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1 Background and issue under discussion

Efforts are currently under way, both at EU level and in Switzerland, to revise the regulation of gene technology in response to developments in plant breeding using new genomic techniques. This controversial discussion has been triggered by calls to make the regulation of these new techniques and resulting products less strict than that of conventional green genetic engineering.

When talking about ‘new’ genomic techniques in plant breeding, the term ‘new’ is not meant to be value-laden. It refers to the fact that genome editing techniques in plant breeding are legally classified as new both at EU level and in Switzerland. In this context, it is necessary to make a distinction between this and the use of the word ‘new’ in which the adjective is contrasted evaluatively with the old, i.e. ‘classical’ transgenesis. In this case, the implication is that the new is better than the old, primarily because genome editing techniques are considered to be more efficient, effective and less risky owing to their greater precision.

At the centre of the debate are techniques such as CRISPR/Cas and other targeted mutagenesis techniques (such as zinc finger nucleases and TALEN). The term ‘genome editing’, used throughout this report, is widely used in scientific publications and science communication and has become established as the umbrella term for these techniques. Genome editing refers to a technological approach or set of techniques used to specifically modify DNA, the information-bearing structure of the genome. Literally speaking, editing means preparing an edition of an author’s work for publication or revising existing texts to correct, condense, or otherwise improve them before publication. Metaphorically speaking, editing means revising

and improving DNA – in this report, the DNA of crops – as the ‘book of life’, using certain techniques for specific purposes, such as adapting to climate change, much like editing a text.

Other metaphors are also used in this context, most prominent of which is the ‘gene scissors’ metaphor.¹ The image of scissors, whether as a word or graphic, alludes to an important aspect of DNA editing: ‘cutting’ the DNA double strand. This image also draws associations with attributes such as precision, simplicity and feasibility, which are understood to be characteristic of genome editing techniques. The ‘gene scissors’ metaphor is generally used to represent the most important of these gene technology methods, namely CRISPR. As an example, the lead paragraph of an article in the *Neue Zürcher Zeitung* on 26 May 2025 about the consultation draft of the Federal Act on Plants from New Breeding Technologies, and the controversy over the use of gene technology, contains the following passage:

“The Federal Council plans to permit gene scissors and other modern genetic breeding methods under certain conditions. Researchers and the industry, however, are pushing back, arguing that the draft legislation would amount to an outright ban. Opponents of gene technology disagree.”²

Similarly, an article on the same topic in *Le Temps*, published on 22 May 2025, said:

“In April, the Federal Council launched a consultation on its proposed law on new genomic techniques (NGTs), which includes the famous CRISPR-Cas9 gene scissors.”³

Metaphors such as ‘genome editing’ and ‘gene scissors’ are used both with-

- ¹ This metaphor is also widely used in French and German, expressed as *ciseaux génétiques* and *ciseaux moléculaires* (molecular scissors) in French and *Genschere* in German, although its frequency of use varies.
- ² *Streit um Gentechnik: Experten kritisieren neuen Gesetzesentwurf*, NZZ of 26.5.25. (Translated for this report.)
- ³ *Tout comprendre au projet de loi sur les « nouveaux OGM »*, *Le Temps* of 22.5.25. (Translated for this report.)

in the scientific community and in public discourse to talk about new genomic techniques such as CRISPR/Cas. The way in which these techniques are discussed and the metaphors used to describe them influence how they are perceived. Furthermore, there are indications (see sections 3 and 4) that the metaphors used in the debate are understood differently by the public than they are within the scientific community. This may contribute to the fact that the public's evaluation of genome editing differs from that of the scientific community.⁴

Given that metaphors relating to genome editing are shaping the public debate on new genomic plant breeding techniques, the question arises as to how these metaphors should be used by the relevant stakeholders. This applies in particular to communication by the state, the media, and the scientific community, or more precisely, by scientific organisations.⁵ The remainder of this report will examine in more detail the role metaphors should play in state communication on genome editing in the field of new genomic plant breeding techniques. It should be noted that plant breeding techniques constitute only one aspect of this field. The relevant metaphors are also used in other fields where genome editing is employed, i.e. in animal (research) contexts and in human medicine. In this respect, the considerations in this report contain aspects that go beyond the field of plant breeding and are more general in nature.

Public communication needs to be transparent if democratic opinion-forming is to be possible. To this end, metaphors are very often used to convey complex scientific facts in an accessible way. Genome editing is a paradigmatic example of this. The question is how should the metaphors characteristic of this technology be

used in state communication so that the public can form an appropriate, i.e. independent and fact-based, opinion? Particular attention should be paid to the implications of the metaphors used for assessing the opportunities and risks of new genomic plant breeding techniques: on the one hand, what does the metaphor omit or obscure, and on the other, what does it put into focus or specifically emphasise – and to what extent might this lead to a problematic assessment? It should be noted that this may occur intentionally or unintentionally. By addressing these questions, the ECNH aims to raise awareness of the functions and effects of metaphors and thereby contribute to an informed and transparent public discussion about new genomic plant breeding techniques.

This report distinguishes between specialist publications within the scientific community on the one hand, and on the other in science communication to the public, in official documents and in public (political) debate.⁶ The Committee focuses its discussion on the use of genome editing metaphors in public – particularly state – communication. The use of metaphors within the scientific community is only addressed to the extent necessary for an appropriate understanding of them in public communication.

In preparation for its report, the ECNH invited biologist and science historian Hans-Jörg Rheinberger⁷ to give a presentation in May 2023. The Commission then requested an expert opinion from science historian Christina Brandt⁸ as a further basis for its discussion,⁹ which provided the ECNH with a wide range of input for this report.

The Commission's considerations are made in fulfilment of its statutory mandate to monitor and assess the developments and applications of

4 According to the latest opinion polls in Switzerland, a narrow majority of the population are sceptical about new genomic plant breeding techniques. Fifty-one per cent of survey respondents are clearly or somewhat opposed to the plans of the Federal Council and Parliament to allow only selective approval of plants produced using new genome editing methods. Fifty-four percent are clearly or somewhat unwilling to buy food produced using new genomic plant breeding techniques. If such plants were to be approved, 91 per cent are clearly or somewhat in favour of a risk assessment before each individual plant variety is approved. Ninety per cent also support mandatory labelling throughout the entire value chain. See the Sotomo population survey *Einstellungen zu neuen gentechnischen Verfahren in der Schweiz* of May 2025, *Einstellungen_zu_NGV_Sotomo.pdf*. Statements issued by the relevant scientific organisations reveal that the attitude within the scientific community – at least within certain scientific communities such as molecular plant physiology, plant biochemistry and molecular plant breeding – is much more positive with regard to both the risks and opportunities of the new genomic plant breeding techniques (cf., for example, Leopoldina and Deutsche Forschungsgemeinschaft 2023; Professor Bruno Studer über molekulare Pflanzenzüchtung | ETH Zürich 2021).

5 Communication by private sector companies, whether start-ups or established corporations, can also have an impact on the public, for example through statements on the internet.

6 The distinction between these functions was taken from Christina Brandt's expert opinion (Brandt 2026).

7 Honorary Professor Dr Hans-Jörg Rheinberger, Liechtenstein-based science historian, former director of the Max Planck Institute for the History of Science in Berlin (from 1997 to 2014), focuses on the history and epistemology of experimentation and the history of molecular biology and protein biosynthesis within the field of science history.

8 Christina Brandt, professor of history and philosophy of life sciences and director of the Ernst-Haeckel-Haus at the Friedrich Schiller University in Jena (Germany).

non-human biotechnology and gene technology from an ethical point of view, as well as its task of advising the Federal Council and the Federal Administration on legislation within its remit, and to promote public dialogue.¹⁰

9 Brandt 2026. The report provides the empirical basis for discussing the normative question of how metaphors should be used appropriately in state communication. The ECNH is aware that further research is needed to understand how metaphors arise, which metaphors prevail (or do not prevail) in which fields, and what role different stakeholders such as researchers, the press, the state, civil society and private sector companies play in this process.

10 Article 23 of the Federal Act on Non-Human Gene Technology (Gene Technology Act, GTA), SR 814.91.

2 Metaphors, conceptual metaphors, connotations, associations, narratives and framing

The terms 'genome editing' and 'gene scissors', used both in scientific discourse and in public debate about new genomic plant breeding techniques, are examples of metaphors. Although the term metaphor is used in different ways, its long history has given it a core meaning that remains largely undisputed to this day: a linguistic expression in which a term is transferred from its familiar context of meaning to another.¹¹ This metaphorical transfer serves to highlight similarities. The extent to which such similarities exist depends on which characteristics associated with the well-known term are emphasised in the new context by the metaphorical transfer. Metaphors can emphasise certain aspects, but they can also conceal or leave out others.

In addition to the use of metaphors, the debate surrounding new genomic plant breeding techniques is also characterised by the use of connotations and associations. Connotations are secondary meanings that are 'invoked' when words are used. They are linked to a positive or negative evaluation, which may also have an emotional facet to it.¹² The concept of connotation must be distinguished from denotation, which is the literal or primary meaning of a word, i.e. non-evaluative and thus neutral; and from association, which is not part of the meaning but consists of shared or individually distinct ideas and connections evoked by this meaning. These concepts can be illustrated by the example of the comparison between 'new versus old' genomic plant breeding techniques. In a denotive sense, these techniques are new in that they did not exist until recently. 'New' is positively connoted (new = good or better than old). This connotation is reinforced by associations such as new = (more) precise, (more) targeted and low(er)-risk, versus old = less precise, less targeted and high(er)-risk. In certain cases, it

can be difficult to attribute associations and connotations. Nevertheless, these concepts can be useful to provide orientation.

Metaphors, connotations and associations are an integral part of linguistic communication. When there is a connection between several metaphors, this is also referred to as a conceptual metaphor. The term 'conceptual metaphor' is an analogy to the linguistic concept of lexical and semantic fields. This is based on the observation that individual metaphors, like individual words, do not exist in isolation.¹³ Genome editing, for example, can be understood both as an individual metaphor and as a conceptual metaphor. Metaphors play an important – some would say indispensable – role in everyday communication, as well as in politics and science.¹⁴ They can help to open up new perspectives in scientific research, while their vividness can help to communicate abstract and complex scientific findings more effectively.

However, metaphors are not merely neutral tools for conveying information in public discourse. They can – often imperceptibly – carry connotations and evoke associations that are tied to covert evaluations. This can, among other things, positively or negatively influence public opinion of new technologies.

The concepts on which this report is based – metaphors, connotations and associations – are supported in this discussion by two further concepts that form a framework within which they are used: narrative and framing. These concepts, which are also part of the current public discourse, are only addressed marginally in the remainder of this report. Nevertheless, they are relevant. For example, metaphors play an important – even key role – in many narratives. Regarding the

11 The Greek word *metaphora* means 'transfer'. This view, which understands metaphor as a phenomenon, "in which a literal term is replaced by a figurative one" (Brandt 2026: 15f.), goes back to Aristotle. The concept of metaphor as a 'shortened comparison' and 'figurative speech' likewise goes back to antiquity. With regard to the natural sciences, this idea led to the widespread view that "metaphors should be understood as 'non-literal' and as 'figurative speech' used solely for the purpose of illustrating otherwise abstract theories or formalised expressions. They should otherwise be avoided in this context." (Brandt 2026: 17). There are metaphors in which the similarity expressed does not represent a comparison. Rather, this relationship is established through the metaphorical act. An example would be: "Man is a wolf": "It is only this interaction between the elements of the metaphor that produces the (...) meaning of the metaphor" (Brandt 2026: 22).

12 Linke et al. 1996: 153.

13 Brandt 2026: 18f.

14 There is also a theory that disputes the indispensability of metaphors. However, this report is not concerned with the question of whether metaphors are a linguistic necessity, but rather with the function they serve in public discourse.

much-discussed concept of narrative, a distinction must be made between individual, mostly autobiographical narratives and social ones.¹⁵ The latter are primarily of interest in the context of this report. It is important to note that these are not fictional stories, but rather patterns of explanation and interpretation that arise in the context of social processes related to social and political happenings or problems that are considered significant.¹⁶ A narrative weaves actors and phenomena into a coherent and meaningful framework that gives them significance and purpose. Coherence is established by presenting events in the form of a narrative in which characters take on an active role. When choosing social narratives, people are primarily guided by their own values and beliefs. They may therefore adhere to a narrative even when there are valid arguments and evidence that contradict it. From a critical perspective, the multitude of narratives should therefore not be accepted unquestioningly. Narratives always contain empirical and normative arguments, beliefs and assertions that can and should be scrutinised for accuracy and plausibility. The same applies to the evaluation of metaphors (as core elements of narratives).

There is a close connection between narratives and framing, which sometimes makes it difficult to clearly distinguish between them. Framing serves to reduce complexity by bringing certain perspectives to the fore, while pushing others into the background. According to Robert Entman's influential conceptualisation, framing means:

"(...) to select some aspects of a perceived reality and make them more salient (...) in such a way as to promote a particular problem definition, causal interpretation, moral evaluation and/or treatment recommendation for the item described."¹⁷

Framing takes advantage of the fact that the presentation of information through the choice of a particular 'interpretative frame' can influence opinions and resulting behaviours and steer them in a specific direction.¹⁸ This happens, for example, when the same event is described using different words that have opposite emotional connotations, such as referring to a demonstration either as a peaceful protest or a riot, to job cuts as restructuring or mass redundancies, or in the context of abortion, talking about either foetuses or babies. In all three cases, the aim is to present the exact same event in a primarily or exclusively positive or negative light by using language that evokes either positive or negative emotions. In this regard, gene technology can be framed as a Pandora's box if the technology is primarily viewed and described as a risk, threat or catastrophe, while ignoring the opportunities it offers. Conversely, gene technology can also be framed in such a way that only the opportunities are considered, while the risks are ignored. One can and should therefore always ask oneself whether the chosen framing is appropriate – bearing in mind that a certain reduction in complexity may be unavoidable in many cases for the sake of public debate.

15 For autobiographical narratives, see Goldie (2012); for social narratives, see Di Giulio, Defila (2022).

16 An example of this is the compilation of narratives on the topic of sustainability in Di Giulio, Defila (2022: 28ff.). Looking at the examples raises questions such as: How can social narratives be identified? How can we check whether they accurately represent social reality? Where are the boundaries of narratives? With regard to new genomic plant breeding techniques, is the description of the contrast between new and old already a narrative in itself, or at the very least a reference to a narrative? Social narratives can arise through anonymous social processes or be purposefully constructed. They seem to meet an inherent human need for orientation. However, they can also be used deliberately to achieve specific purposes. The same applies to metaphors, connotations and associations. There are also similarities between framing and metaphors: both emphasise particular aspects and relegate others to the background.

17 Robert Entman 1993: 52. Entman understands 'salience' as "[...] making a piece of information more noticeable, meaningful, or memorable to audiences" (ibid., 1993: 53).

18 Framing is usually deliberately used. It can even be used with manipulative intent. However, this does not mean that framing is inherently considered manipulative.

3 Metaphors and connotations in the context of new genomic plant breeding techniques: internal scientific discourse and public debate

3.1 On the function of metaphors

Before analysing in more detail some of the metaphors that characterise the public debate on genome editing, we will outline the functions that metaphors can have in general, with a particular focus on genome editing.

With regard to the latter, a distinction must be made between metaphors that represent the new techniques themselves, in particular CRISPR/Cas, and their effect(s), and metaphors that are used in the discourse on them.¹⁹ Regarding the new techniques themselves, it is the task of metaphors such as ‘gene scissors’, ‘toolbox’, ‘programmed molecule’,²⁰ ‘genome editing’ and ‘gene targeting’ to describe these methods as techniques as well as their effect on the genome and appearance of the plant, and to do so with a view to public science communication in a way that enables laypeople to understand how they work in principle and what can be achieved with them.

Metaphors about these new techniques such as ‘CRISPR revolution’, ‘game changer’, ‘disruptive technology’, ‘breakthrough’ and ‘CRISPR wave’, however, rather serve to evaluate them from a scientific and social perspective. The same metaphor can be understood and evaluated differently, and can carry different connotations and associations, depending on the context and the target audience. Take the example of the wave: when surfing it, you can master it and at the same time place yourself at the forefront of a dynamic process. Understood in this way, this metaphor is viewed positively. However, it can also be interpreted

sceptically or negatively if, for example, it is associated with a tidal wave or tsunami, i.e. an unstoppable development that will end in disaster.

Interestingly, a metaphor such as ‘CRISPR revolution’ has a different significance in internal scientific discourse than it does in public debate. The metaphor appears much more frequently in scientific texts than in texts for the public, possibly because internal scientific procedures relating to funding and ranking lead to the frequent use of the metaphor of the ‘revolutionary’ nature of CRISPR. Alternatively, the aspect of something being perceived as a ‘breakthrough’ in development could play an important role with regard to patenting. In public discourse, however, the metaphors of ‘revolution’ and ‘disruption’ are used with caution, as they tend to have negative connotations and are associated with ideas of uncertainty and incalculable risks.

A further distinction is that between ‘active’ and ‘dead’ metaphors. An example of a dead metaphor is ‘table leg’.²¹ In current usage, ‘table leg’ has a lexical meaning, referring to a specific part of a table. The fact that it is a metaphor is no longer perceived.²² Nevertheless, the metaphorical description ‘dead metaphor’ is not entirely accurate, since one can imagine it being revived in a new context. The Commission therefore considers the term ‘dormant metaphor’ to be more appropriate. With regard to the ‘genome editing’ metaphor, there are plausible reasons to describe it as a dormant metaphor, at least with regard to its use in internal scientific discourse. In this context, it is no longer perceived as a metaphor, but as

19 This distinction is taken from Brandt’s expert opinion 2026: 55 ff.

20 Guide RNA is ‘programmed’, like computer software, so that the Cas protein cuts the DNA double helix at the intended location. This is associated with connotations of precision and control – even if it cannot be ruled out that errors may occur during programming. “Scientists can design the guide RNA to recognize a specific DNA sequence; the guide RNA brings the Cas protein to that sequence (like a zip code), and then the Cas protein cuts the DNA in that exact location. Once the cut is made, the cell repairs the DNA either by mending together the broken ends, or by pasting in a new piece of DNA at the site of the cut. It is a programmable system that can re-write the genetic code with great specificity.” (Sarah C.P. Williams (2023), “When Two Disruptive Technologies Converge”). It is said that it is the cell that reassembles the DNA. However, using a phrase such as ‘programmable system’ suggests that this too is the result of human programming and is therefore completely controllable and manageable. This does not reflect the current state of scientific knowledge and is therefore incorrect – even if techniques such as homologous recombination allow certain DNA damage to be precisely repaired. The repair step is not precise. Insertions, for example, may be entirely successful, partially successful, or not successful at all. In animals and plants, this can lead to several breeding lines, which can then be selected and reused according to what is required.

21 Brandt 2026: 101

22 The metaphor of the table leg was originally positive in that it expressed the idea that something is being supported, as if by a leg (similar appearance, same function). This evaluative aspect is no longer consciously conveyed in everyday language. This may be an indication that a living metaphor becomes a dead or dormant one.

a conventional term for a technology in the biosciences. As a metaphor, it can therefore no longer shed new light on the research topic or provide new perspectives. The situation is different in public science communication and the corresponding debate on genome editing. The same applies to the 'gene scissors' metaphor. These metaphors – 'gene scissors' in particular – fulfil different communicative or discursive functions, helping to 'popularise' scientific knowledge by making abstract and complex scientific facts easier to understand and thus more accessible. In addition, they are associated with connotations that carry certain evaluations. The metaphor of 'genome editing' is linked to the broader conceptual metaphor of DNA as a text, connecting it to the idea of revising and improving a text created by nature and thereby shaping certain expectations.

In addition to typical metaphors such as 'gene scissors' and the connotations they carry, certain associations can also be found in the metaphorical concept of 'genome editing'. These include, for example, a pair of terms such as 'new versus old' – whereby this contrast, illustrated in the metaphors of 'gene scissors' (new) and 'gene gun' (old) (Brandt 2026: 37) – is understood primarily in evaluative terms: 'new' initially carries the general connotation of being 'better than old'. 'Revolutionary' functions as an intensification of the new, the association of a 'breakthrough' that opens up new horizons.²³ Another code word in this context is the concept of innovation. This combines the association of genome editing as something potentially revolutionary with the idea that it is therefore capable of making a significant contribution to solving pressing

national and global problems, such as ensuring long-term food security by genetically engineering crops to adapt to climate change.²⁴ However, the conceptual metaphor 'genome editing' also includes associations that do not relate to the opportunities or potential opportunities, but rather to the risks of this technology. Once again, these associations go hand in hand with the concept of 'new versus old'. With regard to risks, 'new' – which is what genome editing stands for – is associated with being targeted and precise, and therefore with the ability to direct and control, and thus with lower risks than the 'old' gene technology prior to genome editing.²⁵

Finally, it is worth mentioning technology-independent metaphors such as that of the jigsaw puzzle or puzzle piece, which are also used in other contexts.²⁶ New genomic plant breeding techniques are discussed as if they were part of a complex jigsaw puzzle.²⁷ This example shows that metaphors can trigger different associations and be understood in different ways. The jigsaw puzzle metaphor can evoke the idea that all the pieces fit together to form a complete picture. If one piece is missing, the picture remains incomplete, which evokes the idea that all breeding approaches – whether involving gene technology or conventional methods – should be pursued equally with neither approach being neglected. However, in communications about new genomic techniques, the image is generally used to single out one approach from a complex interplay of approaches and highlight it, even at the risk of neglecting the development of other solutions by doing so. Alternatives and conflicts between the individual approaches remain beyond

23 The metaphor of 'disruption' and 'disruptive technology' has not caught on and is no longer used very often. More commonly used is the metaphor of the 'game changer' (see, for example: The promise CRISPR holds to revolutionise our world | Bayer Global).

24 The 'genome editing' metaphor implies that it is possible to actively rewrite the 'book of life', to correct errors and improve it, using this type of gene technology. It conveys a value-laden component. However, the metaphor leaves it unclear what is meant by improvement and on what basis such decisions are made. The aims and objectives should be discussed by society and not left to science. These are evaluative or normative decisions that are not (solely) the responsibility of those who develop and apply the technology. This is true even if there may be objectives that are undisputed (such as adapting to climate change or treating serious diseases).

25 State communications should pay attention to the plausibility of statements about relative risk. If it is said that the risks associated with new genomic plant breeding techniques are lower than those of old transgenic methods, then it should be explained what is meant by 'lower'. If risk is regarded as a function of probability and extent of damage, the question arises as to whether sufficient data is available to allow an assessment of relative risks to be made, or whether it would more appropriate to speak of a precautionary situation with regard to the 'old' and the 'new' methods, which serves to generate, under conditions of adequate safety, the data required to determine the risks in the first place. In addition, there would need to be idea of the absolute risks that are acceptable and those that are not. Only then does it make sense to compare risks in order to determine their acceptability. The fact that risk A is lower than risk B does not mean that risk A is more acceptable.

26 For example, in the referendum campaign on motorway expansion in 2024: Abstimmung zum Autobahn-Ausbau: Das musst du jetzt wissen | blue News; Autobahn-Ausbau: Ja-Lager lanciert Abstimmungskampagne – 20 Minuten.

the scope of the image. Furthermore, this use of the puzzle piece metaphor can convey the idea that the overall picture always remains the same and that it makes no difference which approach is given priority. However, prioritisation can make a difference because it can create path dependencies.

3.2 Metaphors and connotations in internal scientific discourse

As already mentioned, terms such as 'gene scissors' and 'genome editing' are generally no longer perceived as metaphors in internal scientific discourse. They are seen as an integral part of scientific terminology, describing a technological approach or set of techniques used to specifically alter the information-carrying structure of the genome. A second, closely related thesis holds that they serve as simple terms for a complex molecular biological procedure or for key aspects of it. The word 'scissors' therefore serves merely as an abbreviated description, at least for science. It remains a metaphor insofar as the concept of scissors is transferred to a new context of meaning. This is because the familiar use of the term 'scissors' refers to a mechanical tool that cuts material by means of two intersecting blades. The term is transferred to the new context in order to draw attention to similarities, namely that interventions in the genome work 'like cutting with scissors'. Within life sciences discourse, the term 'gene scissors' has become an established part of conventional usage, primarily fulfilling a function of conceptual economy by virtue of its brevity.²⁸ The metaphor thus literally stands for the description of the complex scientific process. Understood in this way, there is no room for the vagueness, ambiguity, and multiple meanings that are usually associated

with the use of metaphors in scientific dialogue. In the same way, the metaphor 'genome editing' (which is also a conceptual metaphor) can be understood as a technical abbreviation for a complex technology.

Submitting research proposals and, in general, obtaining third-party funding, involves aspects that straddle the divide between internal scientific discourse and public communication. Where proposals are submitted in accordance with scientific criteria, the metaphors mentioned above are used within the context of internal scientific discourse. This can change when they are used to convince investors of the value of the submitted proposals. In addition, the boundary between internal scientific communication and public communication is blurring to the extent that research proposals now require 'lay summaries', i.e. summaries that are understandable to laypeople, making research projects comprehensible to people outside the scientific community, while still complying with scientific standards. In these lay summaries, metaphors such as 'gene scissors' are no longer dormant metaphors, but rather active metaphors that can be interpreted in different ways and thus have different implications.

3.3 Metaphors and connotations in public debate

The assessment that metaphors such as 'genome editing' and 'gene scissors' serve a purely conceptual function does not apply to public communication. Metaphors are used in public communication to convey complex scientific facts in a sufficiently clear manner, among other things. Metaphors in public discourse have an effect independent of internal scientific discourse and, in line with this thesis,

27 See, for example, Migros Magazin Nr. 35, 25 August 2025, p. 49: «Migros [a major Swiss supermarket chain] would like to give the new breeding techniques a chance, together with the association Sorten für morgen [Varieties for Tomorrow] – as one piece of the jigsaw puzzle that will make Swiss agriculture more sustainable and secure our food supply.” (Translated for this report.)

28 It should be noted that the term 'gene scissors' does not have the same prevalence within the scientific community as it does in public discourse. The terms 'nucleases' and 'CRISPR' are more commonly used. However, the scissors image is still frequently used in scientific publications.

influence how the public perceives and assesses genome editing and the processes covered by this term.

This can be illustrated by the example of the term 'gene scissors'. A word that refers to a familiar mechanical tool is transferred from a mechanical to a molecular biological context. It refers to a process in which a double-strand break in the DNA is induced by means of a gene technology method.²⁹ The image of scissors evokes several connotations associated with the specific properties and functions of cutting tools. These include positive attributes such as being targeted and precise, as well as the ability to direct and control such tools. At the same time, the imagery of the term 'gene scissors' also evokes negative associations linked to the idea of cutting and the potential damage that this entails. Using scissors is not without danger or risk. In this respect, the 'gene scissors' metaphor triggers ambivalent associations. Whether one of these aspects dominates the public discourse, and if so, which one, would have to be investigated empirically. Regardless, this example shows that a metaphor such as 'gene scissors', however vivid it may be, does not simply convey a complex scientific fact in a neutral way, but is accompanied by (implicit) evaluations that can be problematic.

One aspect concerns the connotations and associations linked to a metaphor and how these are evaluated. Another somewhat different aspect is whether these connotations and associations are factually appropriate. This is relevant because in order to adequately evaluate the facts, we need to know that they are correctly described and understood. For example, the characteristic of precision attributed to scissors is questionable,³⁰ because scissors themselves are not precise. Precision is only achieved by placing scissors at

a specific point and – in this context – cutting the DNA. In addition, mechanical scissors only cut at a specific point; they cannot be used to cut at several points at the same time. With 'gene scissors', however, this is possible. And sometimes this happens, which can lead to new errors in the genetic material, such as in the treatment of genetic defects. In this respect, the 'gene scissors' metaphor is inaccurate, misleading even. One example is the use of CRISPR in chronic granulomatous, a rare hereditary disease that impairs the immune system and makes those affected susceptible to severe, even life-threatening infections. In an experiment on cell cultures of immune cells, it was demonstrated that the genetic defect can be repaired using CRISPR gene scissors. However, the procedure can also cause new errors:

"However, it was found that some of the repaired cells now exhibited new defects: entire sections of the chromosome in which the repair had taken place were missing. The reason for this lies in a special genetic constellation of the NCF1 gene: it is present three times on the chromosome, once as an active gene and twice in the form of so-called pseudogenes. These have the same sequence as the defective NCF1 and are not normally used to form the enzyme complex.

The CRISPR gene scissors cannot distinguish between the different versions of the gene and thus sometimes cut the DNA strand at several places on the chromosome – both in the NCF1 gene and in the pseudogenes. When the cut sites are then rejoined, entire gene segments may be misaligned or missing. This can have unforeseeable medical consequences and, in the worst case, contribute to the development of blood cancer."³¹

²⁹ Metaphors such as 'gene scissors' and 'genome editing' suggest a certain interpretation of what genes are, namely chemical entities that are clearly defined in terms of structure and function, arranged as linear sequences at an exact location on the chromosome, and therefore locally identifiable, static and stable, and thus capable of being controlled by technology. This idea also corresponds to the metaphor of 'genome editing' as the careful editing – and thus gentle improvement – of a text in which every word and letter is clearly identifiable and easy to locate. This is not to say that molecular biology and plant breeding work with this concept. With regard to adapting to climate change, for example, it is undisputed that traits such as drought tolerance are not encoded by a single gene, but result from a complex interaction of a myriad of genes. The point here is simply to make it clear that metaphors such as 'genome editing' and 'gene scissors' (can) also influence our understanding of what genes are.

³⁰ It should also be mentioned that CRISPR are by no means the first and only gene scissors. 'Molecular scissors' such as zinc finger nuclease and TALEN have been known to experts since the 1990s (Brandt 2026: 45).

³¹ UZH News, "Use of 'Genetic Scissors' Carries Risks", 6 November 2024, Use of 'Genetic Scissors' Carries Risks | UZH News | UZH. The original publication can be found in: Nature, 9.10.2024: Gene editing of NCF1 loci is associated with homologous recombination and chromosomal rearrangements | Communications Biology).

Metaphors, together with their accompanying connotations and associations, should be viewed in a historical context.³² Contrary to what one might think, associations such as precision and accuracy are not specifically linked to metaphors such as 'genome editing' and 'gene scissors'. Rather, they originate from the older conceptual metaphors of 'genome targeting', 'genome engineering' and 'genome surgery'. The association with safety or low risk, however, seems to be more specific to genome editing, or at least it seems to have gained in significance in conjunction with other associations relevant in this context, such as the targeted and controlled improvement of a 'text created by nature'. However, this somewhat contradicts the 'gene scissors' metaphor, which is ambivalent in terms of the aspect of risk it suggests, and which plays a significant role in the genome editing discussion, at least in German-speaking countries. It is also conceivable that the metaphor will change again as genome editing continues to develop.³³ It may well be that, particularly with the development of 'artificial intelligence' – itself yet another metaphor – and its link with biotechnology, the metaphor of 'designing', and more generally metaphors drawn from the field of genetic engineering, will become increasingly significant. For example, the idea of improving and optimising the genome could be supplemented by the idea of redesigning individual traits ('AI-designed traits') and ultimately entire organisms, something that is fundamental to synthetic biology.³⁴

³² For more on this, see Brandt 2026

³³ Although the 'gene scissors' metaphor continues to dominate public communication about genome editing, it is becoming apparent that metaphors from the field of programming are becoming increasingly important. The metaphor of 'editing' relates to writing as a cultural technique. Scissors come from a different context and are not characteristic of this. More typical are images such as a hand holding a pen rewriting DNA or the image of a touchscreen tablet as a symbol for programming DNA (Brandt 2026: 72f.). This would also reflect the fact that genome editing techniques are continuing to develop and are now available in the form of prime and base editing techniques, which do not require double-strand breaks. However, conventional CRISPR techniques involving double-strand breaks will continue to be used for the foreseeable future. For this reason alone, the 'gene scissors' metaphor is unlikely to disappear any time soon, even if it loses prominence and increasingly fades into the background.

³⁴ The remarks by Mundorf, Simon, Engelhard 2025: 7ff. point in this direction.

4 Discussion on the appropriate use of metaphors and connotations in the field of new genomic plant breeding techniques in public and state communication

Because of their specific structure and the way they work, metaphors have a life of their own that is at least partially beyond control. This becomes clear when a metaphor such as ‘gene scissors’ is used in public discourse to make a complex scientific context understandable to a lay audience. Metaphors have a meaning as well as connotations and associations attached to them that can be deciphered, but cannot be used arbitrarily in communication. The use of metaphors can be linked to certain potentially incompatible evaluations that are not always apparent to those who use them and those who receive them. At the same time, metaphors can also be used deliberately in a biased manner. It is important to distinguish between the motives for using metaphors and the way they work, as this raises awareness of how metaphors are used and thus contributes to an informed and transparent discussion.

As shown, metaphors consist of descriptive and evaluative elements, which determine their effect. The ‘gene scissors’ metaphor, for example, is descriptive in that it draws attention to certain characteristics of genome editing, such as ‘cutting’ the DNA double strand at a specific location. It is both descriptive and evaluative, insofar as it is associated with concepts such as being targeted and precise and thus, by extension, with the ability to be directed and controlled. A characteristic such as ‘precision’ describes, on the one hand, what genome editing claims to be capable of and, to some extent, is capable of; on the other hand, it also implies that this characteristic is seen as positive, i.e. the more precise, the better, because the desired goal can be achieved more effectively. This evalu-

ative aspect forms part of a narrative in which the connection between the metaphor and the (implicitly) evaluative juxtaposition of ‘new’ versus ‘old’ gene technology plays an important role. ‘New’ gene technology is equated with genome editing, which is superior to ‘old’ transgenic gene technology in various respects, including its comparatively greater accuracy. Genome editing as a metaphor also includes the evaluative aspect of gently improving the genome as a ‘text created by nature’. Metaphorically speaking, the aim is not to create a new text, but to revise an existing one in such a way that certain errors can be corrected, and optimised elements incorporated. This aspect becomes all the more important the more significant this process is in terms of the objectives being pursued. In relation to new genomic plant breeding techniques, these objectives relate specifically to ensuring national and global food security in the face of climate change and the associated need to adapt agricultural production to changing climate conditions. This is one possible positive interpretation of what is meant by the ‘genome editing’ metaphor. There are also other, more critical interpretations. Against this backdrop, the following section will examine the question of what role metaphors of this kind should play in communication.

In public communication by the state – as well as by scientific organisations and the media – metaphors can have different effects than they do in internal scientific discourse. Provided they are perceived as metaphors, it is generally true that, because of their structure and the connotations and associations attached to them, they emphasise certain aspects of a particular subject while leaving out others.

What does this mean for communication by the state, particularly with regard to new genomic plant breeding techniques?³⁵ The state communicates with citizens. In normative terms, citizens are self-determining beings, and a democratic constitutional state should communicate with them as equals. 'As equals' means: as part of its public service, the state must structure communication in such a way that it conveys as complete a picture as possible of the subject matter so that it can be understood by all citizens.³⁶ This allows them to understand complex new technologies to such an extent that they are able to make an informed opinion about the opportunities and risks they present, and decide how they should be handled in their view.

For certain topics, the state can assume that the public has a certain familiarity with the subject matter and the metaphors and connotations typically associated with it. In the case of genome editing in general, and its specific application in crop breeding in particular, it cannot and must not (yet) do so. These are complex new technologies and techniques about which the general public knows very little. Communication must therefore be tailored to this situation. Furthermore, the state must assume that this is an aspect of gene technology that is perceived differently and judged controversially by the general public, at least to the extent that it has already considered it in some way.³⁷

For these reasons, metaphors should be used with caution. If state communication uses metaphors such as 'gene scissors' in explanatory reports regarding draft legislation or in official voting papers, for example (which may sometimes be unavoidable due to the necessary brevity of communication), care should be taken to address

the aspects relevant to citizens' opinion-forming and to do so appropriately. This includes, for example, pointing out that this metaphor evokes different connotations and associations, which may be connected to differing evaluations of the technology. Even if the relevant scientific communities were to agree on these associations and connotations, both in terms of how they are described and how they are evaluated with regard to the risks and opportunities of the technology, state communication should not simply adopt this view. Instead, it should explicitly point out that there are differing scientific and social views, list what they are, and present the pros and cons of these views as well as those of the mainstream scientific position.

In order to create transparency, it is also the state's task to point out, when explaining the most important elements of a new technology such as genome editing, that metaphors that have become established in public discourse can sometimes be accompanied by factually misleading connotations and associations that can influence the evaluation of its opportunities and risks. With regard to the 'gene scissors' metaphor, this would mean, for example, explaining the problems of associations such as 'targeted' and 'precise'. These associations, in combination with the way scissors function as a mechanical tool, suggest, among other things, that the genome is always 'cut' at exactly one specific point. That is factually incorrect. This may also occur simultaneously at other unintended locations in the DNA – known as off-target effects – which can lead to undesirable mutations with potentially negative effects, e.g. on the health of an organism (cf. the example of chronic granulomatous disease mentioned in section 3.4).³⁸ It becomes all the more impor-

35 The ECNH is aware that the impact of media communication is generally more far-reaching than that of state communication. Discussing the responsibility of the media and journalists in this context would require separate considerations of media ethics that would go beyond the scope of this report. At the same time, it should be noted that state communication is an important source for media communication and can therefore have an indirect additional impact. Start-ups and established companies also play a public role when, for example, they explain technologies such as CRISPR, their potential, and the latest research findings on their websites in a way that is understandable to a lay audience.

36 This presupposes that the sciences also paint the whole picture, as state communication must be based on the sciences. This in turn presupposes that negative research results can also be published.

37 See the Sotomo population survey, "Attitudes towards new genetic engineering techniques in Switzerland" of May 2025, [Einstellungen_zu_NGV_Sotomo.pdf](#)

tant to communicate this because the imagery is increasingly moving away from mechanics and mechanical tools such as scissors towards the cultural techniques of writing and programming. While the use of scissors is undoubtedly associated with certain risks, actions involving targeted and optimised rewriting and programming are not perceived as having the same level of risk. However, using such metaphors in public communication is also problematic because they can be associated with a false idea of 'programmability' and the ability to control something. Only a cell's own biological repair mechanism can rejoin DNA once it has been cut, and since this can only be influenced to a limited extent and does not always function 'perfectly', gene segments may end up misaligned or missing entirely.

These considerations lead to the conclusion that government bodies should use metaphors such as 'genome editing' and 'gene scissors' sparingly in their communications. They should be aware of the vagueness and ambiguity of these metaphors and, where appropriate, explicitly address this in their communication. The aim should be to explain genome editing to the general public in a way that is as easy to understand as possible and to transparently present how its opportunities and risks can be evaluated.

When it comes to drafting a new law or revising existing legislation, it is inevitable that the state – be it the government or Parliament – will take a position. The state is then no longer a neutral conveyor of information, but rather an actor that must make decisions on the policy line and, on this basis, draft a legislative proposal that contains politically evaluative aspects. Even if the primary political goal is to make a proposal acceptable to the majority, it is still important

from a communication perspective to present these evaluative aspects in a comprehensible manner. This can be achieved by clearly stating the data and undisputed findings on which they are based, including the empirical uncertainties, and by presenting and justifying the evaluations themselves in a transparent manner. It is legitimate to use metaphors in public political debate within the parliamentary legislative process as a means of achieving 'message control' and persuading sceptical citizens to support a proposal, provided that this is not done with manipulative intent. However, as already explained, using this type of metaphor should be avoided in explanatory reports in consultation procedures. This applies all the more to the texts in official voting papers, for example in referendums against bills passed by a parliamentary majority. Here, state communication has an obligation to remain neutral, presenting the arguments for and against a law as simply as possible, but without oversimplifying and without steering voters in a certain direction through the nature of the explanation (and thus without 'framing'). This does not mean that metaphors that may shape a decision, such as 'gene scissors' and 'genome editing', or metaphors from programming language should not be used. However, if they are used, it should be done in such a way that their meaning is transparent. In other words, it should be explained what they emphasise, but also what they omit.

³⁸ At the same time, however, it should also be noted that this is less problematic in the field of plant breeding because of the ethical and constitutional status of plants (and the possibility of achieving the desired outcome through additional selection cycles) than it would be if humans were concerned.

5 Conclusions and recommendations

Metaphors such as ‘genome editing’ and ‘gene scissors’ play an important role in the public discourse on new gene technologies such as CRISPR/Cas, not only with regard to plant breeding, but also in all areas in which these techniques are used. In this respect, the ECNH’s considerations extend beyond plant breeding.

The use of metaphors helps to explain complex technology in a way that makes it understandable in broad terms, even to an audience without scientific expertise. However, metaphors are also ambiguous, carrying connotations and associations that can influence the perception and evaluation of this technology. This raises the question of how the state should use metaphors of this kind when communicating with citizens so that they can form an appropriate, i.e. independent and fact-based, opinion.

Although the ECNH is critical of some uses of metaphors in the field of genome editing, it does not see it as its task to propose alternative terms or ways of speaking. Rather, it is concerned with raising awareness among politicians and the public about the role metaphors play, particularly in state communication, and the effects they can have. In this way, it aims to contribute to ensuring that the public debate on genome editing techniques in plant breeding is as transparent as possible.

With regard to state communication on genome editing techniques, this means several things:

- The aim is not to dispense with metaphors such as ‘gene scissors’, ‘programmed molecules’ or the ‘CRISPR revolution’. It is not a question of completely avoiding metaphors of this kind in state communication. However, they should be used

consciously and with restraint. The overriding goal is to convey information as neutrally as possible as a basis for forming opinions. Metaphors, as a medium of state communication, should be used in such a way that they contribute to the democratic decision-making process by helping to form independent and fact-based opinions about the opportunities and risks of new genomic techniques in plant breeding – rather than hinder or even undermine this process.

- *An appropriate understanding of new genetic engineering techniques:* When metaphors such as ‘genome editing’ or ‘gene scissors’ are used, it is primarily to convey the complex scientific and technological issues involved in a way that is generally understandable to a lay audience with little knowledge of new genomic techniques in plant breeding.
- *An appropriate evaluation of new genetic engineering techniques:* When metaphors such as ‘genome editing’ or ‘gene scissors’ are used, this should be done with an awareness of the connotations and associations attached to them. Connotations and associations should be explicitly explained in order to make the public aware that the metaphors in question obscure or at least shift the focus away from aspects that are relevant to the evaluation of the technology, and in some cases even convey factually misleading aspects. If, for example, the ‘gene scissors’ metaphor is used, it should be pointed out that this metaphor is inaccurate in several respects. For example, double-strand breaks can occur simultaneously at different locations in the genome; the greater precision implied by the metaphor does not mean that the risk is

correspondingly lower; nor does it take into account the fact that ‘repairing’ DNA after a double-strand break is not a technological process, but rather an error-prone biological process carried out by the cell itself.

- *The state as a neutral disseminator of knowledge and as political actor:* It should be noted that the state can take on different roles. Firstly, it may be legitimate to use metaphors such as ‘gene scissors’ in public political debates, for example in parliamentary legislative processes, as a means of achieving ‘message control’ and persuading sceptical members of the public to support a proposal put forward by Parliament or the Federal Council. However, this is only the case if it is done without manipulative intent. When it comes to state communication in the context of consultations and referendums, using metaphors in this way should be avoided. In such cases, the state must remain neutral and present the arguments for and against a proposal as simply as possible, without steering the debate in a particular direction through the way it explains the issue.

Bibliography

Christina Brandt (2026), *Die Rolle von Metaphern im Bereich der Genome Editing-Verfahren*, Gutachten im Auftrag der EKAH, Band 19 der Buchreihe «Beiträge zur Ethik und Biotechnologie», Bern.

Robert Entman (1993), Framing: Towards a Clarification of a Fractured Paradigm, in: *Journal of Communication* 43 (4): 51–58.

Peter Goldie (2012), *The Mess Inside*. Narrative, Emotion, and the Mind, Oxford: OUP.

Antonietta di Giulio, Rico Defila (2022), *Die Bedeutung von Narrativen für Umwelt und Nachhaltigkeit*, Basel: Universität Basel. Online: <https://edoc.unibas.ch/entities/publication/a5c73c9c-f931-4baf-9760-8f1d98beb68b>.

Leopoldina und Deutsche Forschungsgemeinschaft (2023), *Für eine wissenschaftsbasierte Regulierung von mittels neuer genomischer Techniken gezüchteten Pflanzen in der EU*, Ad-hoc-Stellungnahme, 19. Oktober 2023. Online: https://www.leopoldina.org/fileadmin/redaktion/Publikationen/Nationale_Empfehlungen/2023_10_19_Stellungnahme_DFG_Leopoldina_NGT-1-Pflanzen_EU.pdf.

Angelika Linke, Markus Nussbaumer, Paul R. Portmann (1996), *Studienbuch Linguistik*, Tübingen: Niemeyer.

Juliane Mundorf, Samson Simon and Margret Engelhard (2025), The European Commission's regulatory proposal on new genomic techniques in plants: a spotlight on equivalence, complexity, and artificial intelligence, in: *Environmental Sciences Europe* 37 (143), <https://doi.org/10.1186/s12302-025-01199-2>.

Hans-Jörg Rheinberger (2023), Spotlight: Die Metaphernwelt der Molekularbiologie und molekularen Medizin, in: Boris Fehse, Hannah Schickl, Sina Bartfeld, Martin Zenke (Hrsg.), *Gen- und Zelltherapie 2.023 – Forschung, klinische Anwendung und Gesellschaft*, Berlin: Springer, S. 307-314. Online: <https://link.springer.com/book/10.1007/978-3-662-67908-1>.

Sotomo Bevölkerungsbefragung (2025), *Einstellungen zu neuen gentechnischen Verfahren in der Schweiz vom Mai 2025*. Online: https://sotomo.ch/site/wp-content/uploads/2025/06/Einstellungen_zu_NGV_Sotomo.pdf.

Sarah C.P. Williams (2023), *When Two Disruptive Technologies Converge*. Online: <https://gladstone.org/news/when-two-disruptive-technologies-converge>.

UZH News (2024), *Reparatur mit Genschere birgt Risiken*, 6.11.2024, <https://www.news.uzh.ch/de/articles/media/2024/CRISPR.html>.

April 2026

Publisher: Federal Ethics Committee on Non-Human Biotechnology ECNH
c/o Federal Office for the Environment FOEN
CH-3003 Bern
tel. +41 (0)58 463 83 83
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www.ekah.admin.ch

Translation: English Language Service,
Federal Chancellery
Graphic design: Atelier Bundi AG
Typography: Atelier Bläuer, Joel Kaiser

This report is available also in French and German
at www.ekah.admin.ch.



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