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Commission on Science and Technology for Development

Study Guide

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Letter from the chairs

Distinguished Delegates,

We are delighted to welcome you to KAMUN2018, and to your committee, the Commission on Science and Technology for Development. We are Feline Waschneck and Bruno Striebel your chairs. We will guide you through what promises to be exciting debates on a very intriguing topic. But before we start with the topic, we would like to introduce ourselves to you:

Feline is from Northern Germany and currently a second-year undergraduate in International Relations at the TU Dresden. She gathered her first MUN experiences during her time at high school in various MUNs throughout Europe. This year, she helped organising elbMUN in Dresden. She is very much looking forward to having another unique, fun, and memorable MUN experience with you!

Bruno is from Southern Germany and studying law in his third year at the beautiful city of Lisbon. He did his first 2 years in Konstanz, Germany where he served as Vice President of the United Nations Association Konstanz e.V. and hosted the KonMUN 2018 as Secretary General. After having participated at several MUN´s such as Harvard World MUN 2017 and 2018 it is the first time for him to "switch sides" and guide the committee through the conference as a chair. He is looking forward to have a great weekend full of debates, experiences and new friends and to get to know you!

We expect all of you to prepare the topic and especially to find out your countries position. With the studyguide we are trying to give you a basis for further research and to emphasize which topics we would especially like to be discussed in the committee sessions. However this study guide does only provides a broad overview of the topic and further research is necessary. Every delegate should deliver a position paper, illustrating their countries position in matters of the topic. This is inevitable for a sufficient research and also to be considered for an award.

We are looking forward to meet all of you in Karlsruhe and are sure that we are going to experience a great weekend together.

Yours sincerely,
Bruno and Feline

A. Introduction to the Structure and Mandate of the CSTD

I. Legal Foundation and Structure

The Commission on Science and Technology for Development is a subsidiary body of the Economic and Social Council (ECOSOC). It was established in 1992 in the General Assembly's resolution 46/235.

The CSTD consists of 43 members with a mandate of four years, meeting annually. Those members are experts suggested by their respective governments. The present distribution of seats is as follows: eleven members nominated by African countries, nine members nominated by Asian countries, eight members nominated by Latin American and Caribbean States, five members nominated by Eastern European States and ten members nominated by Western European and other States.

II. Mandate and Work

The CSTD reports to the ECOSOC with policy options and recommendations. Its main tasks are the analysis and the development of recommendations of current, important issues. This enables ECOSOC and the General Assembly to agree on actions and common policies. More specifically, the Commission assesses progress of the implementation of the various outcomes of the decisions of the General Assembly on both regional and international levels. In addition, it is a forum of exchanging useful practices or examining questions concerning scientific and technological issues.

III. Competences

Reports of the CSTD are naturally not binding under international law. They are passed to the ECOSOC, which collects reports from its sub-organisations and accepts resolutions that often have broad consensus. In order to become legally binding, those resolutions must be passed by the General Assembly.

IV. Further Reading

ECOSOC Resolutions related to Science and Technology for Development: http://unctad.org/en/Pages/CSTD/ECOSOC-Resolutions.aspx

ECOSOC Decisions related to CSTD:

http://unctad.org/en/Pages/CSTD/ECOSOC-Decisions.aspx

GA Resolutions related to Science and Technology for Development:

http://unctad.org/en/Pages/CSTD/GA-Resolutions.aspx

B. Introduction to the method *CRISPR/Cas9*

I. Introduction to the method *CRISPR/Cas9*

1. Broad Explanation

The two scientists Emmanuelle Charpentier and Jennifer Doudna published their findings on using *CRISPR/Cas9* in bacterial cells, while another scientist, Feng Zhang, transferred this method on other types of cells, too. In 2015/2016, *CRISPR/Cas9* gained broad media attention because it was used more widely, for example by a group of Chinese scientists on embryonic cells. When using *CRISPR/Cas9*, one can modify the genome of a cell.

The first step is the insertion of the CRISPR/Cas 9-DNA-sequence/protein complex into the cell. After it attached itself to the site of the gene one wishes to modify, it induces a targeted double strand DNA break, which means that both strands of the DNA are cut. Depending on the aim of the experiment, one can either cut out a gene with this technique or introduce a new one to the genome. Thus, one can determine the function of a gene or change certain characteristics in an organism.

A so-called *Guide-RNA* is part of the CRISPR/Cas9-DNA-sequence/protein complex. This RNA is used to find the gene that is supposed to be deleted or to find the location where a new gene is supposed to be inserted. The *Cas9-protein* then cuts both DNA strands. Every cell has its own repair mechanism, which then tries to repair the induced cut. Depending on

the aim (and the success) of the experiment, a DNA section is either deleted, changed, or inserted.[1]

A natural mutation works similarly, the only difference being that it is not targeted.

This method might be helpful in crop seed enhancement as one could change specific characteristics thanks to the specific site one can target. Other uses include the medical sector (e.g. different forms of therapy) or animal breeding (e.g. cows giving more milk).

2. Research and Current Development

CRISPR/Cas9 has been adopted readily in current research projects, due to its (cost-)efficiency and controllability. In order to achieve useful progress (see examples below), more time and research is needed.

One of the co-discoverer of *CRISPR/Cas9*, Jennifer Doudna, is currently working on using this gene editing tool to find and develop new, more efficient drugs. With this technique, medicine can be made much more target-specific, as the *Guide RNA* is very specific.

Emmanuelle Charpentier, who published with Doudna, has become the director of the "Emmanuelle Charpentier Lab", a Max Planck Unit for the Science of Pathogens, of the Max Planck Institute for Infection Biology in Berlin. There, her and her team are carrying out research about numerous *CRISPR/Cas9*-related areas like Regulatory small RNAs and RNases or Toxin-Antitoxin Systems.[2]

II. (Possible) Use of *CRISPR/Cas9* in Agriculture

CRISPR/Cas9 can be used in agriculture for numerous aims. Examples are adding certain nutrients to certain crops (e.g. Golden Rice), or increasing the efficiency of crops.

A world-wide problem is Vitamin A deficiency. This is partly tackled by the cultivation of so-called *Golden Rice*. This variety of rice was not produced *CRISPR/Cas9*, but it would be possible to achieve something similar with the latter method.

Golden Rice includes beta-carotene, which can be converted to Vitamin A by the human body. As of now, it is not completely known whether this process can take place in badly undernourished bodies. It would, however, be a success if this is the case.

As of right now, there are many experiments about altering plants to increase their taste, efficiency, nutritional values, or resistance. Tomatoes are altered to enhance flavour, sugar content, or aroma; while the melanin content of certain mushrooms is reduced. Wheat is made resistant to powdery mildew disease and corn is edited against droughts.[3]

While such changes are scientifically possible, a hurdle is the question on how to handle *CRISPR/Cas9* legally, see below. This method is something new and thus, there are discussions about how ethical it is to use it or how the modified products are to be labelled.

III. (Possible) Use of *CRISPR/Cas9* in Medicine

CRISPR/Cas9 is used in the treatment of diseases but also in medical research areas, in order to fully understand a certain genetic or epigenetic disease.

Jennifer Doudna, one of the scientists who discovered CRISPR/Cas, is involved in research about how this method can help discovering useful drugs. As one of the characteristics of CRISPR/Cas9 is that one can target the genes one would like to activate or inhibit, more understanding about the genes causing certain diseases is gained. Thus, it has become easier to identify targets for potential drugs.[4]

Concerning the understanding of certain genetic diseases, the following examples are given:

1. Cancer

The cause for cancer is, in most cases, a mutation in the so-called oncogenes. Those genes are responsible for cell growth. Their antagonists are tumour suppressor genes, and usually, there is a balance between the effects of both genes. In case of a mutation in oncogenes, the cell grows and multiplies much quicker. In case of malignant tumours, the affected cells grow into the tissue surrounding it, use the lymphatic and the blood system, and so-called metastases spread throughout the body.[5]

In this example, CRISPR/Cas9 can be used in two different ways. Firstly in order to find out more about the causes of the mutations that lead to cancer and secondly by editing tumour suppressor genes or mutated oncogenes. If more research is done on the first possibility, for

example by cancer modelling using the CRISPR system, one could detect cancerous cells more easily and, as mentioned, find out more about the causes of the mutations.

As the mutation of oncogenes leads to this illness, one could try to induce a "backwards mutation" by introducing a *CRISPR/Cas9 complex* into the infected cells that changes the mutation back to its former, non-mutated form. One could insert a different *CRISPR/Cas9 complex* that induces a mutation of the tumour suppressor genes, making the latter more active, thus achieving a balance between oncogenes and tumour suppressor genes again.[6]

2. HIV

The human immunodeficiency virus attacks the T cells in a human body. By damaging and destroying these cells, the virus makes the infected patients more prone to other infections and diseases. The latter are called opportunistic infections. The patient's immune system is weakened considerably. If detected early enough, HIV medicine is given to stop the process of getting AIDS. If left untreated, the illness can be fatal.[7]

Scientists of the McGill University AIDS Centre in Canada have experimented with cutting the viral DNA (of the HI virus) inside the host cell. As is the usual process, the host cell then induced a reparation of the damaged DNA. This does work, however, there are some flaws to it. An example is that the repaired sequence obviously has a different form and can thus not be attacked again, in case the reparation was not fully successful.[8]

3. Malaria

Malaria is a disease transmitted by mosquitos. Different parasites (to be precise: plasmodia), like plasmodium falciparum or plasmodium vivax, are the ones that cause malaria. They are carried by female anopheles mosquitos and enter the human body by insect bites. When they arrive in the liver, they multiply and are released into the blood circle. Once there, the plasmodia enter the red blood cells and cause the latter to explode. Thus, the human organs receive gradually less oxygen, which, if untreated, leads to organ failure, coma, and possibly to death.[9]

Researchers have experimented with injecting engineered DNA that are transcribed to antibodies in the mosquito that attack the plasmodia inside the insect – so they did not change the plasmodia itself directly but found a way to introduce a resistance. In test conditions, this

process worked really well and the engineered DNA was inherited with a success percentage of 99.5%.[10]

IV. Possible Use of *CRISPR/Cas9* in Developing Countries

The method *CRISPR/Cas9* is, compared to other Genome Editing techniques, comparably inexpensive and cost effective. It is relatively easy and quick to implement and works comparably precisely. In addition, it is possible to not only change one gene but numerous genes at the same time.

There are numerous possible uses of *CRISPR/Cas9*, especially in developing countries. Challenges faced by the latter include malnutrition, diseases, and hunger; sometimes harsh climate conditions. All these could be addressed by using CRISPR/Cas.

As mentioned before, crops can be genetically modified to contain different genes encoding different vitamins or other components of nutritional value. Another possibility could be to increase the density of nutrients.

A quicker drug discovery could be hoped for, too. As the method *CRISPR/Cas9* is relatively cost-effective, new drugs could become more accessible. This is especially important for diseases like HIV (95% of all cases occur in developing countries[11]) and malaria infections (90% occur in sub-Saharan Africa[12]). Here, not only new, improved, and more effective drugs are helpful, but also the enhanced understanding of these diseases. This is something that could help achieving the third Sustainable Development Goal “Good Health and Well-Being”.[13]

There could be progress in reducing hunger. Crops could be edited to be more stable in extreme conditions, while the genes of livestock could be changed to gain more animal products, like milk or meat. It could help achieving the second Sustainable Development Goal “Zero Hunger”.[14]

Ethical concerns can be raised here.

Concerning the last challenge given as an example, certain crops could be edited to become more resistant to extreme droughts or to become better adapted to different climate zones. As has happened with wheat already, it is possible to introduce a resistance against certain parasites or damaging fungi, which could prevent crop shortfalls.

[1] https://www.transgen.de/lexikon/1845.crispr-cas.html
[2] https://www.emmanuelle-charpentier-lab.org/
[3] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5682324/
[4] https://www.nature.com/articles/d41586-018-02477-1
[5]https://www.krebsgesellschaft.de/onko-internetportal/basis-informationen-krebs/basis-informationen-krebs-allgemeine-informationen/wie-krebs-entsteht.html
[6] https://www.tandfonline.com/doi/full/10.1080/13102818.2017.1406823
[7] https://www.hiv.gov/hiv-basics/overview/about-hiv-and-aids/what-are-hiv-and-aids
[8] https://www.tandfonline.com/doi/full/10.1080/13102818.2017.1406823
[9] https://www.planet-wissen.de/gesellschaft/krankheiten/malaria/
[10] https://www.tandfonline.com/doi/full/10.1080/13102818.2017.1406823
[11] https://www.unfpa.org/publications/state-world-population-2002
[12] www.rbm.who.int/cmc_upload/0/000/015/372/RBMInfosheet_1.htm
[13] https://sustainabledevelopment.un.org/sdg3
[14] https://sustainabledevelopment.un.org/sdg2

C. Risks, restrictions and legislation

Risks of the Crispr/ Cas9 method

Germline edits and somatic cells

A distinction regarding possible threats due to the use of Crispr/ CAS 9 has to be made between germline edits and the use of somatic cells. Germline modifications are genetic changes that would be in every cell of a resulting baby and be passed onto future generations. Somatic cell gene therapies affect only the treated individual, not future offspring.

In 2015, the National Academies of Sciences, Engineering, and Medicine, a private, nonprofit institution published a statement at an international summit on human gene editing also addressing the use of germline modifications:

„Gene editing might also be used, in principle, to make genetic alterations in gametes or embryos, which will be carried by all of the cells of a resulting child and will be passed on to subsequent generations as part of the human gene pool. Examples that have been proposed range from avoidance of severe inherited diseases to ‘enhancement’ of human capabilities. Such modifications of human genomes might include the introduction of naturally occurring variants or totally novel genetic changes thought to be beneficial.

Germline editing poses many important issues, including: (i) the risks of inaccurate editing (such as off-target mutations) and incomplete editing of the cells of early-stage embryos (mosaicism); (ii) the difficulty of predicting harmful effects that genetic changes may have under the wide range of circumstances experienced by the human population, including

interactions with other genetic variants and with the environment; (iii) the obligation to consider implications for both the individual and the future generations who will carry the genetic alterations; (iv) the fact that, once introduced into the human population, genetic alterations would be difficult to remove and would not remain within any single community or country; (v) the possibility that permanent genetic 'enhancements' to subsets of the population could exacerbate social inequities or be used coercively; and (vi) the moral and ethical considerations in purposefully altering human evolution using this technology.

It would be irresponsible to proceed with any clinical use of germline editing unless and until (i) the relevant safety and efficacy issues have been resolved, based on appropriate understanding and balancing of risks, potential benefits, and alternatives, and (ii) there is broad societal consensus about the appropriateness of the proposed application. Moreover, any clinical use should proceed only under appropriate regulatory oversight. At present, these criteria have not been met for any proposed clinical use: the safety issues have not yet been adequately explored; the cases of most compelling benefits are limited; and many nations have legislative or regulatory bans on germline modification. However, as scientific knowledge advances and societal views evolve, the clinical use of germline editing should be revisited on a regular basis."[3]

2. Eugenics and Designer Babys

Furthermore, germline editing could lead to greater social inequalities and also to the attempt of improving a population by controlled breeding to increase the occurrence of desirable heritable characteristics – eugenics. This leads to an ethical discussion whether inheritable diseases should be treated with Crispr/ Cas 9 or if the genome could be even modified to get desirable characteristics. This question is often discussed under the cue „designer baby".

3. Increased Risk of Cancer ?

Eventual side effects of the Crispr/ Cas 9 method have barely been researched. In recent studies, concerns occurred that the use of the method could accidentally increase the risk of cancer.[1][1]To replace a mutant gene, for example, CRISPR-Cas9 targets and excises the mutant gene, generating DNA strand breaks that are then repaired through recombination with synthetic, donor template DNA. However, cells have inherent mechanisms that respond quickly to this type of DNA damage, and the transcription factor p53 is at the center of these mechanisms.Therefore, CRISPR-Cas9 editing worked best in p53-deficient cell lines and ist efficiency decreased in cells as soon as p53 is activated. This technology therefore selects for p53-deficient cells, meaning that edited cells are vulnerable to mutagenesis and a gain in otherwise p53-antagonized signaling pathways that could result in tumors.[2]

[1] E. Haapaniemi, S. Botla, J. Persson, B. Schmierer, J. Taipale, CRISPR-Cas9 genome editing induces a p53-mediated DNA damage response. *Nat. Med.* **24**, 927–930 (2018).
[2] http://stke.sciencemag.org/content/11/539/eaau7344

4. International inconsistencies

The key area of risk relates to the exploitation of international inconsistencies in biosafety and biosecurity with regard to the governance of genome editing experiments. These inconsistencies create an environment where risky experiments might be carried out in countries with no legal framework or in countries where, although legal frameworks exist, their implementation cannot be achieved due to limited resources. This undercuts established European standards of safety and security, while at the same time, due to the nature of some of these experiments, potentially affecting safety and security in Europe and other countries itself.[3][4]

II. Legislation and restriction

1. European Union

In the European Union, the Directive **2**001/18/EC deals with genetically modified organisms (GMO) and their deliberate release into the environment. The European Court of Justice (ECJ) had to decide in July 2018, whether organisms obtained by methods of mutagenesis constitute genetically modified organisms within the scope of the directive or not. The directive regulates under which circumstances GMOs can be deliberately released into the environment, to prevent damages to the nature and human health. This sets up different regulations, that for example a company has to fulfill when it wants to release a product on the market, that was genetically modified. A French court brought this question to the ECJ for a preliminary ruling.

a) Directive 2001/18/EC:[4]

Article 2:
(2) „genetically modified organism (GMO)" means an organism, with the exception of human beings, in which the genetic material has been altered in a way that does not occur naturally by mating and/or natural recombination;

[3] https://link.springer.com/chapter/10.1007/978-3-319-64731-9_13
[4] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32001L0018&from=en

(3) "deliberate release" means any intentional introduction into the environment of a GMO or a combination of GMOs for which no specific containment measures are used to limit their contact with and to provide a high level of safety for the general population and the environment;

Article 3:
(1) This Directive shall not apply to organisms obtained through the techniques of genetic modification listed in Annex I B .

b) Directive 2002/53/EC[5]

Article 4 Council Directive 2002/53/EC
4. In the case of a genetically modified variety within the meaning of Article 2(1) and (2) of Directive 90/220/EEC the deliberate release into the environment of the variety shall be accepted only if all appropriate measures have been taken to avoid adverse effects on human health and the environment.

c.) ECJ C-528/16[6]

Judgement of the ECJ from the 25th of July 2018 in the case C-528/16, after the request for a preliminary ruling under Article 267 TFEU from the Conseil d'État (Council of State, France).
(1). Article 2(2) of Directive 2001/18/EC of the European Parliament and of the Council of 12 March 2001 on the deliberate release into the environment of genetically modified organisms and repealing Council Directive 90/220/EEC must be interpreted as meaning that **organisms obtained by means of techniques/methods of mutagenesis constitute genetically modified organisms within the meaning of that provision.**

(2). Article 4(4) of Council Directive 2002/53/EC of 13 June 2002 on the common catalogue of varieties of agricultural plant species, as amended by Regulation (EC) No 1829/2003 of the European Parliament and of the Council of 22 September 2003, must be interpreted as meaning that genetically modified varieties obtained by means of techniques/methods of mutagenesis which have conventionally been used in a number of applications and have a long safety record are exempt from the obligations laid down in that provision.

(3). Article 3 (1) of Directive 2001/18, read in conjunction with point 1 of Annex I B to that directive, in so far as it excludes from the scope of that directive organisms obtained by means of techniques/methods of mutagenesis which have conventionally been used in a number of applications and have a long safety record, must be interpreted as meaning that it does not have the effect of denying Member States the option of subjecting such organisms,

[5] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32002L0053&from=EN
[6](http://curia.europa.eu/juris/document/document.jsf?text=&docid=204387&pageIndex=0&doclang=EN&mode=req&dir=&occ=first&part=1&cid=2029710)

in compliance with EU law, in particular with the rules on the free movement of goods set out in Articles 34 to 36 TFEU, to the obligations laid down in that directive or to other obligations.

d) Responses to the verdict

The responses to the judgement varied from disapproval and deep concerns by companies and relief by Greenpeace and other NGOs: *"The Court makes it crystal clear that plants and animals derived from gene editing are subject to the same safety and labelling requirements as other GM organisms. These requirements exist to prevent harm and inform consumers about the food they eat. Releasing these new GMOs into the environment without proper safety measures is illegal and irresponsible, particularly given that gene editing can lead to unintended side effects. The European Commission and European governments must now ensure that all new GMOs are fully tested and labelled, and that any field trials are brought under GMO rules."*[7]

*On the other hand, the European Seed Association ESA stated that „*the prohibitive compliance requirements of Directive 2001/18 relative to the value of agricultural crops effectively cut Europe's breeders off from scientific progress and puts them as well as farmers, processors, traders and consumers at a competitive disadvantage to regions with more enabling regulations. Moreover, it will not allow Europe to advance the development of new, better adapted plant varieties that are both high-performing and resilient, contribute to healthy diets to mitigate the effects of climate change and innovate for a more sustainable agri-food system at the pace that is urgently needed."[8]

Emmanuelle Charpentier, who significantly contributed to develop the CRISPR/ CAS 9 method, said:"In terms of using the technology in research I don't think the decision will have any significant impact. The fact that the European Court has decided to keep the technology under the directive doesn't mean that applications will not be developed in other parts of the world where the rules are less stringent, such as the USA and Asia".[9]

There were also some voices, even before the rule of the ECJ, that the current EU-Directive dated from 2001 is not contemporary anymore. The differing views and the different regulatory requirements in countries, it seems even more necessary to provide a supranational regulation.

2. United States of America

The U.S Department of Agriculture (USDA) released the following statement referring to the ECJ ruling: "Government policies should encourage scientific innovation without creating

[7](https://www.greenpeace.org/eu-unit/issues/climate-energy/1265/new-gmos-cannot-escape-testing-and-labelling-under-eu-law-eu-court-rules/)

[8] (https://www.euroseeds.eu/esa-statement-ecj-ruling-c-52816)

[9](https://www.iva.se/en/published/emmanuelle-charpentier-the-technology-will-continue-in-the-usa-and-asia-instead/)

unnecessary barriers or unjustifiably stigmatizing new technologies. Unfortunately, this week's ECJ ruling is a setback in this regard in that it narrowly considers newer genome editing methods to be within the scope of the European Union's regressive and outdated regulations governing genetically modified organisms.

We encourage the European Union to seek input from the scientific and agricultural communities, as well as its trading partners, in determining the appropriate implementation of the ruling.

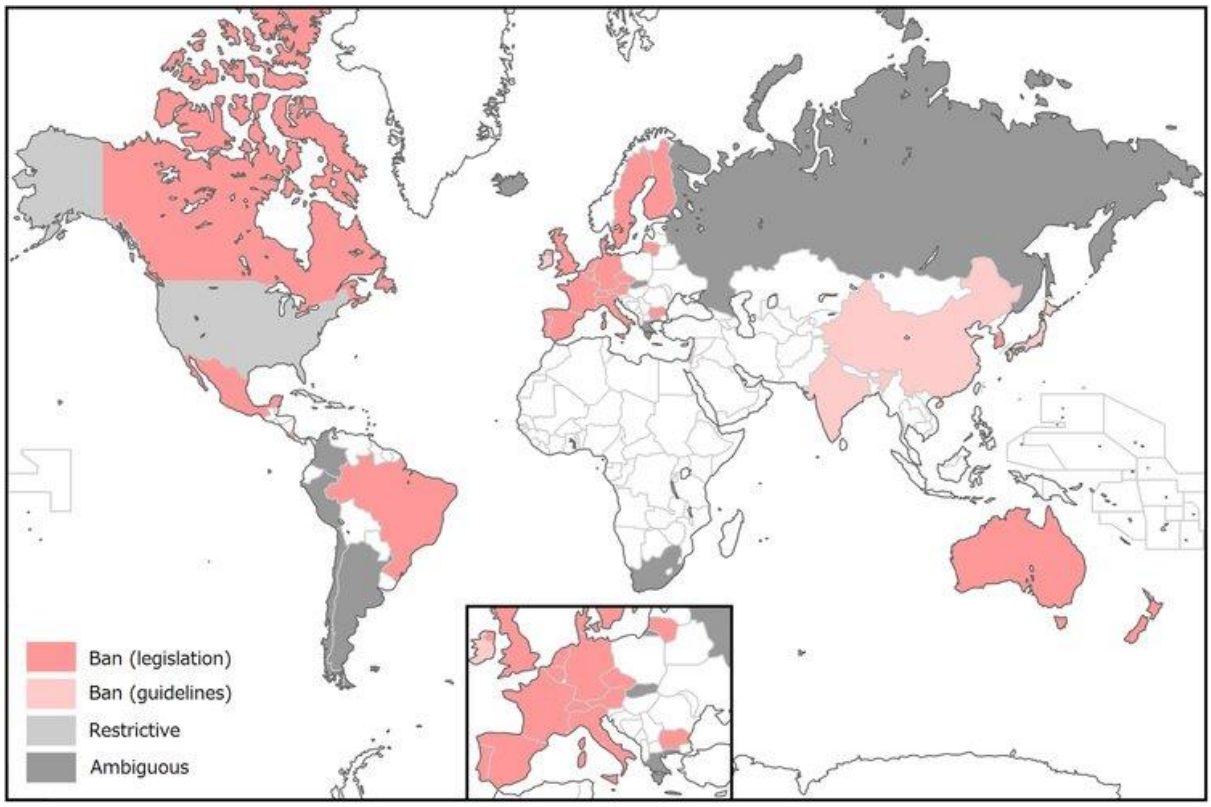
Innovations in precision biotechnology, such as genome editing, hold great promise. For consumers, potential benefits include healthier, higher-quality foods at affordable prices. For farmers, they include improvements in productivity, plant and animal health, and environmental sustainability.[10]

In another statement, the USDA´s Secretary Perdue said, that "With this approach, USDA seeks to allow innovation when there is no risk present. At the same time, I want to be clear to consumers that we will not be stepping away from our regulatory responsibilities. While these crops do not require regulatory oversight, we do have an important role to play in protecting plant health by evaluating products developed using modern biotechnology."[11]

[10] (https://www.usda.gov/media/press-releases/2018/07/27/secretary-perdue-statement-ecj-ruling-genome-editing)

[11](https://www.usda.gov/media/press-releases/2018/03/28/secretary-perdue-issues-usda-statement-plant-breeding-innovation)

3. China - Rest of the World



In a study published in 2014, Motoko Araki and Tetsuya Ishii of Hokkaido University in Japan looked at the rules in 39 countries and found that 29 of them (lighter pink on the map below) had a ban on such (germline editing) research . Of those, 25 (darker pink) had legally binding bans; the other four, including China, had guidelines banning the practice but not exactly enforceable laws. In the remaining 10 countries (dark gray on the map), the rules were "ambiguous."

In China, for example, the Guidelines on Human Assisted Reproductive Technologies say, according to Araki and Ishii, that "using human egg plasma and nuclear transfer technology for the purpose of reproduction, and manipulation of the genes in human gametes, zygotes or embryos for the purpose of reproduction are prohibited." Despite that regulation, Chinese scientists edited the genes of human embryos for the first time in 2015 .

One reason for this is the character of regulations:

A report from the Medical Research Council in the UK[12] notes that China's regulations governing research ethics "consist mostly of guidelines promulgated by the relevant ministries, which could be considered to constitute 'soft law'" and that "the sanctions for breaching ministry guidelines are often unclear." Researchers violating the Guidelines on Human Assisted Reproductive Technologies in particular have lost their licenses, the report notes, which would make it illegal for them to continue their research. But such enforcement appears to be inconsistent, as it's left largely up to local governments. [13]

4. United Nations

There is no Resolution by the United Nations regarding the Technology of CRISPR/CAS9 so far. The Universal Declaration on Bioethics and Human Rights was adopted by UNESCO in October 2005, laying out a series of substantive principles pertaining to bioethics. (http://unesdoc.unesco.org/images/0014/001461/146180E.pdf). A UNESCO panel of scientists, philosophers, lawyers and government ministers has called for a temporary ban on genetic "editing" of the human germline, calling for a wide public debate on genetic modification of human DNA.

(https://en.unesco.org/news/unesco-panel-experts-calls-ban-editing-human-dna-avoid-unethical-tampering-hereditary-traits)

[12] (https://mrc.ukri.org/publications/browse/china-uk-research-ethics-cure-committee-report/)
[13] (https://www.businessinsider.com/china-edited-human-genome-laws-2015-4)