ID# Transgenics
V. 1, April 2015

THE AMERICAN CHESTNUT FOUNDATION®

TACF Fact Sheet

Transgenics and Chestnuts

Frequently Asked Questions

1. Is TACF creating GMOs? What is the connection with the work at SUNY-ESF?

TACF has not formally been active in creating GMOs. However, they (and the New York chapter, especially) have supported research at SUNY-ESF and elsewhere, for growing chestnuts in tissue culture, transforming chestnuts with "engineered" genes, and regenerating whole plants from transformed tissue cultures—all of which are necessary to producing a genetically-engineered American chestnut. Genetic engineering is a well-established, well-understood tool that can complement core breeding efforts to save the American chestnut tree.

2. With the advancement of biotechnology, why doesn't TACF just identify the genes for resistance and insert them into our trees and do away with all the generations of crossing? Wouldn't that be better?

We have been working to identify the genes for resistance for over two decades. Even with the advancement of biotechnology, this is not a trivial task and is not complete. It is clear that several genes are involved in Asian chestnut tree resistance, and they may need to act in concert. In addition, we want to utilize resistance from multiple sources, in order to incorporate genetically-diverse resistance that is more likely to stand up in the long run. This multiplies the effort. Like traditional breeding, production of transgenic trees is neither fast or easy.

Transgenic American chestnut trees face additional regulatory hurdles not faced by trees generated using other methods. The transgenic American chestnut trees face some opposition from vocal segments of the population. In view of all these considerations, the transgenic route is not necessarily "better." Nonetheless, transgenics is a scientifically proven technique that adds valuable elements to the toolbox needed to restore the American chestnut tree.

3. What are the major benefits and risks of reintroducing transgenic American chestnuts?

Genetic engineering is of greatest value for introducing a gene or trait that simply cannot be acquired by conventional breeding—in this case a dominant blight resistance gene. In contrast, the blight resistance genes being exploited by TACF's conventional breeding program are incompletely dominant.

The risks of introducing transgenic American chestnut trees are largely comparable to the risks associated with release of the products of conventional breeding. Modified genes, regardless of source (conventional breeding or biotechnology) may have undesirable side effects. This will be examined in the transgenic trees as part of the regulatory process, and if there are any undesirable side effects, these will be identified and corrected.

4. Isn't single-gene resistance, like that from the wheat gene, more likely to break down over time than a complex of genes for resistance, such as we understand Chinese chestnut to possess?

There are examples of where single-gene resistance has endured for considerable periods of time, but it is generally a good idea to have more than one defense available. The use of multiple genes is being pursued.

5. Will there be an attempt to insert only genes from Chinese chestnut, which would be more similar to traditional breeding?

Work has already begun to insert candidate resistance genes from Chinese chestnut into American chestnut (cisgenics). This is one of the best methods available for determining whether a candidate gene actually confers resistance, and this work will continue whether or not the resulting trees are ever approved for release into the landscape.

6. Will the transgenic trees be crossed with trees from TACF's breeding program?

TACF's breeding program has devoted much space and effort to capturing the genetic diversity of the American chestnut. If the transgenic trees receive regulatory approval, then an obvious way to get their genes into a more genetically-diverse background would be to cross them with trees from TACF's breeding program. This aspect is under active discussion.

7. When and how can I plant a transgenic, blight-resistant American chestnut?

That will depend on when and whether the trees are approved by regulatory agencies. The current target dates are to begin the regulatory review in 2015 with anticipated completion in 2020.

In the meantime, interested growers are encouraged to plant American chestnuts to:
become accustomed to growing these trees;

- preserve local germplasm;
- use for future diversification of material (see Question 11);
- and observe the blight in action.

Each of TACF's Chapters offers members opportunities for planting and growing chestnuts. For more information, please contact The American Chestnut Foundation and/or your local Chapter:
http://www.acf.org/Chapters.php

8. How is Monsanto involved? Will they, or other big business, profit from this effort?

We believe everyone should have the opportunity to contribute to the restoration of the American chestnut tree. Among many funders, Monsanto has funded less than 4% of the research at SUNY-ESF to date, but theirs and all other contributions are appreciated. No funders of the SUNY-ESF work have ownership of the trees or influence the direction of research. The trees will not be patented so they can be released into the public domain. When the trees are released to the public, it will be through a not-for-profit organization just like the backcross trees. The intention is that people will be able to grow their own trees and distribute the nuts as they wish.

9. Is TACF paving the way for wide-scale use of transgenic trees in the landscape?

If SUNY-ESF is successful in obtaining regulatory approval for its transgenic blight-resistant American chestnut trees, then that would pave the way for broader use of transgenic trees in the landscape. Transgenics may prove to be a useful tool for preserving the health of our forests from many introduced pests and pathogens and for increasing yield of desirable products from forest trees.

10. By being involved with transgenic American chestnut creation, is TACF participating in "green washing"?

We believe that the mission of TACF is furthered by our involvement in research leading to transgenic chestnuts. That is a necessary and, in most cases, sufficient reason for our involvement in any project.

11. How will the transgenic tree program account for American chestnut genetic diversity?

Introducing genetic diversity into the transgenic tree program would be most readily accomplished using traditional breeding methods. A "mother" tree program is being established to support crossing of transgenic trees with wild type American chestnut trees.

12. Will the transgenic American chestnut trees being developed all be clones, like a modern-day banana plantation?

The first transgenic blight-resistant American chestnut trees are clonal; however, an out-crossing plan is in place to build in genetic diversity through traditional breeding with the remnant of surviving trees, and thereby rescuing their inherent diversity.

13. Will the transgenic American chestnut trees being developed be sterile? In other words, will they be able to reproduce once introduced to the landscape?

The trees in SUNY-ESF's program are not sterile and would be capable of reproducing if released into the landscape. This ability is essential to the restoration of the species.

14. Can the genes inserted into the transgenic American chestnut trees be passed on to progeny when they cross pollinate with a pure native? Will that level of resistance be watered down as a result?

Yes, the blight resistance genes can be passed on to the progeny of crosses between transgenic American chestnut and native trees. No, the level of resistance will not be watered down. Only one half of the progeny of such a cross would be expected to receive the genes, but those that do should have the same level of resistance. This is typical of single gene, dominant resistance.

15. But my main problem with GMOs is that we just don't know what will happen with them in the future. I keep hearing that they are untested and possibly unsafe. What about my concerns?

Genetically engineered organisms are highly regulated by the government and are subjected to many tests that are not required of conventionally-produced varieties. The scientific consensus formulated over decades of research is that genetic engineering is NOT inherently more risky than conventional breeding. The transgenic American chestnut trees will be some of the most tested varieties of chestnut in history.

16. How can I find out more?

Visit the SUNY-ESF chestnut website: http://www.esf.edu/chestnut/
Watch Dr. Bill Powell's TEDx talk: http://youtu.be/WYHQDLCmgyg
Check out the time-lapse video of current resistance assays: http://www.esf.edu/chestnut/resistance.htm