

Synthetic biology: GMOs 2.0

What is synthetic biology? Synthetic biology (synbio) is an extreme version of genetic engineering. Instead of swapping genes from one species to another (as in conventional genetic engineering), synthetic biologists employ a number of new genetic engineering techniques, such as using synthetic (human-made) DNA to create entirely new forms of life or to “reprogram” existing organisms to produce chemicals that they would not produce naturally.

Commercial use of synthetic biology: Is it “natural,” “sustainable” or necessary? In the absence of regulations to protect human health and the environment, and labeling to ensure consumer right-to-know, synthetic biology is about to enter the market via new ingredients for food, cosmetics and household products, many of which are being marketed as “natural” and “sustainable.”

These new ingredients, including synbio versions of vanilla, stevia and saffron flavorings for food and beverages, and ingredients for cosmetics and cleaning products, are produced by synthetically engineered organisms, including synbio yeast and algae that are raised in vats and feed on sugar.

The claims of “sustainability” for this technology are questionable at best. While the industry claims that synthetic biology could reduce impacts on land by producing products in labs rather than in farm fields, currently commercialized artificial organisms (synbio yeast and algae) require sugar as a feedstock to live and reproduce. Expanding sugarcane plantations to meet feedstock demand from a growing synbio industry could exacerbate the current destruction of critical ecosystems in Latin America (including some of some of Brazil’s most eco-sensitive land), Africa and Southeast Asia.¹ Commodities currently produced by small farmers (e.g. vanilla) may be displaced in favor of synthetic biology products, and the land they preserve (e.g. rain forests where vanilla beans are grown) may in turn be converted into industrial-scale plantations for soy, beef or sugar.

Risk of environmental escape and contamination. No containment strategies are fool proof, and we don’t know how these organisms will interact with the environment. While some types of pollution can be cleaned up, synbio organisms are living and self-replicate. Once in the environment they may be impossible to recall or clean up.

Synthetic biology is virtually unregulated. Before synthetic biology ingredients get passed off as “sustainable” or “natural” or enter our food and consumer products, we need mandatory safety assessment and oversight specific to synthetic biology and the novel risks it may pose to our health and environment² to ensure these new genetically engineered organisms, and their products, are safe and sustainable.

In food: synbio vanilla flavoring. Real natural vanilla production can be environmentally sustainable, culturally critical and provides a livelihood for an estimated 200,000 small farmers. It is primarily grown and harvested by hand in intact rainforests in Madagascar and Mexico, helping to preserve rain forest ecosystems.³ Synbio vanilla is the most high-profile synbio ingredient to enter the market, will likely be unlabeled, and is currently marketed as “natural.” Evolva, the synbio company that makes this product, could capture a large percentage of the global vanilla flavor market. Since this product will be labeled as “natural,” food and consumer products companies could easily replace

Synthetic biology ingredients for food and cosmetics

On the market:

- Grapefruit flavoring
- Orange flavoring
- Resveratrol
- Patchouli
- Squalane (Neossance)
- Vetiver oil (vetivone, Epivone)
- Vanilla

In the pipeline:

- Stevia
- Saffron
- Cocoa butter
- Milk and egg substitutes
- Agarwood

1 Mendonca, Maria Luisa. “Brazil: sugar cane plantations devastate vital Cerrado region.” *Pacific Ecologist* 17 (2009): 25+. Academic OneFile. Web. 18 Aug. 2014.

2 Drinkwater, Kelly, Todd Kuiken, Ph.D, Shlomiya Lightfoot, Julie McNamara, and Kenneth Oye, Ph.D. Creating a Research Agenda for the Ecological Implications of Synthetic Biology. Rep. Woodrow Wilson International Center for Scholars, May 2014. Web. <http://www.synbioproject.org/process/assets/files/6685/synbio_res_agenda1.pdf?>.

3 Communication with Michel Grisoni, CIRAD (Centre de cooperation internationale en recherche agronomique pour le developpement), based in Réunion. Vanilla production estimates provided by Michel Grisoni.

truly natural vanilla produced by small farmers with Evolva's "natural" synbio vanilla, confusing consumers and harming small vanilla farmers across the global south.

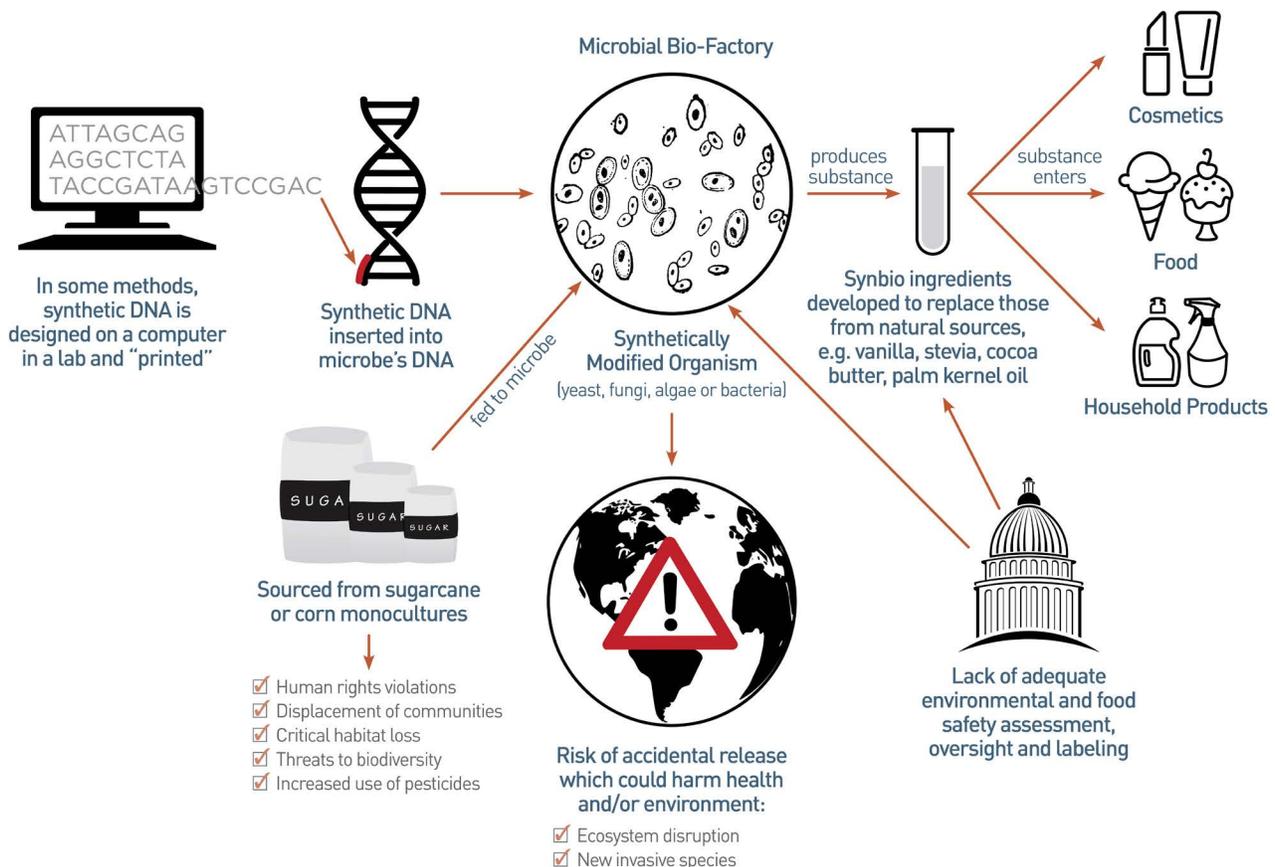
In cosmetics: synbio squalane. Cosmetic products on the shelves may already include a synbio ingredient.⁴ Amyris Biotechnologies produces synbio squalane used in an estimated 300 products, most of which are undisclosed. Squalane is currently primarily sourced from olive oil. A synbio company called Solazyme is developing a cocoa butter-like replacement for use in body care products, made from engineered algae.⁵ However, consistent with the industry trend of little to no transparency, Solazyme does not disclose what specific genetic engineering techniques it uses to produce its oils.

In household products: synbio algal oil. In this process, engineered algae is fed sugar and excretes an oil high in fatty acids such as lauric and myristic acid, key compounds found naturally in palm kernel and coconut oils. Solazyme, this product's manufacturer, claims its algal oil may be replace unsustainable palm kernel oil.⁶ However, synbio algal oil will more likely displace lauric oils on the market such as coconut oil and babaçu oil. Sustainably produced coconut oil is an example of a less risky, more sustainable and natural substitute for palm oil. Consumer products companies currently using or planning to use synbio ingredients include Ecover (parent company of Method), Unilever and Procter & Gamble.

For more information on synthetic biology: www.foe.org/synbio, www.synbiowatch.org

This document has been updated to reflect synbio vanillin's market availability.

How are synbio ingredients made?



4 Strom, Stephanie. "Companies Quietly Apply Biofuel Tools to Household Products." The New York Times. The New York Times, 30 May 2014. Web. <<http://www.nytimes.com/2014/05/31/business/biofuel-tools-applied-to-household-soaps.html>>.

5 Solazyme. www.solazyme.com/innovation.

6 Strom, Stephanie. "Companies Quietly Apply Biofuel Tools to Household Products."