In favor of HB1421
The views expressed here are my own based on my professional experience and not as a faculty member of UCSF.

Dear members of the Health and Government Operations committee:

Remember when the corn stalk was just a whisp and looked nothing like the present-day corn? Don't remember it? Neither do I. That was eons ago, like over eight thousand years ago. Crossbreeding and domestication gave rise to our present-day corn. Exchange of genetic information or crossbreeding is key for survival. In nature, this exchange of genetic information ***is unique to sexual reproduction***; even single cell bacteria undergo "sexual" reproduction periodically to maintain a diverse and healthy genome. They do so with different mating types and do not need to make eggs or sperms. Viruses are unique- they are neither living nor dead. They come to "life" in their hosts, and in the process of making copies of themselves, which they do by usurping host's resources, they also exchange information. Sometimes they steal from the host, sometimes they leave behind their or stolen genetic material in the host, thereby crosspollinating. This crosspollination can be beneficial or harmful or neither (dormant). Genetic modification techniques rely on using viruses and bacteria as vectors and hosts. Hence, regardless of the technique used, CRISPR, mRNA, viral vectors, bacterial plasmids- we cannot prevent or guarantee that exchange of genetic information will not happen. The unintended consequences of such exchanges remain largely unknown. But given that bacteria and viruses use a number of these techniques for their immunity and to evade our immune systems (for examples, CRISPR and RNA modifications, respectively), exchange or integration of these vectors and genes used for modification can have tremendous impact on the functioning of our immune systems and alter expression and function of other genes when consumed.

Recall the bit of green on tomatoes, strawberries, and many other fruits? That green "calyx" has a function- protection from pests and ripening. But without understanding the proper function of calyx, someone got the idea of removing that imperfection and forcibly modified the calyx of crops such as tomatoes, red delicious apples, strawberries, and many others to be perfectly red and "flawless". As a result, the fruits ripened too quickly or didn't ripen at all. And that also comprised their taste. Then to correct ripening error, another gene was introduced to delay ripening. How does that make sense? And despite several modifications, the fruits are now insipid and require ripening under artificial conditions. The latest focus is to remove bitter taste from green leafy vegetables. The bitter taste serves as a satiety signal and people who like bitter foods are relatively thinner. The absurdity of such modifications is beyond words. We are trying to correct issues that were never a problem to start with just because we have cool techniques, instead of focusing on the real problems.

I would like to end by giving an analogy. Many of us like fast and powerful cars. Some dream of owning a Ferrari or a McLaren, or driving a F1 car, an unachievable dream for most. Now imagine, if we could just swap the engine of an F1 racing car and put that into a Fiat or any regular car. Will the modified Fiat run faster than the unmodified one? Will it attain 0-120 mph faster than an unmodified Fiat? Will it give the driver the thrill of F1 car? Would we have achieved the goal of making an F1 car accessible for all? For sure we would have achieved many

of the listed goals. Will this modified Fiat qualify or is fit to race in a real-world F1 formula race? Perhaps it might be able to race with other similarly modified cars of different brands in controlled settings, but will it survive in the real race? Do these modified cars pose a real threat to the original Formula 1 cars? Should we now start tinkering with F1 cars so that these modified Fiats have a better chance of survival in the F1 world? For whose benefit, for what purpose, and at what cost? Keep in mind that the engine is only one part of the game. We need the whole nine yards- the chassis, fuel, the brakes, the tires, the bodyline, lighter material etc. We also need to keep in mind that the F1 cars don't race on regular tracks, are gas guzzlers and the race takes a huge toll on the cars. And the drivers? They are a special breed too and require special training and skills.

So where am I going with this? To modify just one genetic trait or part of a body to make it function better without equipping other parts of the body, whether in plants or animals, is short-sighted and causes more harm than good. To function accordingly with the higher functioning modification that we are trying to make comes at a price. At what stage does that price become apparent? If too much energy and too many resources have been used, will the stakeholders ever accept the mistakes? Or will they continue with the collateral damage no matter what at what cost. So, I urge you to consider that when we tinker with one gene or 1 aspect of a physiological function to try and improve that aspect, we do not fully understand the consequences that it might have on other unmodified traits and functions that go along with that particular trait. In the short term we may not be able to see the harms or understand the full spectrum of the adverse effects that we may experience, but in the long term we might impact not just the modified plant or Organism but the whole ecosystem.

Thank you,
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UCSF