BIOL 305
Spring 2020
General Botany

Out of class assignment

To be handed in the following lab on Thursday 20th February

All plant characteristics, such as size, texture, and sweetness, are determined on the genetic level. What are of more interest to plant scientists are the identification of the genes involved in the hardiness of crop plants, their drought resistance, rate of growth under different soil conditions, dependence on fertilizers, and resistance to various pests and diseases.

It should be remembered that Humans have been influencing plant traits for centuries by selective breeding. The best-known example of this is a wild grass from Southern Mexico called *Teosinte* - a tall, drought-tolerant grass that produces spikes close to the ground, filled with two rows of small, triangular-shaped seeds within an enclosed husk which protected them once they fell to the ground. Around 100 years after discovering that *Teosinte* was edible, people began selecting spikes to plant near their homes, which were close to irrigation sources. These selected plants continued to be developed in isolation from wild *Teosinte* that was growing in the surrounding forests, and thus the process of developing corn had begun. The most-significant differences between *Teosinte* and corn is governed by five genes and corn cobs uncovered by archaeologists show the evolution of modern corn over six thousand years of selective breeding.

Genetic engineering provides a quicker and more precise way to achieve the same goal, in one generation rather than hundreds utilizing *Agrobacterium* based gene transfer, particle bombardment, and most recently, the CRISPR-Cas9 gene editing technique.

However, the ability to genetically alter plants has provoked much controversy since the first commercially available genetically altered tomato was announced to the world in 1992. Fears of passing on resistance to antibiotics by consuming genetically modified foods (referred to as "Frankenstein Food" in the media) to the production of super-weeds, to widespread environmental upheaval, and human illness have all be thrown into the public domain.

Will the Human population of 2100 have accepted this technology? The following issues need to be addressed and fully understood before this will happen

- Is the population going to accept GMO crops?
- Is the farmer, both local and corporate, going to accept such crops?

- Will all concerns of health issues be addressed and fully answered?
- Will governments set up subsidies to aid in this transition and allow GMO crops to become sustainable? Will these allow local farmers to compete economically?
- Resolve issues of agricultural land being developed from other ecosystems. What are the knock on effects of such practices? Can these ecosystems coexist sustainably in a new balance?
- Consider all aspects of plant physiology – how many genes need to be added, deleted, enhanced, and / or repressed to alter a single physiological function?
- Will vegetarians have any additional concerns?
- Will there be religious and cultural concerns which need to be addressed?
- Will there be regulations set in place with minimal legal loopholes to address and govern all issues which may arise?

So, much to think about before 2100. I look forward to reading your views

Write an individual 5-6-page essay on this topic (1-inch margin, 12 pt font, 1 ½ spacing), addressing these points Find primary literature to back up your points and concerns and list them at the end of your essay. This assignment is worth up to 100 points

Here are a few sources to help you start thinking about, and understanding, more about this topic:

Ayres, Crystal (2016) 13 Vital Pros and Cons for GMOs. *The Vittana Personal Finance Blog* https://vittana.org/13-vital-pros-and-cons-of-gmos

Farm Aid Issue Brief (2016) GMOs: Top5 Problems for Family Farmers https://1efnyhsj63r2fo5g01erbmcv-wpengine.netdna-ssl.com/wp-content/uploads/2016/03/GMOs-top_five_issues_for_family_farmers.pdf

Freedman, David (2013) The Truth about Genetically Modified Food. *Scientific American*, **309 (3)**, 80 -85. http://ogoapes.weebly.com/uploads/3/2/3/9/3239894/gmo_foods.pdf

Gilbert, Natasha (2013) Case studies: A hard look at GM crops. Superweeds? Suicides? Stealthy genes? The true, the false and the still unknown about transgenic crops. *Nature*, **497 (7447)**, 24 – 26. https://www.nature.com/news/case-studies-a-hard-look-at-gm-crops-1.12907

Lin, Chih-Hui, and Pan, Tzu-Ming (2016) Perspectives on genetically modified crops and food detection. *Journal of Food and Drug Analysis*, **24**, 1-8. https://ac.els-cdn.com/S1021949815000976/1-s2.0-S1021949815000976-main.pdf?_tid=05b5ec37-782c-4b32-b8f0-fc4a9ac4da2b&acdnat=1550141823_bafad6b3986336d7e4ffcb1dfb6a564a

Zhang, Chen, Wohlhueter, Robert, and Zhang, Han (2016) Genetically modified foods: A critical review of their promise and problems. *Food Science and Human Wellness*, **5**, 116–123. https://ac.els-cdn.com/S2213453016300295/1-s2.0-S2213453016300295-main.pdf?_tid=a47a7348-ed88-4172-9daa-a9c40a0f84e4&acdnat=1550141277_3bf27ad71ecb3a5880082856adf0cd92