Agriculture as an industry has changed significantly over the course of human history. From its early days of selective breeding to the modern innovations of CRISPR and other gene editing programs, pressures from within and without the industry have shaped it. However, with growing attention to the practice just a century old, many look towards this controversial system as an overreach of human behavior, or that of a poorly understood endeavor. Within this project, the impacts of three particular areas of agriculture that CRISPR and other modern genetic modification programs have changed will be examined. Those include the impact on plant science and crop production, the impact on livestock, both small-scale and industrial, and the impact on food science and human health. Each of this triad is part of an interconnected web within the industry, and a generalization of the major components of modern agriculture. By exploring this connection, it is hoped that viewers of this project will attain a more comprehensive understanding of their food and the work that goes on within the industry.

Plant science has always been an area rife for genetic research and experimentation, ranging from the first crop selections before modern science. However, starting in 1947, there was a sharp interest in more direct forms of crop modification. Doctor Norman Borlaug, alongside the Rockefeller Foundation and others, developed many cornerstones of the modern agricultural system that we know today, including the mono-crop field plans, the breeding of dwarf cultivars to best apply this field plan, as well as pesticide/herbicide- crop synergy. Through these efforts, Borlaug established a precedent for approaching current agricultural issues. In his legacy, crop scientists have focused on applying genetic modifications to the current industrial selection, as a means of refining the Borlaug process. Whereas a dwarf cultivar might have prior been bred for space and water efficiency, it can now be altered on the genetic level to ensure high yields, resistance to common pests, and even arid soil compatibility. This allows for a more versatile product, and, in turn, one that can eliminate many conventional needs in the ways of fertilizers and irrigation. However, due to the often free propagation of plants, legal issues have emerged as a result of cultivars on neighboring fields becoming crossbred or cross-propagated with modified plants, resulting in hybrids of ambiguous ownership. Furthermore, unregulated propagation could result in cultivars leaving beyond the confines of their farms, resulting in the creation of feral strains. Determining responsibility for such strains is another potential issue.

In many ways, livestock’s history with genetic modification has been similar to that of its floral counterpart. Starting with selective breeding, the industry has endeavored to ensure improvement with their stock, with the process becoming more refined as time went on. Artificial insemination (AI) revolutionized the process, allowing for the transferal of genetic material beyond that of physically present breeding partners. This, in turn, led to further surrogate research, and eventually allowed for the establishment of genetic industry standards, enabling members of the industry to import the material to their own farms as requested and apply as necessary. With CRISPR and other gene editing methods, this methodology has had an additional component introduced to it: transgenics. As there is no longer a material limitation with that of AI, genetic material can be introduced from a number of myriad sources, cultivated from recessive lines, or even ‘imported’ from non-native sources, such as introducing warthog genes into that of domestic hogs. Some possible results of this process would be an increase in lean meat, fewer resource requirements, a heightened immune system, and an increase in size. Though this has been most successfully applied to mammals such as cattle, sheep, and pigs, the poultry industry has also had success in using gene editing as a scaffolding model. By applying a program such as CRISPR to a ‘base’ bird, agricultural scientists can then attempt to ‘reverse engineer’ future lines of birds, selectively breeding and cultivating genetic lineages that would match the base as ideally reflected. However, as with modified plants, modified animals also possess a potential for outside contamination. With the risks of invasive species already significant, the addition of escaped modified animals would escalate such matters. Additionally, it is possible that the escapees would be able to breed with preexisting feral or wild populations, thereby disseminating those modifications throughout them.

Human health has been changed significantly by the advent of genetically engineered foodstuffs. As the majority of modified crops are utilized as feed for livestock, the resultant increase in nutrition from specifically maintained cultivars makes its way into that of the eventual human consumers. This, in turn, means that most people are affected by the interactions between the two. There are a number of particular advantages to such a system. With an increase in nutrition from meals, human health will increase, thereby allowing for decreased expenditures on vitamin supplements, medical care, and other accessory items related to common health conditions. Additionally, the usage of genetically modified foodstuffs could serve to aid those with preexisting health conditions, such as those that are immunocompromised, by providing a safer and more robust meal option to them. Inversely, however, modified meals could also pose a risk should adverse effects be caused by the modifications in question. Furthermore, though all the components of a modified meal may be acceptable when separated, combining them may result in unexpected occurrences, that could be hazardous to human health. This, in turn, would lead to more ownership disputes.

Agriculture has been altered extensively due to the introduction of genetically modified products, and with its pedestrian use, it is important to consider how and why they are applied. As the demand for foodstuffs increases, continual usage will likely rise, allowing for more development in the field alongside that of other, alternative methods. Due to this, it is beneficial to look towards the current innovations being made within the industry, in an effort to predict what the future holds for agricultural science.