

## Nature's lost scents: Perfumes made to replicate extinct plants provide an olfactory glimpse into the past

Enchant your loved ones with nature's lost scents, revived through biotechnology and perfume artistry.



hen that popped up on Facebook, I was intrigued. So I clicked.

"Meet Invisible Woods: a clean, refreshing scent revived from extinct flower DNA," beneath an image of "origin flower" *Wendlandia angustifolia*.

A quick search revealed that this plant had been presumed extinct, until one popped up in a 1998 survey of its natural habitat in Tamil Nadu, India. Invisible Woods is not really "revived," but "reimagined," using clues from ancient flowers and the tools of biotechnology.

wendlandia angustifolia madras courier  
Wendlandia angustifolia

[Future Society](#) offers six fragrances inspired by past plants, for \$98 per 50 milliliters (a little under 2 ounces) or a [\\$35 sampler](#) ideal for a stocking stuffer. Boston-based [Ginkgo Bioworks](#) provides the expertise in genetics.

I don't use scented products other than Pine-Sol, so this was all new to me. DermNet defines "fragrance" as a combination of organic compounds that produces a distinct smell, whereas a perfume is a liquid mixture that emits a pleasant odor, and oilier than a fragrance. I don't exactly get the distinction, but apparently perfume is the oilier of the two and perfume, cologne, and aftershave are all fragrances.

Before I dig into the science, I'll relate taking a quiz on the Future Society website that would help me choose a product. I clicked on the "friend" option, my bestie, Wendy.

image not found or type unknown

Credit: Future Society

Next, the screen asked me to describe Wendy. I chose "confident," ahead of creative, strong, and calm. Since she and I like to hike, I next selected her preference for "woody" over floral, sweet, or spicy, although spicy was a close second. Next question, easy peasy – her favorite season is summer. Finally, the website asked me to imagine Wendy's fragrance, choosing among "enchanted garden," "mystical forest," "tropical paradise," and "Zen retreat." Definitely Zen retreat, because Wendy meditates.

The website returned *Solar Canopy eau de parfum*. Magically deducing that Wendy likes to take trips, her scent Solar Canopy is “For the joyful traveler: a sunny scent transporting them to their next beachside destination. Top: Bergamot, Red Currant, Pink Pepper; Mid: Turkish Rose, Lychee, Pistachio, Magnolia; Base: Vetiver, Ambroxan, Pink Sugar. We both love pistachio, so I’m sold.

On to the science.

## **Bringing back extinct or threatened species – or just their molecules**

“What if we could grow everything? Biology can,” relates Future Society ads and the opening screen of Ginkgo Bioworks’ webpage.

To recreate a scent from the past, Ginkgo scientists use recombinant DNA technology to:

- identify a gene with an intriguing product, such as an enzyme required to produce a molecule that a human nose interprets as a fragrance. To the plant, it attracts insect pollinators.
- compare the DNA sequence to similar genes in other species.
- tweak a lab-made copy of the DNA sequence using clues from other plant species.
- introduce the synthetic gene into single cells to scale up production of the enzyme. Yeast and bacteria are single-celled organisms useful in biotech.
- use mass spectrometry to identify and confirm that the fragrance molecule is what was sought.

Presumably at some point a functioning human nose is required, too. Not all recipes turn out as expected.

Resurrecting floral scents seems more useful than other tweaks to ancient DNA, a field that dates to [1984](#). Why defrost mammoths to refashion the great beasts in the uteri of modern elephants? Why bring back the heath hen, an extinct creature I’ve seen behind glass at the Martha’s Vineyard museum? Does the world really need more chickens?

But ancient DNA can be used, perhaps, to slow extinction. [Revive and Restore](#) is a wildlife conservation organization striving “to enhance biodiversity through the genetic rescue of endangered and extinct species.”

Their roster includes the aforementioned heath hen and woolly mammoth, as well as the black-footed ferret, passenger pigeon, sea stars succumbing to “wasting disease,” rodent-like Binturongs being illegally traded as pets, inbred sea otters, [quaggas](#), the [Przewalski horse](#), climate-stressed Joshua trees, and kelp forests and their resident blue mussels, sea dragons, and other creatures.

Revive and Restore also lists the horseshoe crab, whose numbers are dwindling because a chemical in their blue blood has been used for many years to detect bacterial contamination of medical products. This news apparently hasn’t reached the shores of Martha’s Vineyard, where every summer I watch the armored animals mate in shallow water.

## Perusing patents

Once I'd clicked on the initial Future Society ad on my feed, I was of course bombarded. I reveled in the colorful, creative names and descriptors: "reclaimed fame," "invisible woods," "grassland opera." I could imagine myself, inhaling rapturously, in a Permian forest some 260 million or so years ago.

The branding folks seem to have had a good time evoking those images of ages past, deeming the recreation of ancient molecules "scent surrections." But much of the verbiage is touchy-feely murky:

Future Society is a vision of a more reciprocal world where we can change outcomes that impact our collective good by acting as our individual best selves.

Huh? I know what recombinant DNA means, but not that. As a biologist, all I could think was that when an organism becomes extinct, there's a reason. It no longer fits in with a changing world, be that climate change, a novel infectious disease, mutation, a comet crash. or competition from an introduced species.

Still, I wanted to follow up. But instead of reading more ad copy evoking memories of Dorothy growing faint in the field of poppies, I searched Ginkgo Bioworks' patents. What was the company behind the brave new fragrances up to?

They "design custom organisms that bring new products to life for countless applications." The [46](#) granted patents begin in 2013. The technology programs single-celled organisms to crank out organic molecules of use to us, such as the enzymes required to synthesize sugars, fats, drug precursors, fine chemicals, and food ingredients like emulsifiers. ("Organic" in chemistry means carbon-containing, a definition long preceding the popular meaning.)

It's complicated.

Some interventions tinker with promoters, the DNA sequences that start genes and can control expression of whichever gene to which they are attached. Also useful to borrow are signal sequences, which are bits of proteins that direct movement of other proteins. These strategies are used to tweak certain bacteria to produce organic molecules of interest.

One patent deals with the biosynthesis of cannabinoids and their precursors. Another harnesses chemicals called mogrosides from the gourd vine *Siraitia grosvenorii*, used in the manufacture of sugar substitutes. Yet another application boosts oleic acid production in yeast to create oil sprays like Pam, and to stabilize drugs.

It's not until patent number 46, granted about a year ago, that fragrance seems to enter the picture. It covers "enzymes and/or binding polypeptides useful for protecting polymers from damage caused by fatty acids from secreted biological fluids such as sebum or sweat." Sebum is the sticky stuff on human skin.

But where were the fragrance patents? The ones that begat the pretty 50-milliliter bottles all over

Facebook? Filed, but not yet issued? Indeed, the company has a cornucopia of patent filings, grants, and published papers from just third quarter [2023](#). And fragrance is only part of the picture.

## How did the idea of ancient scents bloom?

Ginkgo Bioworks' co-founder Jason Kelly had the idea to “recapture the smell of an extinct flower,” according to a feature in [Nature Biotechnology](#).

In 2016, Ginkgo's creative director Christina Agapakis sampled flowers from three otherwise extinct plants from the herbarium at Harvard. The flowers then appeared in art installations called [Resurrecting the Sublime](#).

Three species inspired the first reborn scents.

Hawaiian hibiscus (*Hibiscadelphus wilderianus* Rock) festooned ancient lava fields in Maui until cattle ranching stamped them out by 1912. Multidisciplinary artist Alexandra Daisy Ginsberg, scent researcher and artist Sissel Tolaas, and Ginkgo Bioworks brought back the ancient floral scent in 2019.

*Orbexilum stipulatum* aka largestipule, leather-root, or Falls-of-the-Ohio scurfpea, was last known to live in 1881 in Kentucky until a dam destroyed its habitat.

*Leucadendron grandiflorum* was a shrub that grew on Wynberg Hill, behind Table Mountain in Cape Town, until encroaching colonial vineyards wiped them out. The last known shrub was in a London garden in 1805.

But a complex, multicellular organism like a flowering plant is more than the sum of its genes and the molecules they control. So although scientists can recapitulate, recombine, and refine the molecules that provided a fragrance to an extinct flower, they can't recreate the context in nature.

What did the fragrance do to enhance survival or reproduction in the ancient plant? Or was it a by-product of some other function? Did several odoriferous molecules interact? Was a fragrance vestigial? Hibiscus flowers, for example, don't naturally emit a scent, because birds pollinate them.

In a broader sense, it's comforting to realize, in this time of accelerated climate change, that geneticists of the future will be able to extract and recapitulate today's biochemistry, using genetic instructions.

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