverse effects on non-target organisms is not considered.

Shortly after DEFRA granted consent to the last GM camelina trial (16/R8/01), a new scientific publication (Hixson et al. 2016)[14] concluded that the presence of long chain polyunsaturated fatty acids (LC-PUFA) in the diets of the larval stages of *Pieris rapae* (small cabbage white) could alter adult mass and wing morphology. The research implies that the production of LC-PUFA, such as the eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) in the GM camelina, could potentially pose a threat to non-target invertebrates such as Lepidoptera (butterflies and moths). However, consideration of this risk to non-target organisms is wholly absent from the application. Instead, a suite of untested assumptions is presented:

(Part A4, pg. 8/9) "*There are no obvious mechanisms that could result in a change in behaviour of non-target organisms as a result of exposure to omega-3 long chain polyunsaturated fatty acids and/or ketocarotenoids, or wax esters, retained and compartmentalised in the seeds of the GMHP.*

"Alterations to vegetative tissue chemical composition might increase or decrease attractivity to organisms such as insects, though such changes are likely to very [sic.] *minor and indirect.*

"Increased vegetative levels of oleic acid are unlikely to modify interactions between GMHP plants, comparators and non-plant organisms such as insects. Oleic acid is ubiquitous in all niches and ecosystems."

Part A1, paragraph 22, pg. 23 "*There are no obvious mechanisms that could result in a change in behaviour of non-target organisms as a result of exposure to omega-3 long chain polyunsaturated fatty acids and/or ketocarotenoids.*"

In a comment[15] issued on 25 April 2016, the applicant stated that "*Rothamsted Research is very interested in and takes into serious consideration the findings of the Hixson et al, 2016 study.*" Also that "*Rothamsted Research scientists have discussed with Hixson et al. 2016 the development of collaborative projects to design research experiments to address the above questions*". We find it astonishing, therefore, that the application makes no reference at all to this study.

Shortly after the study was published, ACRE published advice[16] that "*The small scale of the Camelina field trial* [16/R8/01] *means that the levels of exposure to phytophagous insects will be relatively low. In this case, the expression of the additional genes is under the control of seed specific promoters, so the levels of exposure for leaf-feeders will be negligible. Whilst potential dosage levels will clearly be higher in the seeds, exposure of seed feeders is likely to be very low due to the size of the trial.*"

Now that a new trial has been proposed, there are several considerations that need to form part of the risk assessment:

a) The publication by Hixson et al (2016)[17] highlights the potential for compounds not normally present in the diet of organisms to produce adverse effects. This is relevant to all GM crops producing novel compounds. A meaningful risk assessment should, therefore, include a range of non-target species representing all the different functional groups at each level of the food chain. For example, a consideration of what organisms might consume GM camelina seed and whether the presence of novel compounds poses any risk to them.

b) The applicant states that some lines of the GM camelina will "*accumulate chain wax esters in their seeds*" (Part A1, paragraph 13, page 10). These compounds are not normally present in the diet of organisms that may consume the seeds so their potential impact on non-target species should be assessed.

c) The monitoring programme should ensure that levels of LC-PUFA in vegetative tissue, such as leaves, are clearly reported so that any deviation in concentration over the growing season and/or during periods of stress (e.g. drought) is identified and investigated.

d) The risk to non-target organisms posed by monounsaturated oleic acid in the leaves and roots of GM camelina in the lines produced by CRISPR-Cas9 needs to be assessed as "*Two reference lines in which the FAD2 12-desaturase has been mutated by genome editing have an increased level of oleic acid in all tissues"* (Part A4, pg. 8/9). The applicant simply states: "*Increased vegetative levels of oleic acid are unlikely to modify interactions between GMHP plants* [sic.]*, comparators and non-plant organisms such as insects. Oleic acid is ubiquitous in all niches and ecosystems*". However, any risk the increased oleic acid might pose to non-target organisms, both above and below ground, needs to be evaluated prior to any consideration of a GM field trial.

2.4. The applicant does not acknowledge current UK cultivation of camelina.

The application states (Part A1, paragraph 7, page 3) "*C. sativa is grown as a crop in Canada and the Great Plains states (e.g. Montana, Nebraska) of the USA".* This implies strongly that camelina is not currently cultivated in the UK which is untrue. Non-GM *C. sativa* is currently being cultivated by Fairking Ltd[18] and supplied by Hodmedod Ltd[19]. This trial should not proceed until the potential impact on businesses growing or supplying camelina has been assessed.

2.5. The application does not appear to have been prepared with due care and attention.

The proposed trial is the latest stage of a long term 'flagship' project at Rothamsted Research so has presumably been planned for some time. However, we noticed a number of careless errors that suggest the application has been submitted in haste. The period of the proposed trial is stated as two years in paragraph 26 of Part A1 and three years in paragraph 31 of same document. The list of existing GM trial consents held by the applicant (paragraph 25, Part A1) omits their latest consent, 16/R8/02. Although these errors may not be considered material to the application itself, their presence in such important documentation, combined with the tight turnaround between the closure of the statutory public consultation period (8 April 2018) and the applicant's proposed schedule (sowing in April or May), suggests that the application may have been put together without due care and attention. This raises concerns about the accuracy of other details included in the application.

3. THE PROPOSED TRIAL IS UNNECESSARY WILL BE OF NO NET BENEFIT TO SOCIETY

3.1. No credible justification is given for this GM camelina field trial.

The claimed benefits of GM production of EPA, DHA and astaxanthin do not hold water. The applicant argues that a deliberate release of GM camelina producing EPA, DHA and astaxanthin is required on sustainability grounds. Principally, that people require fish containing these compounds for adequate health and nutrition, and that the fish they consume are fed these compounds from marine sources which are becoming depleted by current aquaculture practices.

Despite many claims to the contrary, there is no conclusive evidence of health benefit from omega-3 fatty acid supplementation and some evidence of potential harm[20]. Even if we accept the premise that higher EPA and DHA consumption will lead to better health, it does not follow that these fatty acids must be obtained by eating fish.

Studies report that vegetarians have heart health that is equal to or better than non-vegetarians.[21] Wild fish accumulate the compounds under consideration by consuming marine algae. Indeed, EPA, DHA and astaxanthin are all already commercially available as human food supplements derived from algae[22]. Omega 3 fatty acids (including EPA and DHA) are also available from meat and dairy sources (especially those from organic or other pasture-fed livestock[23]) and humans are able to synthesise EPA and DHA from shorter chain omega 3 sources in plants. These include new plant sources, such as oil from the Ahiflower (*Buglossoides arvensis*) which has recently been launched in the UK[24] and whose omega-3 oils can be converted to EPA.

Astaxanthin is classified as a food dye used in aquaculture to give farmed fish an appearance similar to their wild-caught relatives. Synthetic astaxanthin is currently used in the aquaculture industry and a recent economic evaluation[25] suggested that it could be produced at a lower cost from algae using current technologies. Similarly, the potential for microalgae to be used as a feed for aquaculture has received much attention from the research community and shows potential to have a smaller resource footprint than traditional fish feed.[26]

GM camelina is neither the only nor, in all likelihood, the most economical, solution to reducing the use of fish oil as a feed in aquaculture. In contrast it possibly entails the most risk in terms of the environment and human health. Any escape of GM camelina seeds or pollen would be extremely difficult to recall and possibly irreversible. It is not worth the risk of a release.

Growing GM plants to provide micronutrient, and cosmetic, additives for the diets of animals reared for human consumption is not likely to ever create a truly sustainable food system. The applicant states, in a report published on their own website[27], that "*we would hope to see the bulk volume of 1m MT of fish oils that are harvested from seas matched by a similar amount produced on land by our GM Camelina*". However, we have been unable to find any analysis of the anticipated environmental or agricultural impact of devoting the required area of prime arable land to produce this level of output.

3.2. The proposed trial risks turning arable land into an open-air factory for industrial compounds.

This proposed trial includes a wide variety of both related and unrelated GM traits. The prospective use of the omega 3 "fish oils" and associated food colouring are discussed in detail on the applicant's website but the motivation for using camelina plants to produce wax esters, or the need to improve camelina's architecture and productivity, is not expanded upon beyond a very brief and generic description.

What the lead researcher does say, in a press release announcing this application,[28] is that they are "using camelina as a chassis". We are concerned that, rather than supporting the Secretary of State's stated aims[29] of "a more rational, and sensitive agricultural policy which promotes environmental enhancement, supports profitable food production and contributes to a healthier society", this trial risks turning arable land that should be producing high quality food for direct human consumption into an open-air factory for industrial compounds.

3.3. GM pharma and industrial crops do not need to be grown outdoors.

The production of LC-PUFA in a GM plant intended as a feed supplement renders it a GM pharma crop. The production of wax esters renders it a GM industrial crop. As they are of high value, both GM pharma and GM industrial crops can be grown in glasshouses, under conditions for contained use of GMOs. There is no reason for these plants to be grown in an open-air environment, with all the risks of GM contamination of both agricultural crops and wild plant relatives.

The proposed trial represents an unacceptable risk for people, wildlife and the wider environment. The application raises many questions that remain unanswered. It will not bring any net benefit for society and, should the crops to be trialled ever reach commercial cultivation, is likely to cause significant net harm. We request, therefore, that the Minister denies consent and prevents this open-air field trial from going ahead.

Yours faithfully

Liz O'Neill Director **GM Freeze**	Helen Woodcock Director **The Kindling Trust**	Pete Ritchie Executive Director **Nourish Scotland**	James Campbell Chief Executive **Garden Organic**	Dr Ricarda Steinbrecher Co-Director **Econexus**
Jane O'Meara Spokesperson **GM Free Dorset**	Dr Helen Wallace Director **GeneWatch UK**	Honor Eldridge Policy Officer **Soil Association**	Roger Kerr Chief Executive **OF&G**	Debbie Clarke Co-Operative Member **Unicorn Grocery Ltd**
Roger Hitchings Chair **Organic Growers Alliance**	Adrian Patch Director **LoopyFood.net**	Claire Robinson Editor **GM Watch**	Sally Beare Campaigner **Mums Say No to GMOs**	Lawrence Woodward OBE Director **Future Sustainability**
Pat Thomas Director **Beyond GM**	Carole Shorney Secretary **South East Essex Organic Gardeners**	Mike Pitt Coordinator **Cardiff Friends of the Earth**	Edward Parker Trust Manager **The Springhead Trust**	Lee Smith Managing Director **ACE Energy Ltd**
Oliver Dowding Farmer **Shepton Farms Limited**	Lynda Brown Director **The Biodynamic Association**	Nicholas Hildyard **The Corner House**	Cathy Streeter Founder **Banc Hadau Llambed / Lampeter Seed Library**	Nick Saltmarsh Managing Director **Hodmedod Ltd**
Dr Bruce Pearce Deputy Director Programmes **The Organic Research Centre**				

[1] Ruiz-Lopez, N., Broughton, R., Usher, S., Salas, J.J., Haslam, R.P., Napier, J.A. & Beaudoin, F. 2017. Tailoring the composition of novel wax esters in the seeds of transgenic *Camelina sativa* through systematic metabolic engineering. Plant Biotechnology Journal 15: 837-849.

[2] Ruiz-Lopez, N., Broughton, R., Usher, S., Salas, J.J., Haslam, R.P., Napier, J.A. & Beaudoin, F. 2017. Tailoring the composition of novel wax esters in the seeds of transgenic *Camelina sativa* through systematic metabolic engineering. Plant Biotechnology Journal 15: 837-849.

[3] ACNFP (Advisory Committee on Novel Food and Processes) 2016. *Calanus finmarchicus* oil. EC No. 133. https://acnfp.food.gov.uk/committee/acnfp/assess/fullapplics/calanusfinmarchicusoil

Contact address: GM Freeze, Open Space Cooperative, 41 Old Birley Street, Hulme, Manchester M15 5RF
Tel: 0845 217 8992 **Email:** liz@gmfreeze.org **Web:** www.gmfreeze.org **Twitter:** @GMFreeze
Registered office: 50 South Yorkshire Buildings, Silkstone Common, Barnsley S75 4RJ

[4] ACNFP (Advisory Committee on Novel Food and Processes) 2016. *Calanus finmarchicus* oil. EC No. 133. https://acnfp.food.gov.uk/committee/acnfp/assess/fullapplics/calanusfinmarchicusoil

[5] EFSA (European Food Safety Authority) 2004. Opinion of the Scientific Panel on Contaminants in the Food Chain on a request from the Commission related to the toxicity of fishery products belonging to the family of *Gempylidae*. (Question N° EFSA-Q-2004-016). The EFSA Journal 92: 1-5.

[6] EFSA (European Food Safety Authority) 2004. Opinion of the Scientific Panel on Contaminants in the Food Chain on a request from the Commission related to the toxicity of fishery products belonging to the family of *Gempylidae*. (Question N° EFSA-Q-2004-016). The EFSA Journal 92: 1-5.

[7] EFSA (European Food Safety Authority) 2004. Opinion of the Scientific Panel on Contaminants in the Food Chain on a request from the Commission related to the toxicity of fishery products belonging to the family of *Gempylidae*. (Question N° EFSA-Q-2004-016). The EFSA Journal 92: 1-5.

[8] Green, J.M. 2016. The rise and future of glyphosate and glyphosate-resistant crops. Pest Management Science doi: 10.1002/ps.4462.

[9] GM Freeze et al. 2016. Multi-agency response to GM camelina trial 16_R8_01 https://www.gmfreeze.org/publications/defra-multi-agen…a-trial-16_r8_01/

[10] Lutman, P.J.W., Berry, K., Payne, R.W., Simpson, E., Sweet, J.B., Champion, G.T., May, M.J., Wightman, P., Walker, K. & Lainsbury, M. 2005. Persistence of seeds from crops of conventional and herbicide tolerant oilseed rape (Brassica napus). Proceedings of the Royal Society B 272: 1909-1915.

[11] http://www.smartearthseeds.com/

[12] Zhu, L-H., Krens, F., Smith, M.A. et al. 2016. Dedicated industrial oilseed crops as metabolic engineering platforms for sustainable industrial feedstock production. Scientific Reports 6:22181 | DOI: 10.1038/srep22181.

[13] Zhu, L-H., Krens, F., Smith, M.A. et al. 2016. Dedicated industrial oilseed crops as metabolic engineering platforms for sustainable industrial feedstock production. Scientific Reports 6:22181 | DOI: 10.1038/srep22181.

[14] Hixson, S.M., Shukla, K., Campbell, L.G., Hallett, R.H., Smith, S.M., Packer, L. & Arts, M.T. 2016. Long-chain omega-3 polyunsaturated fatty acids have developmental effects on the crop pest, the cabbage white butterfly *Pieris rapae.* PLoSONE 11:e0152264. doi:10.1371/journal.pone.0152264.

[15] Rothamsted Research 2016. Rothamsted Research comments on the recent study by Hixson et al. 2016 demonstrating that long-chain omega-3 polyunsaturated fatty acids have developmental effects on the crop pest, the cabbage white butterfly *Pieris rapae*. https://www.rothamsted.ac.uk/sites/default/files/project-files/Comment%20on%20Hixson%20et%20al.%202016.pdf

[16] ACRE (Advisory Committee on Releases to the Environment) 2016. Advice on new research investigating the effect of adding long chain polyunsaturated acids (LC-PUFAs) to the diet of a lepidopteran insect. https://www.gov.uk/government/publications/acre-advice-research-on-the-effect-of-adding-long-chain-polyunsaturated-acids-to-the-diet-of-cabbage-white-butterflies

[17] Hixson, S.M., Shukla, K., Campbell, L.G., Hallett, R.H., Smith, S.M., Packer, L. & Arts, M.T. 2016. Long-chain omega-3 polyunsaturated fatty acids have developmental effects on the crop pest, the cabbage white butterfly *Pieris rapae.* PLoSONE 11:e0152264. doi:10.1371/journal.pone.0152264.

[18] http://www.fairking.co.uk/index.php/speciality-crops/camelina

[19] https://hodmedods.co.uk/collections/seeds

[20] Hooper, L., Thompson, R.L., Harrison, R.A. et al. 2006. Risks and benefits of omega 3 fats for mortality, cardiovascular disease, and cancer: systematic review. British Medical Journal 332: 752–760.

Rizos E.C., Ntzani E.E., Bika E., Kostapanos M.S. & Elisaf M.S. 2012. Association between omega-3 fatty acid supplementation and risk of major cardiovascular disease events: A systematic review and meta-analysis. Journal of American Medical Association, 308: 1024–1033.

Contact address: GM Freeze, Open Space Cooperative, 41 Old Birley Street, Hulme, Manchester M15 5RF
Tel: 0845 217 8992 **Email:** liz@gmfreeze.org **Web:** www.gmfreeze.org **Twitter:** @GMFreeze
Registered office: 50 South Yorkshire Buildings, Silkstone Common, Barnsley S75 4RJ

Fezeu, L. K., Laporte, F., Kesse-Guyot, E., Andreeva, V. A., Blacher, J., Hercberg, S. & Galan, P. 2014. Baseline plasma fatty acids profile and incident cardiovascular events in the SU.FOL.OM3 trial: the evidence revisited. PLoS ONE, 9: doi:10.1371/journal.pone.0092548.

Kwak, S.M., Myung, S.-K., Lee, Y.J., Seo, H.G. & Korean Meta-analysis Study Group 2012. Efficacy of omega-3 fatty acid supplements (eicosapentaenoic acid and docosahexaenoic acid) in the secondary prevention of cardiovascular disease: a meta-analysis of randomized, double-blind, placebo-controlled trials. Archives of Internal Medicine 172: 686–694.

Chowdhury, R., Warnakula, S., Kunutsor, S. et al. 2014. Association of dietary, circulating, and supplement fatty acids with coronary risk: a systematic review and meta-analysis. Annals of Internal Medicine, 160: 398–406.

Brasky T.M., Darke A.K., Song X. et al. 2013. Plasma phospholipid fatty acids and prostate cancer risk in the SELECT trial. Journal of the National Cancer Institute 105: 1132–1141.

Brasky T.M., Till C., White E., Neuhouser, M.L., Song, X., Goodman, P., Thompson, I.M., King, I.B., Albanes, D. & Kristal, A.R. 2011. Serum phospholipid fatty acids and prostate cancer risk: results from the prostate cancer prevention trial. American Journal of Epidemiology 173: 1429–1439.

Chua M.E., Sio M.C.D., Sorongon M.C. & Morales M.L. Jr. 2013. The relevance of serum levels of long chain omega-3 polyunsaturated fatty acids and prostate cancer risk: a meta-analysis. Canadian Urology Association Journal 7: E333–343.

[21] Dinu, M., Abbate, R., Gensini, G. F., Casini, A., & Sofi, F. 2017. Vegetarian, vegan diets and multiple health outcomes: a systematic review with meta-analysis of observational studies. Critical Reviews in Food Science and Nutrition 57: 3640-3649.

[22] For example http://www.nordicnaturals.com/en/Products/Product_Details/514/?ProdID=1649 and http://www.devanutrition.com/vegan-astaxanthin-4mg.html

[23] Średnicka-Tober, D. Barański, M., Seal, C. et al. 2016. Composition differences between organic and conventional meat: a systematic literature review and meta-analysis. British Journal of Nutrition 115: 994–1011.

Średnicka-Tober, D. Barański, M., Seal, C. et al. 2016. Higher PUFA and n-3 PUFA, conjugated linoleic acid, α-tocopherol and iron, but lower iodine and selenium concentrations in organic milk: a systematic literature review and meta- and redundancy analyses. British Journal of Nutrition 115: 1043–1060.

[24] Farming Today 2015. Novel crop launched in the UK. http://www.bbc.co.uk/news/science-environment-34464582 7th October 2015 and http://ahiflower.com/the-plant/

[25] Lia, J., Zhu, D., Niu, J., Shen, S. & Wang, G. 2011. An economic assessment of astaxanthin production by large scale cultivation of *Haematococcus pluvialis*. Biotechnology Advances 29: 568–574.

[26] Taelman, S.E., De Meester, S., Roef, L., Michiels, M. & Dewulf, J. 2013. The environmental sustainability of microalgae as feed for aquaculture: a life cycle perspective. Bioresource Technology 150: 513–522.

[27] https://www.rothamsted.ac.uk/projects/omega-3-camelina-development#DETAIL-1

[28] https://www.rothamsted.ac.uk/news/gm-field-trial-planned (21st February 2018.)

[29] DEFRA (Department for Environment, Food and Rural Affairs) 2018. Health and Harmony: the future of food, farming and the environment in a Green Brexit, DEFRA Command Paper Cm 9577. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/684003/future-farming-environment-consult-document.pdf